



Digital
Transformation
Enabler

2020 INSTITUTE FOR
INFORMATION INDUSTRY
ANNUAL REPORT

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Cheng-Hong Cho,
CEO

Chih-Kung Lee,
Chairman of the
Board

Forging Digital Foundations and Jointly Contributing to Society

The COVID-19 pandemic sent the global economy into a deep chill that resulted in many small and medium enterprises running low on cash and fighting for their very survival. The ongoing pandemic has already created unprecedented changes in the global economy, business operations, and consumer behavior. Therefore, the “Digital Transformation” is now a top priority for governments and businesses alike.

Institute for Information Industry (III) has in recent years set out clear values and strategies as a “Digital Transformation Enabler,” coordinated inventories, and adjusted its internal operations. As a neutral, third-party organization, the Institute has helped construct the industry’s order. III focuses on the promotion of the digital transformation in Taiwan’s information society, industry, and government. The Institute fulfills its functions as a platform-type organization, and makes use of existing R&D assets and capabilities in areas such as IoT, 5G Communication Systems, Edge Computing, Big Data, Artificial Intelligence, Block Chain, Information Security, and Software Testing. III works with domain-type organizations to build open, innovative eco-systems that promote inter-disciplinary and value-adding projects.

In addition, in its role as a national think tank and supporter of industry development, III has also worked tirelessly to establish digital transformation models for the financial industry, set up agile software development environments, complete the world’s first satellite system validation, guide industries in complying with international information security regulations, create the 2030 Digital International Talent Development Blueprint, provide industries with key intelligence to respond to the volatile pandemic situation, establish national regulatory policy for data governance, assist local specialty industries in innovation, development, and digital transformation, assist overseas Taiwanese companies in their digital transformation process, connect with Japanese research institutions and industries to promote win-win partnerships, and assist the government with establishing comprehensive interdisciplinary information security and defense mechanisms, etc. III is expanding the scope of its digital transformation services at an accelerated rate to create a win-win model for a “digital transformation.”

Every country around the world has found itself on unfamiliar ground when faced with the changes and impacts brought by the latest wave of digital technologies. Government has planned to establish a Ministry of Digital Development, aiming at coordinating all the government departments to face with the opportunities and challenges of digital technologies. III will answer the government’s call and continue to apply digital innovation technologies to help society and industry bridge the gap caused by the digital transformation. By doing so, III will fulfill its role and mission as a “Digital Transformation Enabler.”

Partnership with III: Digital Transformation and Joint Breakthroughs

Some of the issues facing the global industry today include the rapid evolution of AI technology, market economies dominated by the business models of Uber and other similar digital platforms, the third Digital Revolution that is now blossoming everywhere, and the development of remote technologies driven by the COVID-19 pandemic. According to the observations of III for Taiwanese companies and the country's digital transformation, Taiwanese companies have a high level of awareness of digital transformation, but they do not have enough countermeasures. Under intensified industry competition and innovative technological shock, SMEs are now faced with innovation dilemma (succession gap and innovative change). They must accelerate their application of digital innovation and related technologies to avoid being left behind by the competition. Further analysis showed the common issues that Taiwanese companies face in their enterprise transformation which are as follows: (1) Lack of examples. They want to know if there are some experiences of local business which they can learn from. (2) Lack of talent. They lack digital transformation-related talent and organizational planning. (3) Lack of methods. They don't know where to start, how to keep going, and so on.

III began offering technical consulting and mentoring services on digital transformation to local enterprises in May, 2019. A hundred-strong ACE (Architect, Consultant, Evangelist) consulting team was also formed to meet the service and transformation requirements of different businesses. In 2020, some of the team's accomplishments on digital transformation in partnership with local enterprises were published in the Digital Transformation Enabler. In addition to the sharing of global digital transformation trends and challenges, the book also shared 33 success stories on partnering with local industries to overcome the competition.

To accelerate the systematic promotion of the digital transformation among enterprises, III has continued to assemble its technology R&D, think tank consulting, talent development, and industry service capabilities. III also set up the STEPS (Survey, Target, Engage Pilot, Spread) collaboration platform. At present, the platform's digital transformation methodology, teaching materials, and tool environment have been applied by ACE consultants. In the future, external mentoring experts will be introduced to build a network for the sharing of methods, tools, and inter-disciplinary co-creation. This package for mentoring enterprises on innovative industry R&D in response to the digital transformation has already accumulated a large number of successful examples in a number of industries, including the manufacturing industry (metal processing, bicycle and components, textiles, semiconductors etc.), logistics, healthcare, agriculture, fishery, and information services.

I. Partnering with Industry Associations to Promote AI Applications

III has partnered with ten industry associations, including Taiwan Electrical and Electronic Manufacturers' Association (TEEMA), Taiwan Silk & Filament Weaving Industrial Association (TSFA), and Taipei Computer Association (TCA) to analyze the requirements for their relevant industry and progressively establish examples of successful applications.

II. Leading Industry Players to Co-create New Business Models

Retail services have a significant impact in people's lives. III worked with leading providers of logistics, customer support, marketing, and e-commerce services to promote a secure data sharing and intelligent business assistant platform based on Block Chain technology. The platform allowed brand-name enterprises to seamlessly integrate their online and offline services for an improved customer experience. It also allowed process operators that span commercial flow, cash flow, and logistics flow to track data at all times which helped enterprises enhance the quality of their services.



III. Carefully Selected Topics to Cooperate with Industry Associations

(1) The OpenSEA was co-founded by III and CISA to promote the open software industry ecology and the establishment of digital transformation industry clusters. The key open co-creation themes supported by the OpenSEA and other sectors include: deployment of a post-AI management environment, open-source data center management, and integrated agile utility platform for development, operation, and maintenance (DevOps). (2) III partnered with TEEMA and established the Digital Transformation Committee to draw up the industry's digital transformation goals. In 2020, III, CISA, and the Cloud Computing & IoT Association co-hosted the Digital Transformation Model Awards. During this event, 12 model enterprises for digital transformation were jointly endorsed. By adopting digital technologies or by setting up designated digital transformation units, these enterprises have become roles models for other Taiwanese companies and provided real-world examples on how to achieve a successful digital transformation. (3) III partnered with the Intelligent Transportation Society (ITS) to develop and launch the "Smart Car Rental Platform and Application Service." This innovative high-tech vehicle management platform has met the operational requirements of car rental agencies in Taiwan.

The eco-system itself is like reverse engineering which the demand side drives the economic behavior of the production side or the supply side. III connected the points (individual enterprise cases) to draw lines (domain industries) that gradually formed an integrated plane (digital ecosystem of up/mid/downstream industries). In the future, Taiwanese business operators must learn how to create a digital transformation ecology by establishing a web of alliances with upstream/downstream vendors, peers or with other industry players. III will continue to take preventive actions for the business model of digital transformation for value customers.

