



Information Security

Biopharmacy Industry

**Next-Generation** Vehicle

> Smart Machinery

Communications Industry

Semiconductor

Industry

Internet of Things

Circular Economy

Green Energy

International Logistics and E-commerce

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### **Policy Initiatives**



#### 1 | 5G Infrastructure Policies and Measures |

Taiwan launched the "Digital Nation & Innovative Economic Development Program (2017-2025)" (DIGI+) at the end of 2016. DIGI+ places equal emphasis on software and hardware, and builds infrastructure that will benefit digital innovation and lay a solid foundation for a digital nation. In 2021, the DIGI+ Program was renamed and upgraded to the "Smart Nation Program (2021-2025)" and included information security, Beyond 5G (B5G) satellite communications, next-generation semiconductors, cloud era industry transformation, advanced network construction, and other advanced technologies to promote the overall digital transformation of the nation, society, and industries. In terms of communications infrastructure. Taiwan will accelerate 5G broadband construction and verification, complete advanced network construction, promote B5G satellite communications, enhance cybersecurity protection, create bandwidth policies, and implement legal adjustments to respond to the arrival of the digital society deregulation, innovation, proofs of concepts, and forging connections

In addition, our government launched the "Taiwan 5G Action Plan" (2019-2022) in May 2019, which calls for investment NT\$20.466 billion within 4 years to implement deregulation, innovation, proofs of concepts, and forging of connections. Taiwan will develop various value-added and vertical application services in 5G telecommunications to establish Taiwan as an environment suitable for the development of innovative 5G applications, enhance digital competitiveness, promote industrial innovation, and create smart living.

With regard to the opening of 5G bandwidths, the government in Taiwan has released 3.5GHz and 28GHz commercial bandwidths for telecommunications operators to provide 5G services to consumers and businesses. On the other hand, the 100MHz between 4.8GHz and 4.9GHz is dedicated to 5G applications. All industries may apply for site tests and license applications will be accepted in 2021 and 2022.

The "Communications Industry Development Project Office, Industrial Development Bureau, Ministry of Economic Affairs" is the unit responsible for promoting development in Taiwan's communications industry. The Office acts as a sort of government think tank responsible for comprehensively developing the network communications industry, and for guiding industries to invest in the development of integrated solutions. The Office integrates resources and links startups and international platforms to develop innovation capabilities and talent, in hopes of enhancing the competitiveness of Taiwan's communications industry.

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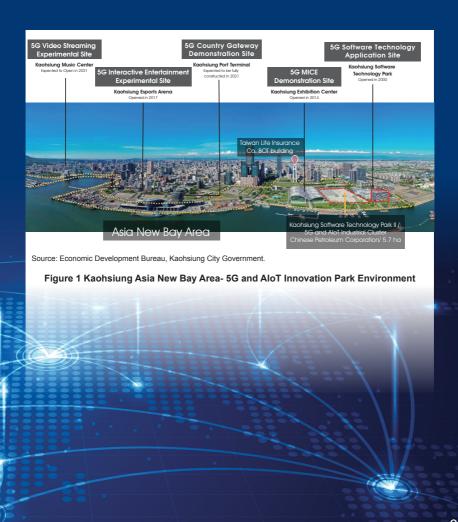
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### 2 | Asia New Bay Area 5G AloT Innovation Park |

The "Asia New Bay Area 5G AloT Innovation Park Promotion Plan" in Kaohsiung is led by the Ministry of Economic Affairs, which is expected to invest approximately NT\$11 billion in 2021-2025 to set up an end-to-end application and demonstration site for 5G AloT. Domestic and foreign telecommunications operators, cloud service providers, system integrators of all industries, and startup teams will adopt a "large companies supporting small companies" approach to form industrial clustering and attract domestic and foreign accelerators, incubators, and entire startup platforms. The aim is to create a comprehensive industrial ecosystem and become the largest 5G AloT innovation testing facility in Taiwan.

