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The Strategic Alliance in 5G Development in Taiwan: A Resource-based Approach

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Abstract

The 5G spectrum bidding was finalized, and the total 5G bid had hit a sky-high of NT \$142.191 billion (\$ 4748.33million). In the month of July, it is expected that there will be two telecom operators launching the 5G services, which is where the 5G era begins in Taiwan. Following Chunghwa Telecom and Far Eastern Telecom, the mobile broadband service security maintenance plan proposed by Taiwan Mobile has also been approved by the NCC on May 6, 2020. Taiwan Mobile is very active in cooperating with other players, including promoting the “5G Super Alliance” using the resource advantages available in the telecommunications industry, which allows cross-domain and cross-country alliance cooperation along with various leadership styles from different fields together with modern operation planning. In Taiwan, there is very few research about evaluating or selecting strategic alliance partners of telecommunications companies in the next generation network era. Taiwan Mobile’s core resources and capabilities are different from those of other telecom operators. This research conducts a case study on Taiwan Mobile, using resource-based theory of strategic alliances to analyze its current status of 5G application service operations, "core resources" and 5G application service "strategic alliances" and other planning and development, exploring how Taiwan Mobile establishes its advantages and characteristics to develop its business strategy. Taiwan Mobile’s "5G Super Alliance" gathers nearly 100 top teams in the three areas of production, government and research. Taiwan Mobile mainly forms a 5G application development strategic alliance in the form of functional agreements, joint research and development, and diversified integration. However, even with ambitious aspiration for the 5G technology, the real challenge of "network construction" in Taiwan’s development of the 5G industry has only just begun.

Keywords : 5G networks, complementary resources, resource-based theory of strategic alliances, spectrum bidding

Introduction

The 5G spectrum bidding was finalized on January 16, 2020, with a total bid amount of NT \$ 138.081 billion (\$ 4611.08 million), setting a record for the three previous spectrum bids in Taiwan, with the highest global unit band price, and the largest number of telecom operators participating in bidding. However, the bidding price is too high, all the five major telecommunications companies in Taiwan believe that "no one is the winner." Moreover, as the telecom operators are unable to coordinate the winning bandwidth position by themselves, another round of bidding was called on February 21, 2020. This time around the bidding price rose again, and the total 5G bid had hit a sky-high of NT \$142.191 billion (\$ 4748.33million).

Chunghwa Telecom has spent NT \$ 45.675 billion (\$ 1525.27million) to obtain a 3.5GHz mainstream frequency band of 90MHz, and NT \$ 618 million (\$ 20.63million) to obtain a 28GHz frequency band of 600MHz. Taiwan Mobile has gotten 60MHz in the 3.5GHz mainstream band, which cost NT \$ 30.45 billion (\$ 1017.06million) in total, whereas, they have spent NT \$ 206 million (\$ 6.87million) for a 28GHz frequency band of 200MHz. Far Eastern Telecom spent NT \$ 40.6 billion (\$ 1355.79million) to get 80MHz in the mainstream 3.5GHz band, while spending NT \$ 412 million (\$ 13.75 million) for 400MHz in the 28GHz band. Asia-Pacific Telecom gave up the number of 20MHz band requirements and spent NT \$ 412 million (\$ 13.75 million) to obtain 400MHz at 28GHz, while Taiwan Star spent NT \$ 19.7 billion (\$ 657.86 million) to obtain 3.5GHz at 40MHz.

As 5G networks promise much faster speed, lower latencies, and more reliable connections, “this results in better quality video on mobile devices and far more immersive experiences with virtual reality (VR) and augmented reality (AR), among other benefits” (Rob van den Dam, 14 September 2019). Several studies have indicated that 5G should be considered as a disruptive innovation (Liu & Hsu, 2019). Suryanegara (2016) notes that 5G could be regarded as disruptive because of offering new value to mobile phone users. Michael Goodman, Director of TV and Media Strategies for Strategy Analytics said: “The arrival of 5G TV wireless services could herald another wave of TV disruption through the 2020s and beyond (Jon Mundy, <https://5g.co.uk/guides/5g-tv/>).” The battle is reshaping the industry landscape as new players are entering and existing players are no longer satisfied with performing business-as-usual roles (Rob van Dam, 2019).

In Taiwan, the recorded amount of 5G spectrum bids has not only caused a substantial increase in the cost, but also had a significant impact on consumer rights, which inevitably led to a negative impact on the development of the industry. To counterbalance mutual benefit and progress, stakeholders should work together to build networks, promote smart life and the digital economy. Chairman of Chunghwa Telecom said, “The frequency position of the 3.5GHz band is between 3.42 to 3.51GHz. At present, in terms of equipment supply and schedule, it is very conducive to

the early construction of a 5G network.” In other words, Chunghwa Telecom has achieved the maximum bandwidth in both 3.5GHz and 28GHz bands, and the frequency position is also a favorable target, it has obtained important resources for the development of mobile broadband services in the future. As Chunghwa Telecom stated that it will be launched in July 2020, and this opens up future cooperation with other players, where unsuccessful bidders can then cooperate with operators who have 5G spectrum.