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Continuously Optimizing the Organizational Structure to Strengthen Technological Autonomy

In July 2017, III re-defined itself as a “Digital Transformation Enabler” in response to regulatory reforms for non-profit organizations. Since then, III has gradually withdrawn from portfolios that have less relevance and developed a risk project spectrum for identifying the risk factors in research commissions so as to build consensus among the departments. In 2019, III outsourced the risky component of a medium to high-risk program. Program caps were also introduced in the same year to progressively withdraw from risky activities (see Fig. 1). At the end of 2020, III completed the transfer of operations for the grant administration office, establishing a major milestone by focusing on core areas and exiting disputed businesses. III risk program is expected to meet the target program cap in 2021. Rolling reviews will also be conducted on III's project commissions and management mechanisms to continue reducing conflicts of interest.

In addition, III also strived to assist operators upgrade their technology, so that the whole industry can benefit. With industry trends and the R&D needs of domestic ICT operators as reference, and with accumulated pending and awarded patents as the foundation, III continued to follow the “five key R&D schemes for implementation of cross-industry innovation ecosystem” (see Fig. 2) of 2019, and closely aligned its R&D focus in fields such as “cutting-edge applications”, “smart manufacturing”, “network and communication sensors”, “construction of digital environments”, and “smart services” to match policy in 2020.

To help industries embrace the digital transformation and improve their competitiveness, the top 10 technology sectors covered by III patent applications in 2020 were: 5G Communication Systems, AI, data algorithm processing, content security and threat management, image processing, Edge Computing, application platforms and application software, Big Data applications, CNC machines and ServBox, and Virtual Machine Manager. Most of these sectors were related to the “Six Core Strategic Industries” advocated by the National Development Council. The ratio of domestic to overseas patent applications was approximately 1:2. All applications for utility patents are available for industrial use. III has applied for 168 patents on average per year in the past three years (see Table 1).

III has obtained on average 145 patents per year in the past three years (see Table 2). The ratio of domestic to overseas patent approvals was approximately 1:1.2. Out of these, 100% were utility patents. The top 10 technology sectors included: LTE/LTE-A Communication Systems, content security and threat management, image processing, data algorithm processing, 5G Communication Systems, Big Data applications, application platforms and application software, wireless sensor networks, CNC machines and ServBox, and dedicated processing systems or methods.

Table 1. Number of patent applications in the past three years

Region	2018	2019	2020
Taiwan (R.O.C.)	64	57	52
China (P.R.C.)	61	47	36
Hong Kong	0	0	51
Japan	0	5	1
South Korea	0	0	2
Singapore	0	0	1
The Philippines	1	0	0
Malaysia	1	0	0
U.S.	58	53	0
Canada	1	0	0
Europe	3	1	4
United Kingdom	2	0	4
Total	191	163	151

Table 2. Number of patents obtained in the past three years

Region	2018	2019	2020
Taiwan (R.O.C.)	87	99	36
China (P.R.C.)	34	24	16
Japan	3	1	0
The Philippines	1	0	0
U.S.	44	47	27
Canada	2	1	0
Europe	2	1	0
United Kingdom	1	3	0
Germany	0	2	1
France	1	2	0
Total	175	180	80

In the past three years, III has completed around 300 technology transfers and facilitated investments amounting to NT\$15.4 billion. In 2020, the revenue from technology transfers reached approx. NT\$120 million, accounting for 11% of all funding for technology development programs. (As shown in Fig. 3)

In addition, III is also maintaining and strengthening its internal and external relationships by actively responding to public opinion. We are working to enhance our image and professional reputation in order to bring more opportunities for internal and external cooperation. III has also upgraded its level of disclosure to improve its business integrity and avoid conflicts of interest. The relevant information is now disclosed on III website:

- I. **Key resolutions of the Board:** The key resolutions of the Board of Directors are regularly disclosed. Minutes of Board meetings are also retained for one year.
- II. **Government subsidized projects managed by III:** Information on government subsidized projects being carried out by III is now disclosed. The webpage provides links to the websites of each project. Disclosure of relevant information is then provided by each project in accordance with the Freedom of Government Information Law.
- III. **Financial disclosure:** Financial reports are disclosed on a regular basis including the business and capital utilization plan, budget, and final statements.
- IV. **Affiliates:** Disclosure of information related to the Institute's affiliates including capital, III's shareholding, other shareholders, and main business activities.

To provide the directors and supervisors with a better understanding of III's activities, the activities of each department are also reported to III directors and supervisors as of 2020. III's business activities include: Think tank consulting, R&D, industry services, and talent cultivation. The resource allocation and output ratio for each department each year, their business performance, and future development strategies are reported to the directors and supervisors.

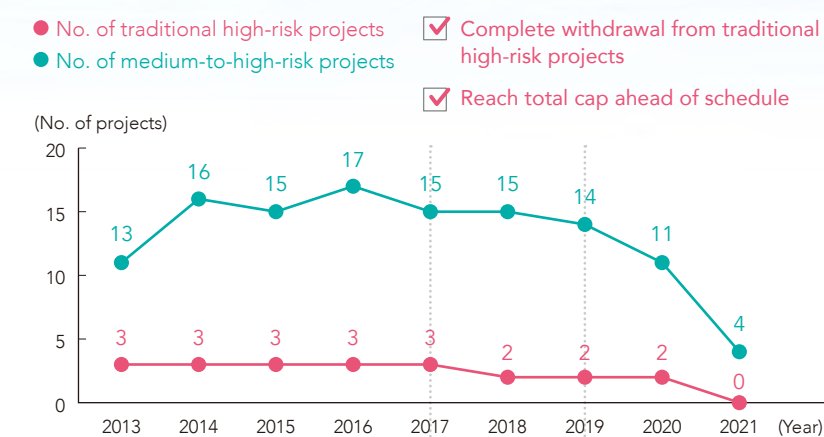


Figure 1. Summary of medium-to-high-risk projects exited

Implementation of the reform for non-profit research organizations
Introduction of caps