The plan includes five major measures: (a) Expand phase 2 of Kaohsiung Software Technology Park and business head office area; (b) establish startup parks and attract international accelerators; (c) create an incubation base and work with leading local companies to cultivate talent for content technologies; (d) complete the infrastructure necessary for smart city technologies, such as 5G networks and smart light poles; and (e) use the Kaohsiung Music Center, Exhibition Hall, Esports Arena, and Port Terminal to provide 5G and AR

technology experiences. The 5G AloT Innovation Park Promotion Plan is an important cross-agency plan. The Ministry of Economic Affairs is responsible for development and integration of the park, while the Economic Development Bureau of Kaohsiung City Government is responsible for joint development.



## Overview of Industrial Development

## 1 | Output Value |

Having the manufacturing systems for several communications products, Taiwan is one of the key players in the global communications industry. The output value of Taiwan's communications industry (including network communication equipment, personal mobile devices, and telecommunications services) was NT\$1.2201 trillion in 2020, dropping 10.3% from 2019 mainly due to the impact of the COVID-19 epidemic. The continued expansion of demand for Internet of Things (IoT) products and cloud applications, as well as the development of emerging technologies such as network virtualization, LPWAN, AI, 5G, and Edge computing are expected to boost the demand for wired/ wireless communication products. In 2021. Taiwan's communications industry can therefore expect to grow once again to NT\$1.248 trillion for an annual growth rate of 2.3%.

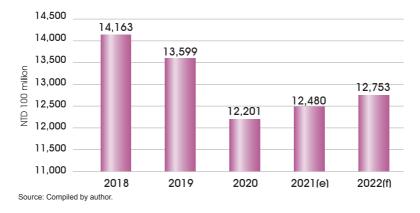
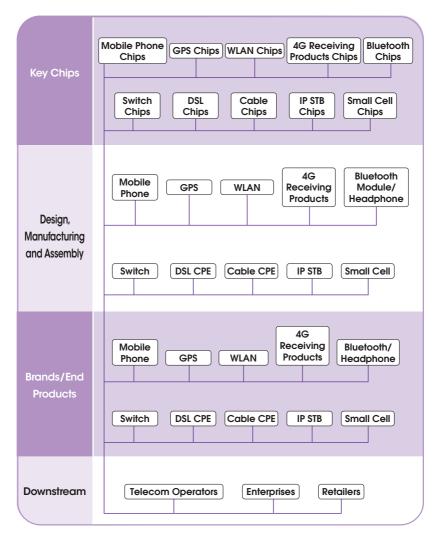


Figure 2 Output Value of Taiwan's Communications Industry in 2018-2022

## 2 | Industry Chain |

Taiwan's communications industry is very comprehensive and Taiwanese companies excel in system product design, production, and assembly. Figure 3 shows the main products and companies in the upstream and downstream parts of the communications technology industry. In terms of upstream manufacturing of key chips, Taiwan's communication chip manufacturers have actively entered the market in recent years and companies such as MediaTek, Realtek, and ALi Corporation have performed well across the world. In terms of midstream communication equipment, companies have made preparations for OEM and brand management. Companies mostly work with telecommunications operators in Western countries to provide OEM manufacturing and design services. However, many network communications operators have leveraged their strong design and production capacity and entered the white-label hardware market. In terms of brand management, many companies have continuously invested in the development of mobile phone and network communication equipment. Downstream operators consist mainly of telecommunications operators who focus on the domestic communication services market.





Source: Industry, Science and Technology International Strategy Center, ITRI.

Figure 3 Communications Industry Chain in Taiwan



## 3 | Industrial Clusters |

#### 1. Northern Taiwan

Taiwanese companies involved in the communications industry include IC manufacturers, equipment manufacturers, equipment branding companies, and telecom operators. Generally speaking, Taiwan's communications industry clusters are located in the northern parts of Taiwan, including Greater Taipei, Taoyuan, and Hsinchu, where Neihu Technology Park, Hsinchu Science Park, and Tai Yuen Hi-Tech Industrial Park are located, as well as the Guishan Township area in Taoyuan. Taiwan's leading communications companies are Accton Technology, Sercomm, and Wistron NeWeb. Leading telecom operators are Chunghwa Telecom. Far Eastone, Taiwan Mobile, and Asia Pacific Telecom.

#### 2. Central and Southern Taiwan

Communications companies in central Taiwan are mainly automobile communications electronics and consumer electronics manufacturers such as Merry Electronics and Jabil Green Point. Even though southern Taiwan is home to Kaohsiung Software Technology Park and Southern Taiwan Science Park, occupancy by communications companies is lower than in northern Taiwan.