On June 3, 2020, the National Communications Commissions (NCC) approved the 5G license of Chunghwa Telecom’s mobile broadband service in the 3.5GHz and 28GHz band, making it the first 5G license in Taiwan. Chunghwa Telecom is expecting to open its services as soon as in July 2020. Far Eastern Telecom has also obtained the letter of certification for the 3.5GHz and 28GHz frequency band systems on June 3, 2020. As the number of 5G base station deployments has reached the threshold for opening, and the license can be obtained within one week at the earliest. In the month of July, it is expected that there will be two telecom operators launching the 5G services, which is where the 5G era begins in Taiwan (He, June 4, 2020).

NCC has not only urged fellow telecom operators to accelerate their network deployment, but also supervises the operators closely to ensure the security of 5G mobile broadband communications as the new network architecture and technology of the fifth-generation mobile system (5G system) is conducive to promoting and supporting various emerging services and innovative applications in the digital age. Following Chunghwa Telecom and Far Eastern Telecom, the mobile broadband service security maintenance plan proposed by Taiwan Mobile has also been approved by the NCC on May 6, 2020. As the business plan for Asia-Pacific Telecom to share the 3.5GHz band with Taiwan Mobile has yet to pass, where in order to build the 28GHz band obtained by the bid, the "shared frequency" involves the "Telecommunication Management Law", which only allows them to start services from July 1st onwards. Therefore, Taiwan Mobile has changed its strategy, by focusing on 250 base stations to build a network within the 28GHz frequency band (Chen, June 3, 2020), actively carrying out base station construction, which pulls them closer to the launch of the 5G system.

Although Taiwan Mobile has yet to submit the application for its 5G system verification, however, due to the bidding rank in the second stage, they have managed to obtain 3.51 to 3.57GHz in the 3.5GHz band and 200MHz in the 28GHz band with zero penny spent. General Manager, Lin Zhichen believes that Taiwan Mobile adheres to a rational and pragmatic financial analysis, and takes into account the good bidding policy of the industry. The spectrum obtained is enough to provide various high-speed networks that would not be lacking in the next 10 years of the "Super 5G" services and applications. In particular, Taiwan Mobile is very active in cooperating with other players, including promoting the “Three-C’s” collaboration, implementing the sustainable development spirit of 5G frequency sharing, network sharing, and co-construction; at the same time, the remaining funds after the bid will be fully invested in the construction of 5G base stations,

sprint coverage, availability, and the opening of the system in the third quarter of the year (Chen, Feb.25, 2020).

As Taiwan Mobile hires young entrepreneurs with non-telecom background but high performance venture capital in the past as the General Manager, they are currently promoting the “5G Super Alliance” using the resource advantages available in the telecommunications industry, which allows cross-domain and cross-country alliance cooperation along with various leadership styles from different fields together with modern operation planning. Taiwan Mobile believes that this would be the transformation of the telecommunications businesses, where it takes the first step of success to combine telecommunication businesses with venture capital, develop innovative services, and create new realms for the 5G era. Therefore, this research conducts a case study on Taiwan Mobile, using resource-based theory of strategic alliances to analyze its current status of 5G application service operations, "core resources" and 5G application service "strategic alliances" and other planning and development, exploring how Taiwan Mobile establishes its advantages and characteristics to develop its business strategy; meanwhile, it examines the resources, strategic alliances and competitive advantages of Taiwan's telecommunications industry.

Theories

Resource-Based Theory

Resource-based theory (Resource-Based Theory, RBT) is derived from the strategy management theory, evolved from the resource-based view (RBV). Wernerfelt (1984) pointed out that competition among enterprises based on resources and combined resource is of great significance to the ability of enterprises to gain advantages in implementing product market strategies (Barney & Clark, 2007). Resource-Based View is based on the internal perspective of the company to explore the company's competitive advantage, emphasizing that resources must be used effectively to become assets, and internal resources and capabilities of the company will guide the company's business direction. In 1991, Barney formally proposed the Resource-Based Theory that it should first examine the internal resources of the enterprise, and then think about the strategy of competition in the industry and how to obtain sustainable competitive advantage through resources. The resource-based perspective analyzes the internal resources of the enterprise. It is suitable for analyzing the unaccustomed 5G application service industry to understand how enterprises establish advantages and characteristics, so as to develop business strategies.

Barney (1991) noted that resources that meet four conditions: valuable, rare, imperfectly imitable, and imperfectly substitutable can lead to competitive advantage. Turba (2011) pointed out that the core resources/capabilities of the enterprise can be found based on the key resources in the respective company's core resource standards including imperfectly imitable, imperfectly substitutable, durability, appropriability and competitive advantage, etc. The evaluation criteria

are as follows: (1) imperfectly imitable: the difficulty of actual or potential competitors to imitate this resource, for example, it cannot be imitated due to the natural uniqueness of the resource, path dependency, causal ambiguity, or economic deterrence. (2) imperfectly substitutable: the difficulty for competitors to use alternative resources with the same advantages to replace the resources. (3) durability: The benefits brought by this resource can continue in the long term. (4) appropriability: whether the enterprise has the ability to apply its advantages in the market. (5) competitive advantage: whether or not this resource will help the company establish differentiation with competitors, or to what extent.