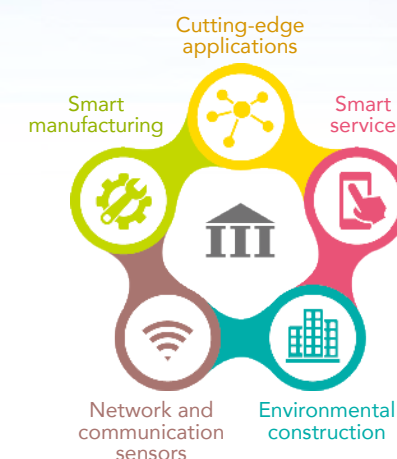


Figure 2. Patent portfolio in five main sectors

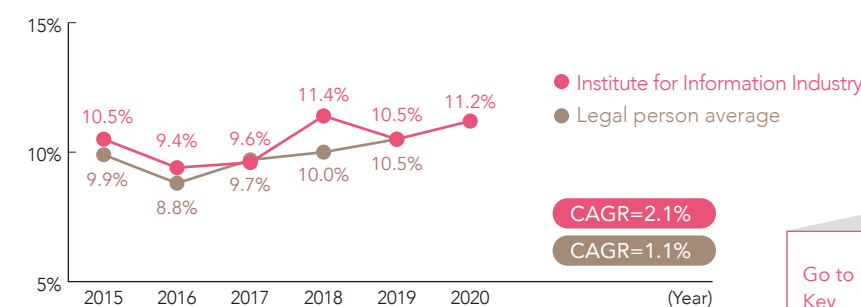


Figure 3. CAGR of R&D results

(CAGR = technology transfer revenue per unit of technology development funding)

Note: CAGR — Compound Annual Growth Rate

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Enhancing Technology R&D and Promoting the Digital Transformation and Innovation in the Government and Industry

The external environment has been changing in recent years. In response to these changes, III has taken into consideration the long-term population, labor, and energy issues that future social trends will bring as well as the opportunities offered by new technological applications. We are therefore continuing to inventory our in-house R&D capabilities and responding to social trends by focusing on cutting-edge R&D in three main themes.

First, III has continued to focus on 5G and cybersecurity to improve its ability to support the government's push for digital governance and digital equality under the "Six Core Strategic Industries" and "National Security is Information Security" policies. Second, by 2025 the Taiwanese society is expected to become a super-aged society. In response to this trend, the Institute is developing new smart services for long-term care that reduce the financial burden. Third, in response to the growing international software open source movement, the Institute has shared the outcomes of technology development programs to promote constructive exchanges between domestic research agencies in order to improve performance and expand industry services.

Promoting Organizational Reforms and Business Focus for Key Topics in Technology R&D

III has rolled out support measures on the organizational, system, and business levels to guarantee the quality and benefits from key R&D topics. On the organizational level, III engaged in organizational reforms to stay in touch with industry developments and establish itself as a "Digital Transformation Enabler." The R&D direction was set through cross-departmental joint creation and engagement.

On the R&D management system level, III has trialed large technology R&D projects for multi-unit partnerships for the selection of R&D topics. The projects will create both consensus and benefit topic to the development of the government and the industry. The R&D strategies of each department are leveraged to strengthen cross-functional cooperation. The Business Model Canvas (BMC) concept has also been introduced at the start of the R&D phase. Priority is given to business model innovation over technological innovation to enhance operational autonomy. On the business level, III conducted an inventory of its business portfolio to better align itself with the digital development strategies set by the government. The Institute then focused on setting entry and commercialization milestones for teams working on key technologies to expand their industry influence.

Enhancing Technology R&D and Applications to Promote Government and Industry Innovation

Technology R&D at III will continue to focus on five key areas: "smart manufacturing," "smart services," "network and communication sensors," "cutting-edge applications," and "construction of digital environments." In terms of core technologies, III will look ahead to advanced technologies and continue their development. Take 5G's "cutting-edge applications" for example, which have been a long-term investment for III. This technology first started by researching wireless communication technology in 2001. It has since evolved from vertical private networks, mobile private network applications, wireless communications, to private 5G networks, and now 5G satellite communications. MediaTek and Inmarsat recently completed the first data transmission trial for a 5G satellite Internet-of-Things (IoT) network. III's communication applications have therefore expanded beyond rural regions to outer space. The Institute is now well-placed to take advantage of the opportunities offered by space communications. III will continue to develop and apply communications-related technologies in the future to meet the needs of the industry.

III will also continue to support the development of new technologies and emerging applications of SMEs throughout Taiwan by transferring technology to the industry/private sector. The Institute's assistance with the refinement of business models and other techniques will help boost industry development, improve the business performance and competitiveness of operators, and lead to a sound innovation ecosystem for the entire industry. III will respond to challenges by continuing to refine its R&D and applications of advanced technologies in order to fulfill the goal of "demonstrating the value of non-profit organizations and contributing to society and the industry."



Honors International Awards — Group Awards

- The "Production Decision Support System with Digital Twins Solution for Bicycle Industry" (PDSS) by the RISD won the R&D 100 Awards.
- The RISD "Sustainable Urban Business Solution" won the "COVID-19 Tech Solutions for Cities & Localities" award at the WITSA Global ICT Excellence Awards.
- The SSI's "Scooter2Infra Safety System" won a bronze medal at the U.S.-based Edison Awards.
- The DEI's projects also received multiple awards at the Horizon Interactive Awards. These projects include: the "DIGI+ Talent Accelerator & Jumpstart Program Promotional Video," which won a silver medal in the advocacy/non-profit category; the "Talent Circulation Alliance Promotional Video," which won a bronze medal in the same category; the "Talent Circulation Alliance website," which won a silver medal in the website category; and the "Smart Education Expo Video and Industry Solution" and the "ATD Asia Pacific Conference Video and Talent Cultivate," which both won a bronze medal in the advertisement category.
- The "Smart School Alliance," established by the DEI, was included in the Finland-based HundRED Global Collection 2020.

Supporting the Digital Transformation Eco-system through the Project for the Construction of Digital Environments

So far, the software engineering model has evolved from the Waterfall model to an Agile development environment. Although this is more in keeping with project requirements, it also makes management more difficult. Support in the form of DevOps (Development+Operations) tools is needed to simplify management and avoid cybersecurity issues.

The digital transformation of Taiwanese industries requires the development of digital technology. The lack of sound agile tools, however, makes it difficult to respond to fast-changing environments. The complexity and variety of agile management tools used by different teams lead to differences over usage and management. Therefore, an urgent requirement must exist for an integrated suite of agile management tools that R&D teams within an organization can use. III launched a program in 2020 that focused on introducing the agile development concept throughout its entire organization.

The program is based on open source solutions and integrates a number of open source software (OSS) tools, including Gitlab, Jenkins, Rancher, Redmine and Postman. Besides, it is also an integrated DevOps agile development platform that meets both engineering and management needs.

The platform can be configured with specialized roles such as system administrators, project managers, and engineers each with their own management interface. The platform also allows for switching between low-level open source tools and the user interface so that less-experienced engineers can start working through the system-provided UI; those used to working with open source tools such as Gitlab and Redmine can also opt to use the low-level open source tools directly.

The platform can be deployed on a variety of environments as well. Rapid deployment services are available on demand for different development languages, frameworks, and runtime environments. Additional flexibility is provided through value-adding plug-ins. The plug-in interface can interface with external tools (e.g., Checkmarx) to create business models. Most importantly, the one-click submission system automatically converts the test results into tasks. Developers can therefore submit their work with just one click and automatically complete an entire operational cycle.