# Potential Investment and Collaboration Opportunities in Taiwan

Leveraging Taiwanese Industry Clusters to Invest in Technological R&D and High-end Manufacturing

Taiwan's communications companies have both manufacturing and global logistics capabilities. Their strengths include networking chips, parts and components, touch panels, and system integration. The industrial chain is relatively complete. Therefore, Taiwan's complete communications industry cluster can improve the performance of R&D centers and manufacturing bases established by foreign companies in Taiwan. In upstream base components, for example, Taiwan Semiconductor Manufacturing Corp. (TSMC) has partnered with leading IC vendors such as Qualcomm and Ericsson to develop and produce 5G chips on an OEM basis. Taiwan's MediaTek has now launched a chip for the M70 5G Modem and is working on 5G System-on-Chip (SoC) products that are compatible with both Sub-6 GHz and mmWave bands. WIN. Wha Yu Industrial, Universal Microwave Technology (UMT), Advanced Wireless Semiconductor (AWSC), and other companies are working on power amplifiers, antennae, and radio-frequency components. In the midstream segment, Taiwanese manufacturers are working on networking and hardware infrastructure (switches, routers, micro-cells, consumer premise equipment, and set top boxes. For downstream end-user applications, Quanta, Advantech, and Gigabyte are developing virtual platform servers; Askey, Wistron NeWeb, Jorjin Technologies, and HTC are developing wearable devices. In the future, foreign companies can invest in business opportunities offered by Taiwan's communications industry through collaborative R&D and technology transfers.

The US-China trade and tech wars have prompted several network communications operators to return to invest in Taiwan, and Taiwan's

advantageous position has become more consolidated. The unique characteristics of the 5G Open Radio Access Network (Open RAN) will create opportunities for collaboration between telecommunications operators, software and hardware companies, and system integration companies. Foreign companies can collaborate with Taiwanese companies on the development of 5G application services. The integration of AI, IoT, and AR/VR technologies in particular will lead to the development of new business opportunities in diverse applications.

## 2

# Taiwan as a Base for the Development of 5G Business Models and Innovative Applications

Due to the rapid development of mobile communications technologies worldwide, 5G services will become a key focal point for anyone observing the global communications industry's development in 2020. Even as other countries around the world are launching their own 5G development efforts, Taiwan already plays an important global role thanks to its edge in the development of key chips, modules, and terminal products. Taiwanese companies will have an opportunity to connect central office equipment to terminal equipment, then gradually complete the industrial value chain as they integrate 5G, cloud computing, IoT, and AI technologies, thereby becoming system solution suppliers.

In addition, local telecom operators are all actively building their own 5G testing facilities to develop a new business model for 5G. The availability of open networks and communications infrastructure will hopefully encourage vendors to experiment with different solutions. Chunghwa Telecom, for example, has partnered with KingwayTek to transform the Hutoushan Innovation Hub into a 5G pilot trial site for the development of a wide range of application scenarios. Taiwan Mobile has built a team of 6 local start-ups to enable 8 5G application services and scenarios for baseball, including 3D instant replay, AR virtual opening pitch display, and 4K multi-angle live streams. Technology is used to provide people watching baseball in the stadium or online with brand new services. The integration of AI, IoT, and AR/VR technologies in particular should lead to the development of further business opportunities in vertical applications.



## Partnering with Taiwan to Take Advantage of Emerging Opportunities Due to COVID-19

The COVID-19 pandemic has driven changes in industries and accelerated the development of the "three zero" business model -- i.e. the zerocontact economy (remote work and online meetings), zero-human production (automatic production, warehousing, and logistics), and unlimited applications (artificial intelligence and big data analysis) -- from which new information and communication technology products and applications have been born. The pandemic has increased the demand for remote work by video conference, online shopping, channel service logistics, and home entertainment. People are expected to have grown accustomed to the current consumption and lifestyle and the stay-at-home economy will continue to expand, which will increase the demand for network communication equipment and communication software. A convergence of the communications and medical industries to develop electronic quarantine and tracking systems in response to the pandemic may become a future trend as well. As a key hub of the global communications industry, Taiwan is home to a number of communications hardware manufacturing systems. It can help foreign companies to conduct technology R&D, development of smart application systems, and subsequent commercialization and hardware production. Foreign companies can take advantage of these business opportunities through collaborative R&D and investment in Taiwan.