The Reasons for Alliances

Alliance is “a flexible vehicle of learning; a way to transfer effective knowledge in partner firms and to generate combinations of resources; and a superior means of access to technological capabilities and other complex capabilities” (Mamédio, Rocha, Szczepanik, & Kato, 2019).

According to Ireland et al. (2002), the strategy alliance refers to more than two companies, with each other as the premise, and the two parties have reached a cooperation agreement based on their strategic goals to increase competition. Das & Teng (2000) pointed out that there are two motivations for strategic alliances: one is to acquire new resources, and the other is to develop their own resources by combining other enterprise resources (Franco & Haase, 2012; Hsu & Shih, 2013). The main goals of the strategy alliance are: (1) Expand the scale of operation and increase market competition. (2) Obtain new resources, create new opportunities and bases. (3) Learning complementary resources and improving competition through alliances. In short, the purpose is to effectively increase the market competitiveness of both parties, expand the scale of the economy, or try to obtain new opportunities (Ireland, Hitt, & Vaidyanath, 2002).

Strategic alliances have become a key focus in the management and marketing literature (Yu, Xu & Dong, 2019). Over the last two decades, the use of strategic alliances has grown in telecommunications industries. One business player might try to collaborate or integrate with other firms because it cannot provide all kinds of telecommunication services in the next generation network environment (e.g., 5G or beyond 5G) (Min, 2018). As for the types of strategic alliances, they can be divided into intra-industry alliances or inter-industry alliances (Albarran, 1997).

Resource-Based Theory of Strategic Alliances

Das & Teng (2000) suggested that a resource-based view has the potential for helping us understand alliances better (Hsu & Shih, 2013). The Resource Based Theory (RBT), where “specific sets of resources are bundled into precious, scarce, and hard-to-imitate capabilities, has been demonstrated to be helpful for explaining why some companies have been better than others over time” (Gönül Kaya Özbağ, & Osman Arslan, 2020).

The resource-based theory of strategic alliance means that a single firm cannot have all the resources and capabilities, collaboration between enterprises and strategic alliances for resource exchange with complementary resources that can develop synergies (Harrison et al., 1991; 2001), even core resources can be strengthened through cooperation. Based on related literature, enterprises exchange resources in order to obtain insufficient resources, strengthen their own resources or find partners. The choice of partners is mainly based on cooperation experience and complementary resources. Studies have shown that if resources cooperation with each other is complementary, there will be higher cooperation benefits. As for the alliance, it includes functional agreements, joint ventures, horizontal and vertical integration, etc., and achieve synergies through cooperation to obtain sustainable competitive advantages.

Alliances can serve as a type of strategic choice that can enable firms to cope with unstable, global and competitive environments with threats and opportunities (Mamédio, Rocha, Szczepanik & Kato, 2019). In Taiwan, there is very few research about evaluating or selecting strategic alliance partners of telecommunications companies in the next generation network era. According to the above discussion, firms use alliances to gain access to other firms' valuable resources so the resource-based view is appropriate for this research to exam strategic alliances.

How to strengthen resources and develop competitive advantages through strategic alliances? What are the opportunities and challenges faced by Taiwanese telecom operators and Taiwan Mobile? The sole purpose of the strategic alliance is to examine which of the following is the intent of the Taiwan Mobile's alliance aim, which includes: complementary resources of alliance partners, proximity to new markets, joint risk allocation, learning of new knowledge, setting industry standard technologies, research and development of new products, reducing transaction costs, joint marketing of products, brand creation etc. Alliance partners choose to consider the following: complementary resources between enterprises, interactive relationship between the two, whether the past cooperation is smooth or not. The collaboration methods are vertical or horizontal, inter-industry or cross-industry, as well as joint ventures, capital investment or no capital investment, etc.

The research questions are as follows: What is Taiwan Mobile's core resources/capabilities for 5G application service development and planned operation projects? What are the competitive advantages that are different from other competitors? What are the core resources and competitive advantages that are strengthened or focused? What are the new resources required or missing? How to obtain new resources to access sustainable competitive advantage? And how to strengthen resources, develop competitive strategies and competitive advantages through cooperation? What is the motivation and purpose of the strategic alliance? What are the strategic alliance types, alliance partners, and partner selection criteria? What are the resources exchanged by strategic alliances? Expected benefit evaluation?

Methods

Resource-based view research indicates that when the resources studied are intangible resources, qualitative methods, such as case studies, are often used to explore corporate strategies (Godfrey & Hill, 1995; Lockett & Thompson, 2001; Oba & Chan-Olmsted, 2007). In addition, the research on strategic alliances is mostly conducted in qualitative research methods, such as secondary data analysis, in-depth interviews, case studies, and field study.