When the development of the integrated DevOps agile development platform was completed in 2020, it was deployed in III. During this period, user feedback was collected; furthermore, improvements were made based on feedback, and in early 2021 a second round of promotion and training was conducted. Administrative authority was not used during this gradual process to compel III's engineers to adopt the platform because the goal was to create a platform that truly improved the working environment and enabled the accumulation of knowledge and experience.

Adhering to the spirit of providing non-profit organizations' R&D results for external usage, and as part of its business development, III will also establish an open source community based on an open source authorization mechanism (Apache 2.0), which will be used to continue expanding the scope of applications. Tailored packages will be developed for individual vendor environments to help them construct a digital environment. Actual digital tools and methods will help the industry realize the ultimate goal of implementing the digital transformation.



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Quantum-Inspired Digital Annealing

In the post-Moore's Law era, quantum-inspired computing will be an important strategy to bridge the gap between digital computing and quantum computing before quantum computing are ready for practical use. Quantum-inspired digital annealing technology is inspired by quantum computing as well as classical annealing. By making use of quantum physics principles such as superposition, entanglement, and tunneling that are absent in conventional digital computing, quantum computing has the potential to provide an unprecedented level of information processing power that far exceeds conventional limits. The concept of annealing comes from thermal annealing, a technique used in conventional metallurgy. A metallic material is heated to above its recrystallization temperature, and then gradually cooled at a controlled schedule until its microstructure reaches its stable, lowest energy state. Digital annealing (DA) as well as quantum annealing (QA) is emerging as a new type of high-performance computing technology for solving large and complex Combinatorial Optimization Problems (COPs) that challenge conventional computers.

During annealing, the cost function for a conventional optimization problem is converted into a physical energy function (Hamiltonian) with its lowest energy state being searched by applying annealing method to escape from local minimum energy state in the solution space defined by the cost function, and finally transformed to the global or global approximate optimal solution to the target problem. For instance, as an important process in automotive manufacturing for corrosion protection, water-proofing, wear-proofing, and sound insulation, PVC sealing is carried out by several robotic arms operating in parallel. Taking 65 seams as an example, there will be approximately 2.34×10^{108} possible search paths. To complete this complex task, a Proof of Concept (PoC) conducted in collaboration with an international high tech company and auto maker found that digital annealing technology could calculate in near real time the optimal position and movement path for each robotic arm.

Quantum computing will inevitably have an effect on the future development of nations, businesses and mankind. Given the current domestic shortage of quantum computing talent, in addition to most current engineers being, while curious about quantum computing, reluctant to enter the field due their insufficient understanding of the matter, III has focused its efforts on the quantum-inspired computing (the red area in Fig. 1) and teamed up with the ARC, SSI, DTI of III and the Physics, EE and IECS departments of National Taiwan University to cope with the talent issue to research and develop Quadratic Unconstrained Binary Optimization (QUBO) modeling and digital annealing technology. Moreover, the team is also leveraging the resources from the Ministry of Science and Technology programs, the Taiwan Association of Quantum Computation and Information Technology (TAQCIT), and private-sector enterprises to expand the industry-university-research chain and develop new partnerships.

In the post-Moore's Law era while quantum computing is yet to hit market, quantum-inspired computing will be an important technology strategy to bridge the gap facing businesses between digital computing and quantum computing. By taking advantage of its domestic strength in the information and semiconductor industries to develop new intellectual property, products, and/or services based on this emerging computing, Taiwan will be able to gain a competitive edge to address the new challenges and opportunities in the quantum computing age.



Figure 1. Quantum-inspired digital annealing

Regional Industry Service Division Technology R&D

Digital Twin AI Systems Restoring the "A-Team Crown" of the Bicycle Industry

The Industry 4.0 is sweeping through the industry like a tidal wave making the digital transformation inevitable. Though the bicycle and components industry in Taiwan has its own complete industry chain, the global digital transformation trend has exposed problems in its information technology, equipment and processes.

According to Director, Shon Wang of the Regional Industry Service Division (RISD), in terms of information, it is hard to make effective data collection due to the differences in machine specifications and processing methods, and insufficient digitalization capabilities which resulted in production parameter formats not being standardized. In terms of production, the fact that production lines needed to be frequently changed, and that manufacturing parameter adjustments relied on experience, the consistency of the quality may be affected. In terms of quality control, as it is mostly conducted through manual quality inspection and sample testing, not total inspection, defects may inevitably slip through.



The "Production Decision Support System with Digital Twins Solution for Bicycle Industry (PDSS)" was developed by III to assist the bicycle and components industry with their smart transformation. Digital Twins means creating a digital twin of an actual product. Sensors are used to connect them and collect real-time data for monitoring, processing, analysis, decision-making and conversion into meaningful feedback data. The probability of non-conforming products can then be predicted to help machine operators adjust production parameters on the fly to prevent the build-up of non-conformities. Product value and quality is enhanced as a result.

The PDSS system replaces "passive" manual inspections with "active" production quality root cause analysis methods, and utilizes digital twin predictive modeling systems to greatly reduce the introduction costs and build a digital transformation and smart manufacturing solution with high dimensional precision and low repair rates. In the future, with experience in the bicycle parts and components industry as a foundation, III will continue to expand to other metal processing industries such as hand tools, and automotive parts and components.

The system has been introduced in more than ten bicycle component, hand tool and hardware manufacturers, such as VP Components and Proval (parking pillars). Non-conformity rates have now been reduced from over 10% to about 3%. This has not only greatly increased quality and availability, but also indirectly boosted business performance as well. The PDSS system also won the R&D 100 Awards in 2020, an award widely considered to be the Oscars of technology. The Institute will help manufacturers improve their production quality, lower costs, swiftly adjust production lines, and break into international markets.

Go to > "Production Decision Support System with digital twins solution for bicycle industry" Award Report

Smart System Institute x Cybersecurity Technology Institute Technology R&D

Incubating Base Station and Core Network Technologies in the Industry for 5G Launch

2020 was the year Taiwan welcomed the advent of 5G. In addition to the astronomical bids made by telcos for spectrum licenses to take advantage of the future opportunities offered by 5G, other ICT vendors were rubbing their hands with glee at the prospect of this huge new market.

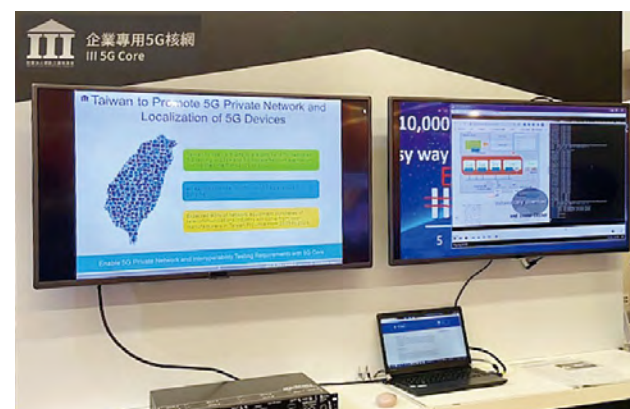
III has been involved with the 5G sector for many years. It can provide a variety of services tailored to the needs of the manufacturing and cultural industries. More recent developments include III 5GC core network software and 5G small cell base stations based on the 3PP R15 standard. These can be used by Taiwanese device makers seeking to enter the 5G market for the testing and validation of software/hardware system integration.