## **Investment Incentive Measures**



Taiwan's profit-seeking enterprise income tax rate is 20%. To encourage foreign companies to invest in Taiwan, support industrial innovation, and promote industry-academia collaboration, foreign companies are eligible for the following preferential taxes (Table 1):

#### **Table 1 Preferential Taxes**

Item	Preferential tax(es)
R&D and introduction of technology or mechanical equipment	Up to 15% of the company's R&D expenditures may be deducted from its profit-seeking enterprise income tax for current year; or up to 10% of such expenditures may be credited over three years against the profit-seeking enterprise income tax payable by the company.
	<ul> <li>Royalty payments to foreign companies for imported new production technologies or products that use patents, copyrights, or other special rights owned by foreign companies is, with the approval of the Industrial Development Bureau, MOEA, exempt from the corporate income tax.</li> </ul>
	<ul> <li>Imported machinery which local manufacturers cannot produce are eligible for duty-free treatment.</li> </ul>
Foreign special professionals	<ul> <li>Foreign special professionals who meet criteria are eligible for a 50% deduction of total income tax for amounts exceeding NT\$3 million.</li> </ul>

Item	Preferential tax(es)
Investment in smart machinery / 5G	• 5G: Related investment projects include 5G communication systems, and new hardware, software, technology, or technical services.
	<ul> <li>Smart machinery: Automatically scheduled, flexible, or mixed-model production lines that utilize big data, AI, and IoT.</li> </ul>
	• For investments of no less than NT\$1 million and no more than NT\$1 billion, either "5% of investment spending deducted from profit-seeking enterprise income tax (current FY)" or "3% of investment spending deducted from profit-seeking enterprise income tax, if total spending spread over three years" may be selected, but the total amount deducted may not exceed 30% of corporate income tax that year.
	<ul> <li>The applicable periods are January 1, 2019 through December 31, 2021 (smart machinery) and January 1, 2019 through December 31, 2022 (5G).</li> </ul>
Employee stock compensation	<ul> <li>A company employee who has obtained stock compensation worth a combined total of less than NT\$5 million and continuously held the stock while remaining in the company's employ for at least two years may choose to be taxed on the market price of the stock at either the time the stock was obtained or the time the stock is sold, whichever is lower.</li> </ul>
Setting up operations in industry parks	<ul> <li>Companies that set up operations in export processing zones, science industrial parks, or free trade ports are eligible for exemptions on import duties, commodity tax, and business tax for the import of machinery and equipment, ingredients, fuel, materials, and semi-finished products for their own use.</li> </ul>
Others	Companies that use undistributed earnings to engage in substantive investments may exclude the amount when calculating their profit-seeking enterprise income tax.

## 2 | Subsidies |

#### 1. Global R&D Innovation Partner Program

Some foreign companies have a high degree of complementarity with Taiwan's industries, so we encourage them to come to Taiwan to plan and develop forward-looking technologies more advanced than those that Taiwanese firms currently possess, as well as key technologies or integrated technologies. By engaging in R&D work on such technologies in cooperation with Taiwanese firms, they could exert a key influence on Taiwanese industry by: (a) spurring R&D work on industrial technologies as well as the establishment and development of supply chains; (b) improving R&D efficiency; (c) accelerating the timetable from R&D to production; and (d) contributing actively to expansion of international markets. Foreign companies that achieve such things, after gaining approval from the MOEA, will be eligible for subsidies of up to 50% of total R&D expenditures.

## 2. Program for the Development of Pioneering Companies

The purpose of this program is to build Taiwan into a high-tech R&D center and encourage leading international manufacturers to establish cutting-edge R&D bases in Taiwan so that they can work here on forward-looking technologies and link up with the Taiwan supply chain, thereby creating a division of labor in the areas of research, cocreation, and development, with an eye to strengthening the technological competitiveness of Taiwan's leading industries and accelerating the formation of clusters in emerging industries. Program funding of up to 50% of total expenditures may be granted for any project that has been approved by the Ministry of Economic Affairs.