Due to the COVID-19 epidemic, under the so-called “safe social distance” regulations in Taiwan, thus, in order to facilitate this research, direct observations, in-depth interviews and a focus group interview and other research methods has been scraped and to conduct the research in writing, that is, sending email attached with the interview questions to the interviewees, providing an appropriate time limit for them to revert to the researcher in writing. The interviewees include senior executives of Taiwan Mobile, heads of marketing departments, heads of planning and operating strategies, heads of service departments, etc. In addition, secondary data analysis is used to supplement the collection of research data. Seeing the condition of COVID-19 epidemic in Taiwan slowly improves in the month of May, an interview with the experts Dr. Liu, P. (Director of Taiwan of Institute Economic Research) has been arranged on May 20 to conduct an in-depth analysis of the operation status, resource base and strategic alliance of Taiwan Mobile and the 5G application services of the Taiwan telecommunications industry.

Results

Taiwan Telecom Industry 5G Application Service Operation Status

In the 5G spectrum, the 28GHz frequency band is high frequency, which has the advantages of high rate and low delay, suitable for vertical field or enterprise private network use; whereas, the 3.5GHz frequency band is intermediate frequency, mainly used as signal coverage, and supports many terminal models. The characteristics of mid and high frequencies are different, and they can provide the best 5G network speed and performance by matching with each other. At present, the first step for Taiwan’s telecommunications industry is to set up a platform and gradually bring 5G services onto the track. Among them, Chunghwa Telecom locks in smart city applications such as smart transportation and smart agriculture, Far Eastern Telecom strongly concentrates on smart healthcare, and Asia-Pacific Telecom deploys air quality monitoring and smart agriculture. As for Taiwan Mobile, it locks the smart application of Xinzhuang Baseball Stadium in the 5G experimental field, providing smart parking, smart home care, smart retail, 3D face recognition and skeleton tracking, smart eye movement care, real-time preview of the stadium seats and 360-

degrees applied technology such as location selection, augmented reality (AR)/virtual reality (VR) and retail guide (Huang, February 2, 2020).

In recent years, Chunghwa Telecom, has undertaken the government's smart urban-rural plan, where it provides solutions such as smart parking, smart transportation, smart health, smart agriculture, smart environment, smart tourism, smart retail and other solutions to tap into the 5G era, combining 5G and smart urban and rural, providing large data to assist government policy decisions. Chunghwa Telecom, together with partners such as Ericsson, Nokia and HTC, collaborated with the National Palace Museum to create a 5G virtual reality integrated AR smart navigation service in the National Palace Museum, and cooperated with China Steel Express, Taiwan International Shipbuilding and Kaohsiung Veterans General Hospital to build smart ships and telemedicine services, to achieve "offshore smart office" and "offshore medical services" (Huang, February 2, 2020).

On the other hand, Far Eastern Telecom believes that with the combination of 5G and artificial intelligence, Internet of Things (AIoT) it can realize more application fields, and launch cooperation in smart cities, air quality detection, smart street lights, smart hospitals, and smart manufacturing. Far Eastern Telecom mentioned that it is the first telecommunication network (POB) to introduce commercial experimental research and development in Taiwan with the Taipei City Government and Cloud Industry Association to build a 5G test plan in Neihu. There are already 30 to 40 upstream and downstream suppliers to conduct actual 5G testing. Far Eastern Telecom has driven into the 5G telemedicine with the three major medical centers, Far Eastern Memorial Hospital, Kaohsiung Medical College and Tzu Chi Hospital, and launched the world's first NB-IoT (Mobile Internet of Things) blood glucose machine (Huang, February 2, 2020).

Asia-Pacific Telecom, a subsidiary of Hon Hai Precision Industry, has been actively deploying various vertical applications in recent years, including smart manufacturing, smart grid, smart agriculture, air product monitoring, and face recognition, all of which have grown well. They are optimistic about the future of the industry of industrial, health and transportation, as 5G acts as an important vertical application. Asia-Pacific Telecom stated that it has now integrated into the related applications of "AI Visual Recognition", combined with innovative services such as communications, information, artificial intelligence and the Internet of Things, and has now entered the fields of banking, retail and manufacturing. In addition, they will continue to cultivate various applications in smart cities, where recently, the air quality monitoring solution has been adopted by many local governments. For instance, more than 1,000 air quality sensors have been deployed in Chiayi City and other five counties and cities. (Huang, February 2, 2020).

Taiwan Mobile 5G Application Service Operation Status and Core Resources

Planning Business Projects, Motivation, Goals and Service Positioning

5G has four technical characteristics including enhanced mobile broadband (eMBB), low-latency communication (URLLC), massive network connection (mMTC), and multiple access edge computing (MEC), but the relevant technical specifications are not completely finalized, and application services are still developing. In fact, the chances of killer applications appearing in the short term are relatively low (Liu, May 20,2020). Therefore, Taiwan Mobile aims to increase 5G coverage and availability in the short term, and actively build to enhance the user experience. On the other hand, through the optimization of Internet speed, they will continue to develop digital convergence services (combining telecommunications, digital cable TV, and OTT platforms) to meet user needs, value-added services of the Internet of Things (such as wearable devices, smart speakers, etc.), interactive diversified business projects such as entertainment services (eg, multi-view relay, AR/VR).

Based on the promotion of digital convergence services and IoT value-added services, Taiwan Mobile further integrates multiple terminal devices, high-definition digital content and cloud technology. Employing the complete network coverage of 5G mobile networks and high-speed optical fiber Internet access, they have developed innovations such as smart home services, so that individuals and home users can enjoy the convenience of life brought by digital convergence integration services.