The growing number of 5G small cell base station shipments should eventually see the adoption of System on a Chip (SoC) single-chip solutions. The Smart System Institute (SSI) has experiences with small cell base stations and related solutions have now been transferred to the private sector. The spin-off company, SynDesignTek, supplies SoC-based solutions that effectively lower the cost of small cell base stations, reduce the dependence on foreign and certain vendors, and shortens the time-to-market of small cell base stations for network communications vendors.

The 5G core network service launched by the Cybersecurity Technology Institute (CSTI) is intended for software/hardware system compatibility testing and validation by device makers seeking to enter the 5G market. III 5G Core (III 5GC) is now available in III 5GC Basic and III 5GC Professional editions, with the former intended for laboratory testing while the latter is designed for private enterprise networks. A hardware acceleration solution was included to improve the efficiency of data signaling and system stability. In addition to basic networking functionality, commercial trials can be conducted for the network elements such as AUSF (Authentication Server Function), UDM (Unified Data Management), PCF (Policy Control Function), and NEF (Network Exposure Function).

"The real battlefield for 5G device makers introducing their own brand will be applied for private enterprise network," said Director Chin Shin Lin from CSTI, who oversaw the development of III 5GC. Software-Defined Network (SDN) and Network Functions Virtualization (NFV) technologies allow 5G to stop depending on market-dominant vendors for certain software and hardware functional elements.

III began collaborating with a variety of industry partners in 2019 to build up more experience on the applications of III 5GC in entertainment, smart factory, and other sectors. The VR 360 live stream at Taipei Music Center is one such example. III also partnered with machine tool makers to deploy a private network that collects real-time information from the machines to predict their operating status. Overall, III has made a number of R&D accomplishments in 5G at different levels. The Institute is therefore well-equipped to help Taiwanese industries overcome the monopoly that leading international brands have on key technologies, and offer businesses the perfect partner for entering the 5G sector.



Science & Technology Law Institute Think Tank Consulting

Promotion of inter-agency cooperation and inclusion of intellectual property operations into corporate governance evaluation

Listed companies used to be more conservative regarding the disclosure of their intellectual property (IP) protection and management information in the past. Influenced by recent international events and trends, many companies now agree that an appropriate level of disclosure can not only enhance their control and management over IP, but also give investors a better understanding of their IP governance capabilities. Business profits can be boosted through proper management and application.

Director Anderson Chen from III's Science & Technology Law Institute (STLI) gave the following example: "A recent case is the mutual imposition of tariffs due to the U.S. taking issue with China's infringement of its intellectual property rights, among other issues. For the phase 1 trade agreement in early 2020, the two parties agreed that China was required to strengthen legislative protection for patents, trademarks, and copyrights including changes to the civil and criminal procedures for online infringement and counterfeit goods. China also promised to stop requiring technology transfers by foreign companies if they wish to enter the Chinese market or obtain a business permit, and to reduce foreign investments aimed at obtaining foreign technology." This clearly exemplifies the importance of IP for business operations or even national economies.

Similar cases abound in the industry as well. In 2015, Entegris sued Gudeng Precision that the latter's reticle pods violated its patents. The Intellectual Property Court ruled in March 2019 that Gudeng's related products knowingly infringed Entegris' patents. Gudeng sales of the infringing product between 2009 and 2018 amounted to NT\$650 million, so it was required to pay 1.5 times that amount in compensation, i.e., more than NT\$978 million.

The above examples reinforce the importance of IP as an indicator of competitiveness. Nations, industries, and companies must take IP-related topics into account for risk reduction measures or even as strategic business opportunities.

Back in 2014, III recommended that the Securities and Futures Bureau (SFB) of the Financial Supervisory Commission (FSC) should incorporate IP management into its R&D cycle, one of the eight internal control cycles for publicly owned corporations. The US-China trade conflict over IP issues in recent years made the FSC pay more attention to IP management. It also accepted III's recommendations and organized a meeting between the Industrial Development Bureau, MOEA, Intellectual Property Office, Ministry of Economic Affairs, and the SFB. During this meeting, they reached a consensus regarding the formal inclusion of IP in the Corporate Governance Best Practice Principles for TWSE/TPEX Listed Companies. Corresponding corporate governance evaluation indicators were also added to strengthen the linkage between business strategy and IP issues.

III has now partnered with industry associations, corporate governance associations, and patent attorneys associations to support this initiative through networking events, training courses, and the establishment of dedicated units for promoting IP management. IP is the foundation stone of business sustainability. III is certain that its efforts on the promotion of proper IP protection will gradually gain widespread acceptance among Taiwanese businesses.

The Three Arrows of Innovation in Financial Regulation Gave Birth to the “FinTech Development Roadmap”

FinTech has been advancing at a breakneck pace recently. The Financial Supervisory Commission (FSC) has been collating the views and suggestions of all eco-system participants to help FinTech startups and companies overcome the difficulties they encounter. International FinTech trends were also used as a reference to devise a “FinTech Development Roadmap” that covers the next three years.

The Development Roadmap encompasses four goals, three principles, and eight promotion strategies. The inclusivity, innovation and resilience goals are aimed at meeting all the different needs from each type of business and the general public; the promotion of responsible innovation is aimed at boosting the value of the financial industry and creating a sustainable balance that benefits the economy, environment, and society.

Regarding the principles of promotion, the first principle is function and behavior supervision. The framework for financial supervision will shift from an institutional management-oriented approach to a function and behavior-oriented approach. The development of innovative new business models is encouraged along with effective risk identification and management. In addition, technology neutrality can be promoted through technology used to enhance management efficiency and productivity. By establishing a fair competition environment, industry competitiveness can also be increased. Last is an innovation-friendly environment. Policies that support innovation and provide resources for entrepreneurship can help build a vibrant FinTech ecosystem.

In terms of promotion, it will be done in stages over a three-year period, and will include: The development of one-stop window and communication platforms, data sharing, regulatory adjustments and code of ethics, capacity building, digital infrastructure, campus eco-system, international linkage, and supervisory technology. III also play a key role as the executor of the “FinTechSpace” project.