#### 3. Taiwan Industry Innovation Platform Program

The Industrial Development Bureau and the Ministry of Science and Technology are jointly running the "Taiwan Industry Innovation Platform Program" to guide industries to develop towards greater value, and encourage companies to enter high-end product application markets to increase the industry's overall added value. The program provides companies with R&D teams in Taiwan with 40-50% of funding required for theme-based R&D projects, and up to 40% of funding for R&D projects proposed by companies.



## Leading Taiwanese Companies



MediaTek Inc. was established in 1997 and it has become a leading global IC design company through continuous investments in advanced processes and technologies. The Company's core businesses include mobile communications, smart home technologies, and automotive electronics. It focuses on the development of core technologies for chips suitable for these three platforms. It uses highly integrated and innovative chip designs to help manufacturers optimize the supply chain and reduce new product development time<sup>1</sup>.

Realtek, which was established in 1987, focuses on the development and design of network chips and integrates key components (e.g., MCU, DSP, RISC, PLL, RFIC, and memory) to create systems on a chip (SoCs) and provide customers with total solutions<sup>2</sup>. Realtek is the largest supplier of high-speed Ethernet and a leading maker of audio codec chips for computers. Its well-known products include communications network chips, multimedia chips, screen control chips, and high-speed wireless broadband chips.

<sup>1</sup> Official website of MediaTek: https://www.mediatek.com/.

<sup>2</sup> Official website of Realtek: https://www.realtek.com/zh-tw/.



## 2 | Network Communication Equipment |

Accton Technology was established in 1988 and focuses on the R&D, design, and manufacturing of Ethernet and wireless equipment. It is a leader in the design of open hardware platforms for data center, carrier access, and campus networks. Accton has R&D and sales centers in Taiwan, the US, and China, and has over 5,000 employees worldwide<sup>3</sup>.

Sercomm was established in 1992 with broadband network software and firmware R&D as its core business, but it is now a leading vendor of broadband equipment. It is headquartered in Taipei and has sales offices throughout North America, Europe, China, and the Asia-Pacific with several thousand employees worldwide. Its products span home-use, commercialuse, telecommunications, security surveillance, and cloud applications, and main products include: Integrated Access Devices (IAD), commercial

<sup>3</sup> Official website of Accton: https://www.accton.com.tw/accton/.



network communication equipment, FTTx fiber optic products, cable DOCSIS equipment, small cells, and smart IoT solutions.

Wistron NeWeb Corporation (WNC) was established in 1996 and specializes in the design, R&D, and manufacturing of communications products. It offers comprehensive technical support in RF antenna design, software design, hardware design, mechanical design, system integration, user interface development, and product testing & certification. Headquartered in Taiwan's Hsinchu Science Park, WNC has also established an overseas presence in the USA, the UK, Japan, China, and Vietnam. WNC is the global leader in built-in antennas for notebooks with a 35% market share, and has shipped over 300 million units of satellite communications and digital home products to date<sup>4</sup>.

<sup>4</sup> Official website of Wistron NeWeb Corporation: http://www.wnc.com.tw/index.php?action=about&cid=1.

## 3

#### **Telecommunications**

Chunghwa Telecom was established in 1996, prior to which it had long operated as a business department of the Directorate General of Telecommunications, Ministry of Transportation and Communications. It is the largest general telecoms operator in Taiwan, and its scope of business covers fixed network communications, mobile communications, broadband access, and Internet service. It also provides corporate customers with ICT services using its big data, information security, cloud, and network data center technologies. Chunghwa Telecom is also developing emerging technology services such as IoT and AI<sup>5</sup>.

Taiwan Mobile was established in 1997 and was the first private telecommunications company listed on Taiwan Stock Exchange (TWSE). It has comprehensive WCDMA (3G), LTE (4G), and NR (5G) frequency licenses. In 2017, Taiwan Mobile announced its transformation into a next-generation network technology company that would focus on the four industries of "T.I.M.E" (i.e., telecoms, Internet, media & entertainment, and e-commerce) for diverse operations. In response to the 5G, IoT, and AI smart cloud developments, Taiwan Mobile in 2019 implemented the "Super 5G Strategy" to actively develop IoT services and conduct innovation and R&D on 5G applications<sup>6</sup>.

<sup>5</sup> Official website of Chunghwa Telecom: https://www.cht.com.tw/zh-tw/home/cht.