While the 5G technology matures, as for the mid-to-long term, Taiwan Mobile's development goal is to extend existing telecommunications services to the cloud, Internet of Things, ICT integration services, and information security, and to develop new types of operations and business with vertical field enterprise users in the service application model, providing resources for the development of innovative services with forward-looking thoughts, and building a 5G industry ecosystem with the 10 to 15 years of long-term thinking (Grit).

Analysis of Core Resources/Capabilities and Competitive Advantages

Taiwan Mobile's core resources and capabilities are different from those of other telecom operators, which makes Taiwan Mobile no longer consider itself only a telecom operator, but reposition and transform into a new generation network technology company to meet 5G, AI and Internet of Things New generation. To achieve transformation goals, Taiwan Mobile fully integrates telecommunications services, my series of new services (such as: myVideo/MyMusic/myBook/myAir), digital cable TV and home broadband services, momo shopping, AppWorks Startups, and Fubon Financial Holdings (Group) resources, through the diversified business layout to promote new business, cross-sell between products, audio and video resource integration and channel cooperation to maximize the synergy.

At present, Taiwan Mobile has carried out "mobile-to-Internet and home fiber optic convergence "good speed double project", through momo shopping and cable TV to increase the penetration of

my series of services, cooperation with startup kkday to sell roaming prepaid cards, launching momo shopping Multi-product mobile tariff solutions, new myfone stores to provide momo shopping customers to pick up stores, combined with Taipei Fubon Bank launched momo website shopping 5% back unlimited momo card and other cross-business cooperation projects; in addition, the use of 7.16 million active Gifts such as paying customers, nearly 800 physical stores, and massive data can accurately and quickly create differentiated products and services that are different from other telecommunications companies. In other words, other competitors lack the aforementioned resources including digital cable TV and the banking system. For example, the banking system can help accelerate cash flow services, increase added value, and create new benefits. Taiwan Mobile develops core resources/capabilities for 5G applications. With inimitability, in-substitutability, durability, and appropriability of resources, it will have competitive superiority in the near future. It is worth observing how its integrated group resources play its role. The effect of 1 +1 greater than 2 makes the aforementioned core resources and capabilities contribute to the qualitative and quantitative changes of the overall operation and achieve sustainable competitive advantage.

Strengthen or Focus on Core Resources, New Resources and Continuous Competitive Advantage Analysis

In recent years, the decline in ARPU of Taiwan's telecommunications services has obviously affected revenue growth. Analysis of the reason why Taiwan Mobile's revenue continues to grow steadily is mainly due to the growth momentum contributed by its subsidiary company, MOMO, an e-commerce platform. In addition to the growth in operation profit in the first quarter of 2020 compared to the same period last year, the existing business of telecommunications has also gradually improved, with the transformation strategy and has led Taiwan Mobile into slight competitive advantage, where they would have to face the challenges of high capital investment, which is required for 5G hardware construction.

On the other hand, Taiwan Mobile makes good use of the “Last Mile” group advantage by combining the digital convergence project of mobile Internet access and home broadband service, with the integration of mobile phones, commercially available connected home appliances, OTT services and cloud services. The Google Nest Mini smart speaker of the database expands the smart home market and gradually shows the development potential of the smart home system in the 5G application market. Google Nest Mini smart speaker sales has been ranked first in the telecommunications industry in the second quarter of 2020, where it can be seen as the efforts plunge in to obtain new resources to achieve sustainable competitive advantage. Taiwan Mobile used this as a basis to actively expand the smart home ecosystem and gradually practice to lead home users to upgrade the operation goals of "Smarter Home".

In addition, Taiwan Mobile is also actively creating a platform for the convergence of audio and video content, not only investing resources in local homemade dramas (including: "Story of Two Cities", "workers", etc.), multi-view/AR/VR and 4K high-quality broadcast services. It also integrates OTTs such as myVideo/MyMusic/myBook and 4K set-top boxes for digital cable TV to bring users a comprehensive audio-visual entertainment experience different from other manufacturers. With the aid of AppWorks Startups, Taiwan Mobile will take SaaS (software-as-a-service) thinking as the core, get rid of the role of "dumb pipe", actively provide software services, and make good use of the group's diversified resources to achieve multiplied benefits and further develop the Internet of Things with the vertical field market. Taiwan Mobile has the opportunity to strengthen and expand new resources to obtain its sustainable competitive advantage.

Cross-Industry Alliances and Transnational Cooperation to Develop Competitive Strategies and Competitive Advantages

5G affects the revolutionary changes in the entire industry chain. In fact, competitors of Taiwan Mobile include vertical industry players who participate in the development of 5G application services in addition to other telecom peers. Therefore, the strategic thinking of cross-industry alliance is needed. Taiwan Mobile integrates IT, CT industry, and the leading teams of the newly created teams to form a "5G Super Alliance", trying to take advantage of the cooperation of different industries in research and development, and consolidating the advantages of their respective industries, creating a 5G industry ecosystem, and getting Taiwan Mobile the opportunity to develop 5G applications.