FinTechSpace provides the resources and environment for one-stop innovation and development. Adaptive mentoring is provided based on the stage of innovation. Nine types of mentoring resources are provided including Regulatory Clinic, Regulatory Checkup, Cybersecurity Checkup, Venture Capital Matchmaking, Digital Sandbox, Industry-Startup Matchmaking, Community Co-creation, Cloud Resources, and International Development. The campus provides dedicated corporate labs for financial institutions and corporate members. Mentoring was provided for the corporate labs of CTBC Financial Holding, Cathay Financial Holdings, SinoPac Holdings, LINE Bank, Microsoft Taiwan, and Easy Card in 2020, which resulted in 32 joint projects.

“Regulatory Clinic” was the most popular of the nine mentoring resources offered by the campus and the first arrow of regulatory innovation in the “FinTech Development Roadmap.” Representatives from the FSC are regularly stationed at the campus to help teams with compliance. The second arrow is the Taiwan RegTech Challenge. The consensus-building process between the industry, government and start-ups is accelerated through cross-industry collaboration and participation in finance to solve the pain points in digital regulation for the industry, government, and tech sector. The third arrow is the organizing of joint in-house empirical verification. Trans-institutional verification environments are provided through different innovation themes to reduce the cost of initial verification for start-ups and support risk assessments for innovative applications.

The development of FinTech needs businesses that are willing to innovate. The FSC support and encouragement of responsible innovation means that III will fulfill its role as a think tank, provide professional services, and strengthen the links with the industry. The Institute serves as a model digital transformation enabler for a highly regulated financial industry.

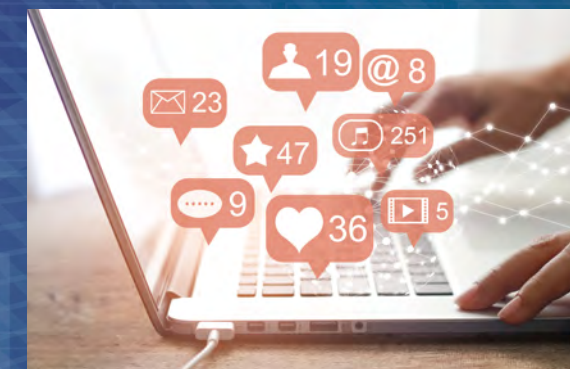


[Go to > FinTechSpace](#)

Smart Data Innovation: Digital Volume Economy 2.0, Tech-enabled Fact Verification

The vibrant development of social media in recent years has changed how people communicate. Social media has also become an important source of news and information for the general public; unfortunately, this has also turned it into a platform for spreading fake news and disinformation. The 2019 V-Dem project, an international academic research project conducted by the University of Gothenburg, found that Taiwan was the No.1 target of disinformation attacks from overseas. This is a very serious issue.

Verification of false information involves fact checking, detection of the propagation path, and issuing of clarifications. The verification process at the Taiwan FactCheck Center is still highly dependent on manual screening, inspection and verification. Although the process has a high level of accuracy, in practice, it is too slow to keep up with the sheer mass of disinformation being churned out and spread around the Internet every day. To help combat disinformation, III turned to the Taiwan FactCheck Center; with its professional knowledge and verification methodology, both institutions launched a joint verification partnership. A combination of different AI technologies, including rheological analysis of text, analysis and prediction of propagation paths, and account identification analysis were used to develop the “Rumour Catcher.” Fact checking organizations now have access to objective data for real-time monitoring. The speed of rumors can be viewed in real-time to substantially improve the speed and accuracy of the verification process.



Ping-I Chen, the leader of the “Rumour Catcher” development project at III’s Digital Service Innovation Institute (DSI), said that III combined the R&D capabilities of the Digital Service Innovation Institute (DSI), Digital Technology Institute (DTI), and Cybersecurity Technology Institute (CTSI) on social network analysis, semantic analysis, cybersecurity problem analysis, and digital communications analysis to analyze risk indicators in terms of content, scenarios, and social interactions. After the fact-checking organization has completed the practical verification, III used AI technologies such as neural networks and deep learning to develop three advanced indicators that included Semantic Feature Analysis (SFA), communications model analysis, and user account forensics analysis. These can further detect the degree of disinformation risk from reports and spreading channels.

SFA is a process of automatic detection based on the writing style of a message. The messages that are often used to spread disinformation can be assertive, emotional, celebrity support/witnessed in person, calls to action, sharing of social media, and hypothetical scenarios. These can also be used to calculate the risk score of rumors. The analysis of communication models starts by establishing a network of relationships between community members and using the AI fake news communication relationship learning model to identify the relationship between channels and determine the authenticity of the information being transmitted. In addition, user account forensics analysis dissects the dynamic and static information used to define a social account; furthermore, a learning model is constructed through the features of that account to determine whether the social media account spreading such information is fake or not.

The “Rumour Catcher” can speed up the selection of topics for verification, as well as accelerate fact checking and clarification. Compared to the time required for manual verification of topics, this platform is 70 to 80% faster. Fake news can also be fact checked and reported back to a social media platform for their immediate removal. By automatically verifying information with low credibility or information with significant impact, these technologies can provide expert verification services to help community analysts or system integrators integrate fact verification functions into their businesses. This can reduce the dissemination and spread rate of fake news and disinformation, lowering their impacts on the public.

[Go to > III > AI Enabled Disinformation and Media Forensics System](#)

[Go to > Taiwan FactCheck Center](#)

International Partnerships and Regional Revitalization

International Partnerships

To assist the Taiwanese ICT industry expand its international business and connect industry players with international R&D organizations, III facilitated the export of Taiwanese system integrators and security vendors and explored international business opportunities through the establishment of partnerships with overseas organizations. By doing so, III has also assisted in enhancing Taiwan's technological diplomacy, marketing Taiwan's technological capabilities, and promoting international exchanges and cooperation.

1. Cultivation of a world-class system integrator—Glory Technology

Glory-Tek is a member of Taiwan's "A-team" for the export of system integration services. It is also one of the world-class system integration (SI) companies that are being incubated through the Asia Silicon Valley Development Agency (ASVDA). The System Integration Promotion Alliance Project Office (SIPA), jointly established by III and the MOEA's Industrial Development Bureau, helped Glory-Tek enter the Thai market. III has successfully led Taiwanese vendors to innovate their business models, to replicate their successful subway and high-speed rail transportation experience, and to export made in Taiwan products and technologies to overseas markets.

2. Assisting vendors with bidding on three Asian Development Bank projects, and winning one bid

System Integration Promotion Alliance Project Office, SIPA was dedicated to working with the Asian Development Bank (ADB) platform and investigated its related mechanisms. SIPA assisted vendors in obtaining the latest tender information, submit bids during the bidding process, and connected vendors to form a Taiwan team to cover any shortcomings such as insufficient past experiences, or insufficient project management or technical competencies. In the end, SIPA successfully helped the team secure the tender for the ADB transportation database. The experience accumulated through this project will help Taiwanese enterprises compete for business opportunities in local Southeast Asian markets.