<sup>6</sup> Official website of Taiwan Mobile: https://www.taiwanmobile.com/index. html.

# Examples of Successes Achieved by Foreign Companies



Qualcomm announced the establishment of its "Center for Operations, Manufacturing Engineering and Testing in Taiwan (COMET)" in June 2019 and planned to set up 4 excellence centers/laboratories including a 5G mmWave testing center, a laboratory for the development of 5G radio frequency devices and 5G modules, a center of excellence for biometric sensing technology, a production and testing center, and an IC packaging thermal/mechanical laboratory. It invested NT\$5.5 billion in the COMET building on more than 7,200 square meters of land. It is now collaborating with testing service providers such as KYEC and MPI.

Other cooperative undertakings have included the completion of joint 5G testing in collaboration with Nokia and Mediatek in 2019. At the end of 2019, Nokia also announced that it would release a 5G baseband IC developed by Mediatek based on specifications issued by Intel. Dell and HP were expected to introduce the new IC on their 5G notebooks in early 2021. Europe's multinational telecom operator Vodafone selected Accton subsidiaries Edgecore Networks and Alpha Networks, along with Delta Electronics subsidiary Delta Networks to develop disaggregated cell site gateways (DCSGs). Synopsys established the "Hsinchu AI Chip Design Lab" in February 2020 to introduce core technologies necessary for AI chip design.

## 2 | Testing Facilities |

US-based Cisco partnered with the Taoyuan City Government in late 2019 to establish a "Cisco Innovation Center" for smart solutions in Taoyuan's Chingpu district. This Innovation Center will serve as an R&D hub for IoT in Taiwan. A number of Taiwanese companies, including Delta Electronics, MiTAC, and Syscom, had already signed on to the project. Cisco also formed a partnership with the Industrial Development Bureau of the Ministry of Economic Affairs in August 2020 to establish the first 5G open architecture network platform with domestic network communication equipment manufacturers (Pegatron, UfiSpace, Compal Electronics, Askey, Quanta Cloud, Foxconn Global Network, Wistron NeWeb Corporation, Wollemi Technical Incorporation, and Hwacom Systems). This platform will provide an interface with the Taiwanese communications industry for the co-development of a dedicated 5G open architecture network and ecosystem. In the future, white-label equipment and applications produced in Taiwan can be marketed internationally through Cisco's global sales network.

Qualcomm joined forces with ASE and Chunghwa Telecom to create a dedicated 5G mmWave private network smart factory which was inaugurated in December 2020 and integrated the following three major applications into the production lines of ASE Group's Kaohsiung Plant: AI + autonomous guided vehicles (AGV); remote AR maintenance assistance; and the Green Technology Education Center AR Experience. The smart factory creates a development environment for 5G innovations and applications. It demonstrates the scope and complexity of future smart factory and automation and accelerates the smart manufacturing process to serve as the best demonstration site for 5G applications in smart manufacturing. The project will last one year and it is expected to fulfill more vertical application functions for 5G enterprise private networks after its completion.

### 3 | Talent Development |

To help industries discover local talent with creativity and design application abilities, the Industrial Development Bureau, MOEA established a competition mechanism with themes based on development trends and needs of the communications industry. The idea is to attract youths to R&D and design work in innovative industries. The 2021 Mobile Heroes competitions focused on the Connected Future Challenge, Next-Generation 5G+ User Applications and Micro Base Station Antenna System Design Competition, 5G Pioneering Innovative Application Competition, and the Connectivity International Award for international submissions aimed at connecting international innovation with local industry talent. Nearly 10,000 students and other members of society have participated in the competitions to date. Leading international communications companies such as Google, Qualcomm, Microsoft, AWS, Sigfox, and Cisco have also taken part<sup>7</sup> to recruit exceptional teams and talents for their companies. The program has also given birth to startup companies such as ChaseWind Co., which was founded by the champion team Chasewind of the 2015 Mobile Heroes competitions. The team signed an MOU with Qualcomm in 2016 for joint development of communication chips.

<sup>7</sup> For example, Sigfox provided development modules for free to encourage contestants to develop innovative IoT applications using Sigfox technology. It also organized Hacking House to guide excellent startup teams in Taiwan to participate in its global IoT product development project.







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