At the same time, Taiwan Mobile is more active in forming alliances with regional partners to develop cross-border cooperation, combining the technology and resources of telecom operators in various countries, and developing innovative business applications. Taiwan Mobile is the only telecom operator (Bridge Alliance Department) in Taiwan that participates in the Bridge Alliance, where it is composed of more than 20 members and business partners including Singapore's Singtel, Hong Kong's CSL, Australia's Optus, Malaysia's Maxis, Thailand's AIS, South Korea's SK Telecom, Japan's Softbank, etc.), and also actively initiates regional cooperation with 5G operators in other countries, such as: SK Telecom, the largest telecommunications provider in South Korea, signed a memorandum of cooperation in 2020, focusing on technological cooperation such as 5G network construction, network performance improvement, and technology transfer. It is hoped that SK Telecom will provide 5G commercial transfer experience to enable Taiwan Mobile to work in 5G network deployment, vertical field commercial applications, and personal user service promotion, where they will have a grasp of the development opportunities and strengthen their competitive advantage. In the following studies, we will further discuss the "strategic alliance" and trend planning of Taiwan Mobile's development of 5G application services.

Motivation and Purpose of Strategic Alliance

The technical characteristics of 5G Low-Latency Communication (URLLC) and Mass Connectivity (mMTC) can create a variety of applications other than mobile connected services, unlike 2G to 4G, because the main market of the 5G generation will expand from individual users to corporate verticals. In the field, the business model of the telecommunications industry must no longer be based solely on the provision of networked services, but must be accompanied by the introduction of other application services.

Therefore, experts analyze the current common motivation and goal of the five major telecommunications undertakings in Taiwan is to form an alliance. After all, the telecommunications industry is a typical network-based industry. The network-based industry has three characteristics: economies of scale, complementarity and network effects, and alliance is the concept of complementarity. In the past, the telecommunications service network was mainly dominated by telecommunications. However, it has been transformed into a network service, and the telecommunications industry has started to provide a full range of services, ushering in the 5G generation, and the alliance has become a "must" (Liu, May 20 ,2020).

In addition to considering the motivation and purpose of Taiwan Mobile's strategic alliance to enter new markets, complement each other's resources and capabilities, cost reduction, economies of scale, increase efficiency, learn new knowledge, and joint risks allocation. It also includes setting industry standard technologies, developing new products, and joint product marketing and even brand collaborations. In order to implement various field applications, Taiwan Mobile and the media, esports industry, finance, government units, transportation, education, medical care, manufacturing and agriculture jointly form a "5G Super Alliance" to integrate resources through cross-border strategic collaboration. It has allowed full play to the professional advantages in their respective fields, as it spurs cross-industry integration of creativity and increase R&D efficiency, propose applications and products covering software/hardware and cloud, and to meet different users' needs with differentiated solutions.

Strategic Alliance Type, Cooperation Partners, Exchange Resources and Expected Benefits

The types of strategic alliances mainly include: functional agreements, joint ventures, horizontal integration, vertical integration, diversification, and groups. Taiwan Mobile mainly forms 5G application development strategic alliances in the form of functional agreements, joint research and development, and diversified integration, such as: integrating AppWorks' innovative energy R&D and innovative applications; The Carota company formed an alliance to jointly launch the IoV service management platform service; signed a 5G letter of intent (MOU) with the Industrial Technology Research Institute, focusing on the cross-industry Industrial Internet of Things (IIoT)

and Artificial Intelligence Internet of Things (AIoT), to develop the wisdom of "unmanned economy" business opportunities. Taiwan Mobile believes that by collaborating with different industries and creating a cross-industry friendly cooperation environment with 1+1 which is greater than 2, it is possible to find a mutually beneficial business cooperation in the unknown 5G application market through the balance of strengths and weakness.

As for the partners of the alliance, at present, Taiwan Mobile's "5G Super Alliance" gathers nearly 100 top teams in the three areas of production, government and research. The alliance lineup includes domestic and foreign telecommunications equipment manufacturers (such as Nokia, Ericsson, etc.), mobile phone manufacturers (such as ASUS, HTC, Samsung, Sony, LG, etc.), application platforms and service providers, startups and R&D teams, etc., covering 5G technology research and development, innovative business services, smart homes, smart parking, smart care, AR/VR and holographic projection interaction and other applications technology.

Generally, the selection criteria of strategic alliance partners include: resources and capabilities of the other party, past cooperation experience, mutual cooperation with common goals, long-term cooperation on the timeline, open communication and coordination with each other, willingness to stick to commitments, etc. Taiwan Mobile's cooperation partners in the 5G application development strategy alliance are extensive and huge. The general manager Lin Zhichen said: "5G is not only a change in people's lives, but even a revolutionary change in the entire industry chain; the formation of the "5G Super Alliance" not only symbolizes Taiwan. It will move towards a new generation of 5G technology companies, and will provide more innovative and diverse vertical application services to build a complete 5G ecosystem." In fact, expert analysis believes that the concept of strategic partners is to form an ecosystem (Liu, May 20, 2020).