3. Boosting software and hardware exports by assisting vendors with competing for public-private joint projects and system integration service opportunities

III created a clustering effect, implemented a strategic layout and supply chain transfer, and negotiated 29 international cooperation projects. In addition, III completed 15 investment assessments and eliminated 7 obstacles, leading to the signing of letters of intent between InSynerger and CWTel (Thailand), and between Intradin and Hong Sheng Da (Viet Nam) Co. Ltd. of Vietnam.

4. Continuously expanding trade of ICT with the Middle East in the face of the COVID-19 pandemic

- (1) In April, III signed an MOU online for the first time with MADA - Assistive Technology Center Qatar for the export of digital assistive technology from Taiwan to Qatar. The exports will help the Center promote assistive technology and accessible digital spaces.
- (2) III assisted Golden Camel, a Taiwanese consulting company with a long-term presence in the Middle East, to partner with the Kuwait Institute for Scientific Research (KISR) and the Kuwait Association for Biomedical Engineer (KABME) to establish a rapid prototyping lab. The three parties use reverse engineering technology to develop and produce protective face masks, intubation boxes, and other medical supplies needed for fighting COVID-19.

Regional Revitalization and Digital Transformation

III made technology its fulcrum and the needs of the industry its starting point for the integration of internal and external R&D accomplishments and professional know-how (including smart manufacturing, 5G applications, somatosensory recreation, startup incubators, and digital talent cultivation). Through interdisciplinary collaboration, III supports local industries (especially SMEs) across the northern, central, and southern regions of Taiwan, so that they can achieve a digital optimization and transformation, and jointly create industrial development with local characteristics.

1. The development of the PDSS served to establish an eco-system for a localized bicycle industry, that improve production resilience, and help the entire supply chain for bicycles and related components boost their export revenue by eight fold. **1**
2. III has also served as a digital transformation consultant to the local government. The Institute helped the Taichung City Government build the "Sustainable Urban Business Solution" with one-stop hybrid marketing that connects living circles and festivals in each local district of Taichung City. The project was recognized with the top prize at the WITSA Global ICT Excellence Awards. The award showed the effectiveness of III as a digital transformation consultant for local governments. **2**
3. III launched the "Industry Technology Support Center" to build a proving ground for R&D into somatosensory technology, guide vendors in connecting with domestic and overseas hardware and software technologies, and facilitate operators of software engines, motion capture and other technologies to contribute to industry technology innovation. Through cross-domain technological innovation, III also connected with the international market and facilitated the international export of innovative product research and digital content application, won the "Technology Management Award" of the Chinese Society for Management of Technology. **3**
4. The COVID-19 pandemic has accelerated the development of digital technologies, compelling smart manufacturing and high-end manufacturing industries to undergo reforms. In line with the government's "Great South, Great Development" policy, III assisted in the planning of the Asia New Bay Area. Leveraging the new opportunities arising from the inter-regional transformation, III offered guidance to southern electronic parts and components manufacturers, fastener manufacturers, and other manufacturers, as well as state-owned enterprises, and encouraged the industry to increase its added value through digital transformation. **4**



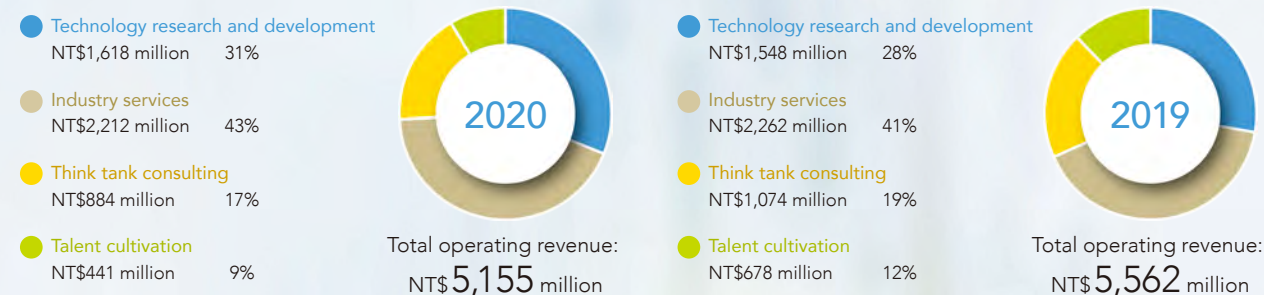
Financial Statements

Statements of Income

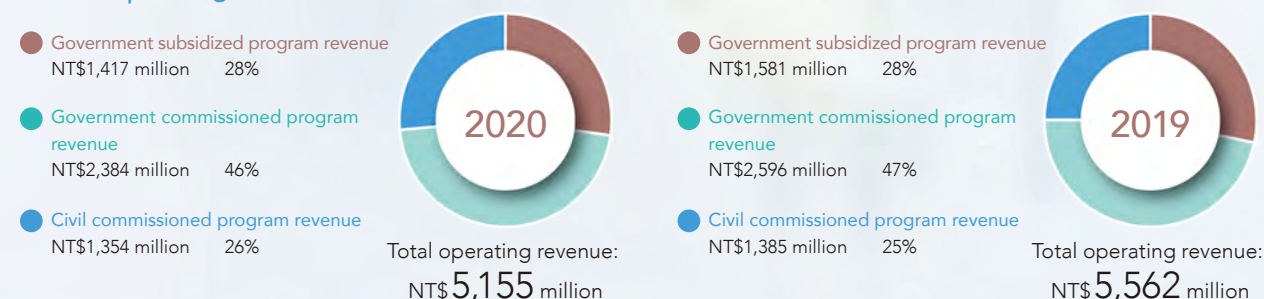
Unit: Million NTD

Account	2020	2019
Total revenues	\$ 5,301	\$ 5,664
Operating revenues	5,155	5,562
Service revenues	5,155	5,562
Non-operating revenues	146	102
Total expenses	\$ 5,269	\$ 5,623
Operating expenses	5,205	5,591
Service costs	4,727	5,124
Administrative expenses	478	467
Non-operating expenses	64	32
Income tax benefit	9	11
Net surplus	\$ 41	\$ 52
Other comprehensive income, net		
Gain (loss) on remeasurement of defined benefit plan	89	(23)
Share of other comprehensive income (loss) of associates accounted for using equity method	-	-
Income tax relating to components of other comprehensive income	(18)	4
Total other comprehensive income (loss) for the year	\$ 71	\$ (19)
Total comprehensive income for the year	\$ 112	\$ 33