For the purpose of exchanging resources to achieve benefit evaluation and other aspects, taking Taiwan Mobile's construction of a "smart stadium" 5G experimental network at Xinzhuang Baseball Stadium as an example, Chief Technology Officer pointed out that in order to respond to the instantaneous simultaneous launch of a large number of videos in the smart stadium field, a 5G transmission network of data "one-to-many" or "many-to-many" has been implemented, where a 5G experimental network was built at the Xinzhuang Baseball Stadium. In addition to the 5G private network and small cell and CPE measured fields, it was also established in cooperation with the Industrial Research Institute The iMEC platform, combined with VR relay equipment and image transmission technology, provides real-time high-definition VR video and audio experience, including VR 360 multi-view events, interactive time slicing, and three-dimensional VR stadium tour; there are also smart parking, video self-checkout and other systems for fans, surrounding all services from arrival to departure. Taiwan Mobile builds the first "5G Wisdom Demonstration Zone" in Taiwan that starts from the stadium and integrates with the neighboring business districts. It aims to show the perfect combination of new technologies and sports events in the future (Chen, July 30, 2019), and build a complete "Smart Stadium" 5G ecosystem. Combining the

aforementioned resources and strategic alliance practices, Taiwan Mobile attempts to create a complete ecosystem that combines cash flow, logistics, and information flow.

Concluding Remarks

Taiwan Mobile Case Analysis Inspiration

In this study, the resource-based theory of strategic alliances has been implied to analyze the case of Taiwan Mobile's current 5G application service operation status, "core resources", and 5G application service "strategic alliance" planning and development, etc. which also examines the initial resources of the telecommunications industry and the competitive advantage of the strategic alliances in Taiwan.

The differences of the core resources and capabilities between Taiwan Mobile and the other telecom operators, has made Taiwan Mobile to no longer consider itself being only a telecom operator, but instead to reposition and transform into a new generation network technology company that matches 5G, AI and Internet of Things. In comparison with competitors that are lacking resources such as television and banking systems, Taiwan Mobile's banking system can help accelerate cash flow services, enhance overall added value, and create new benefits. Some of them have the core resources/ability to develop 5G applications, for instance, inimitability, in-substitutability, durability, and appropriateness, which allows the follow-up, being one that is worth observing on how to integrate group resources and truly acquire sustainable competitive advantage.

Even with the declining of Taiwan's telecommunications service ARPU, which affected the revenue growth, Taiwan Mobile's revenue continued to grow steadily, although it is mainly due to the growth of its subsidiary company, MOMO, an e-commerce platform. In fact, the telecommunications business has gradually improved with the transformation strategy and has led Taiwan Mobile into slight competitive advantage, where they would have to face the challenges of high capital investment, which is required for 5G hardware construction. In particular, competitors of Taiwan Mobile include vertical field players involved in the development of 5G application services in addition to other telecom peers. Therefore, Taiwan Mobile integrates IT, CT industry and new team leaders to form a "5G Super Alliance", to take advantage of the cooperation of different industries in research and development, consolidating the advantages of their respective industries, and building a 5G industry ecosystem. Expert analysis also believes that it is the correct way as the concept of strategic partners is to form an ecosystem (Liu, May 20, 2020).

As Taiwan Mobile is also actively forming alliances with regional partners to develop cross-border cooperation, combining the technology and resources of telecom operators in various countries,

developing innovative business applications; in addition, it is also the only telecom operator in Taiwan that participates in the Bridge Alliance, the largest mobile communications operator alliance in the Asia-Pacific region. It is also actively working with operators of 5G in other countries to launch regional cooperation and to provide Taiwan Mobile with 5G network deployment, vertical field commercial applications, and personal user service promotion to strengthen its competitive advantage.

The motivation and purpose for Taiwan Mobile's strategic alliance to develop 5G application services, takes into consideration of not only entering new markets, complementary resources and capabilities, cost reduction, economies of scale, increased efficiency, learning new knowledge, and joint risk allocation. It also includes setting industry standard technologies, research and developing new products, joint marketing of products, and even brand creation. In order to implement various field applications, Taiwan Mobile and the media, esports industry, finance, government units, transportation, education, medical care, manufacturing and agriculture have joined together to form a "5G Super Alliance" to integrate resources through cross-border strategic cooperation. Giving it a full play to the professional advantages in their respective fields, it spurs cross-industry integration of creativity and increase R&D efficiency, which also propose applications and products covering software/hardware and cloud, and meet different users' needs with differentiated solutions

In the future, as 5G technology matures, the mid and long-term development goal of Taiwan Mobile is to extend existing telecommunications services to the cloud, Internet of Things, ICT integration services, and information security, and to also develop new types of operations and services with vertical field enterprise users in the application mode, providing resources for the development of innovative services with forward-looking thoughts, and building a 5G industry ecosystem with the 10 to 15 years of long-term thinking (Grit). Taiwan Mobile has the opportunity to strengthen and expand new resources to obtain its sustainable competitive advantage.

Taiwan Mobile mainly forms a 5G application development strategic alliance in the form of functional agreements, joint research and development, and diversified integration. As for the partners of the alliance, currently, Taiwan Mobile's "5G Super Alliance" gathers nearly 100 top teams in the three areas of production, government and research. The alliance lineup includes domestic and foreign telecommunications equipment manufacturers (such as Nokia, Ericsson, etc.), mobile phone manufacturers (such as ASUS, HTC, Samsung, Sony, LG, etc.), application platforms and service providers, startup and R&D teams, etc, which yields applied technologies such as R&D, innovative business services, smart home, smart parking, smart care, AR/VR and holographic projection interaction. The selection criteria for a strategic alliance partner, looks into its resources and capabilities with the other party, past collaboration experience, mutual collaboration with common goals, long-term cooperation on the timeline, genuine communication and coordination with one other, willingness to stick to commitments, etc. With its extensive 5G

application development strategy with the alliance partners, the “5G Super Alliance” need not only symbolizes Taiwan Mobile's progress towards a new generation of 5G technology companies, but also provides more innovative and diversified vertical application services. It integrates the aforementioned resource integration and strategic alliance practices. Taiwan Mobile tries to create a complete ecosystem that combines cash flow, logistics, and information flow.

According to expert analysis, the current talk on the development of 5G services, mainly surrounds the expectation of technical characteristics, because the real service has yet to roll out, and it is too early to draw a conclusion to it. However, the innovative resources and alliances currently displayed by Taiwan Mobile, combining both the innovation system of cyberspace and physical space has led to a social and industrial ecology that realizes value creation, which is a breakthrough known as Society 5.0 (Liu, May 20 ,2020).

Opportunities and Challenges for Taiwan Telecom Operators to Develop 5G Application Services

To develop 5G application services, the most basic resource is spectrum and network. If the frequency spectrum can meet the technical requirements of 5G, the bandwidth must be at least 100 MHz to fully utilize the technical characteristics of 5G. However, four out of the five telecommunications companies in Taiwan won the bids at 90 MHz, 80 MHz, 60 MHz, and 40 MHz, totalling to 270 MHz. Experts analyzed that in terms of spectrum resources required for 5G innovative applications, the released bandwidth is actually insufficient, and it still needs to be developed and adjusted in the future. Secondly, the high frequency band of the network is relatively short, and the range is not broad enough. Hence, the coverage of the base station needs to be relatively dense, and we will see a spike in the construction cost accordingly. In other words, the cost burden of the network construction of the Taiwanese telecommunications industry will be considerably costly; in particular, the industry is obligated to cover coverage, but the business model of 5G application services is still in the exploration stage. Even with ambitious aspiration for the 5G technology, the real challenge of "network construction" in Taiwan's development of the 5G industry has only just begun (Liu, May 20 ,2020).

Moreover, the poor physical characteristics of the 3.5GHz indoor penetration rate of the 5G mainstream frequency band has also made the 5G construction to cost 3 to 5 times more than 4G. Additionally, since telecommunications operators now use 5G equipment provided by foreign manufacturers, the construction cost invested by the government cannot benefit domestic related industries within Taiwan itself. Taiwan Mobile believes that in the 5G era, the underlying network coverage and connection quality are also the key to competition. However, the main users of the service have shifted from the general consumer to the industries and enterprises that require cutting-edge applications. The application, platform, system integration and new business model

that can promote the world may be a niche for Taiwan's new generation of industrial transformation and economic development.

Relevant Policies, Regulations and Resource Suggestions

According to Taiwanese telecom operators and experts, they have analyzed and pointed out that the "Enterprise-Specific Private Network" is an innovative application for enterprises to develop 5G services, but the demand derived from it, is a system that Taiwan has yet to tap into. Although the Telecommunications Management Law allows "Common Frequency Sharing", the concept is still vague (Liu, May 20 ,2020).

Taiwan Mobile believes that the government should open up the sharing of resources at the base layer (telecommunications network) coming under the "Shared Frequency and Network" policy. In addition to inter-telecom operators, it also includes telecom operators and vertical fields, allowing telecom operators to focus on the competition of the operating layer (telecommunications services) and the content application service layer to promote frequency utilization efficiency, encourage new technology research and development, drive enterprise vertical field application service development, which allows consumers to enjoy more life-oriented 5G innovative services, that is aligned with Taiwan's goal of being a fully digitalized country.

In 2020, Taiwan has released commercial frequency bands for both 3.5GHz and 28GHz power supply operators. It is in plan where the 4.8 to 4.9GHz enterprise-specific frequencies for electronics manufacturers such as telecommunications and telecommunications are to be released after 2022. In order to make Taiwan an important core strategic industry, if a company's private network that exhibits high-speed, large-bandwidth, massive transmission, and takes into account coverage and indoor penetration can be deployed ahead of time, it is also necessary to rent or share the currently released frequency combination using 5G technology with the telecommunications operator. Build a complete 5G performance private network across high, medium and low frequencies. Taiwan Mobile believes that NCC should adhere to the aforementioned national strategy and the spirit of the parent law, and authorize the draft of the first version of the "Radio Frequency Use Management Method" ("this draft") authorized by the Telecommunication Management Law. "Common frequency band", except for the 3.5GHz and 28GHz that have been released, the "frequency band using 5G technology" should be opened simultaneously, and the NCC has the right to veto such applications in accordance with the law to drive the leading trend of industrial research and development.

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