Annual operating focus achieved



Annual operating revenue structure

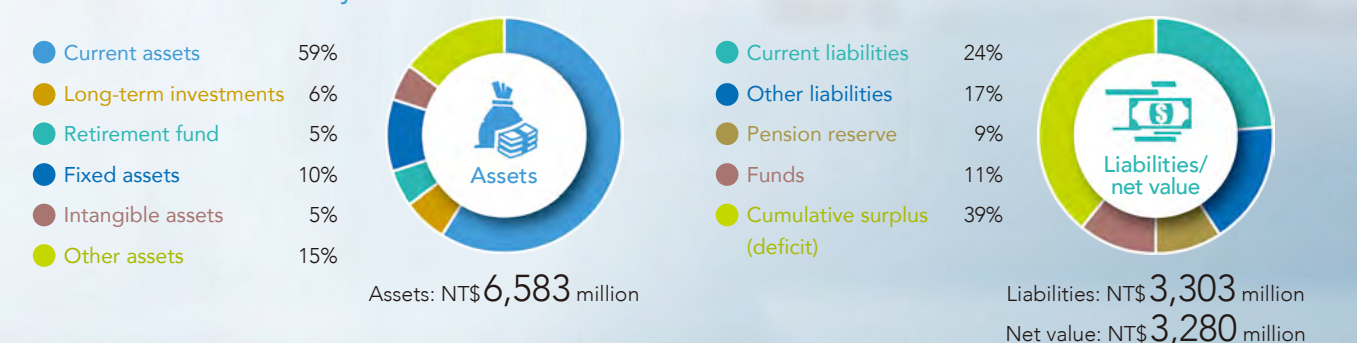


Balance Sheets

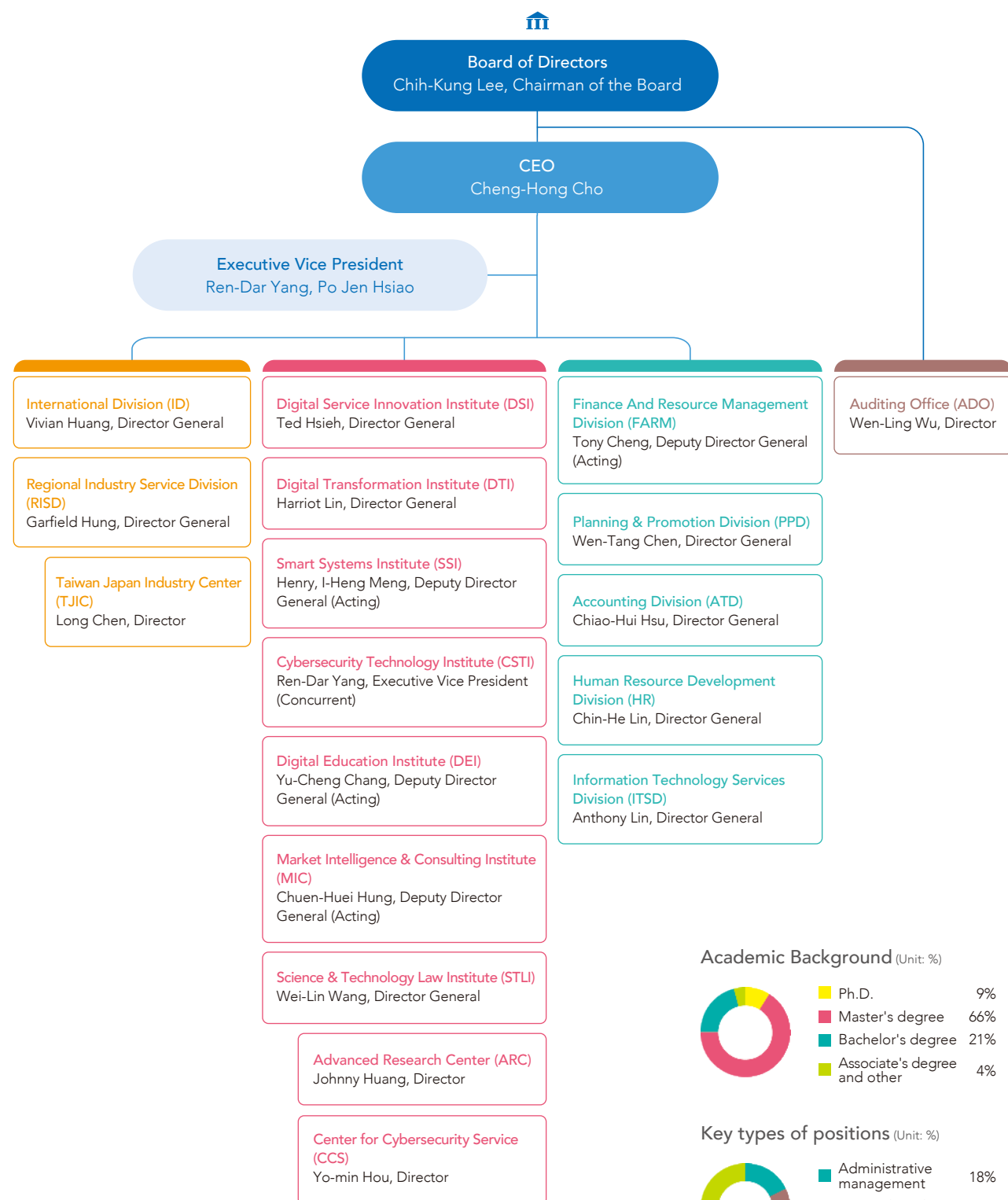
Unit: Million NTD

Account	2020	2019
Assets		
Current assets	\$ 3,896	\$ 3,283
Cash	843	591
Financial assets-current	1,550	1,012
Receivables	830	1,033
Prepayments	100	125
Other current assets	573	522
Investments, long-term receivables and reserves	746	1,503
Investments accounted for using equity method	176	565
Financial assets-non-current	247	596
Pension fund	323	342
Property, plant and equipment	355	372
Investment property	301	304
Intangible assets	308	329
Other assets	977	220
Total assets	\$ 6,583	\$ 6,011
Liabilities and Net Position		
Liabilities		
Current liabilities	\$ 1,612	\$ 1,771
Payables	1,273	1,335
Advanced receipts	333	430
Other current liabilities	6	6
Long term liabilities	591	726
Other liabilities	1,100	341
Deferred tax liabilities	171	179
Provisions	38	35
Miscellaneous liabilities	891	127
Total liabilities	\$ 3,303	\$ 2,838
Net Position		
Funds	\$ 700	\$ 700
Other net surplus	-	5
Accumulated surplus	2,580	2,468
Other net position	-	-
Total net position	\$ 3,280	\$ 3,173
Total liabilities and net position	\$ 6,583	\$ 6,011

2020 net asset and liability structure



Organizational Structure



Statistics: March 31, 2021

Root in Taiwan, Lay out the Global

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Market Intelligence & Consulting Institute (MIC)

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Science & Technology Law Institute (STLI)

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TEL: 02-6631-8500

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