2022 ABAC Digital Health Report

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Executive Summary

The ABAC DWG is implementing the ABAC Digital Health Project under the direction of Dr. Ted Chang who is serving as a Co-Chair of DWG. This year, the focus on digital health is on the value creation from real world data through AI in specific areas: 1) Precision health; 2) Smart medicine; 3) Telemedicine from hospital to hospital; 4) Telehealth from hospital to community and home; and 5) Aging in place. This report presents an overview of the work of Asia-Pacific Economic Cooperation (APEC) on digital health and the views of Organization for Economic Cooperation and Development (OECD) on health data governance. Furthermore, this report summarizes the main points of the 2022 ABAC Digital Health Forum, as the Forum is a major deliverable of the Project. Moreover, another significant output of the project is the collection of cases of firms that have been advancing digital health, and they are described in this report. In addition, this report provides recommendations for APEC to enhance digital health.

Recommendations of the Digital Health Project

- Ensure the unceasing support of ABAC for the Aotearoa Plan of Action (APA) that calls for utilizing digital technologies for inclusive and sustainable growth in healthcare.

- Foster the interoperability of digital health systems through the utilization of common and open standards for realizing the safe, effective and efficient usage of technologies.

- Create an enabling environment for digital health technologies through establishing a regulatory framework for the safe, secure access for disaggregated medical data for analysis, and fostering greater investment for its development that will help build resilience in the region.

- Advance human-centered digital health through the development of digital health systems that support technological innovation, enable access to medical data, foster efficient regulatory process, enhance education and training as well as promote user-friendly design of technologies.

- Support OECD's call for the establishment of a health data governance framework to encourage the utilization of personal health data to serve health-related public interests. The OECD's framework has included twelve principles, such as public consultation, approval procedures, transparency, and skill development in privacy and data security measures.

- Promote the collection of cases and the holding of events on digital health to raise awareness of the value creation from real world health data through AI, so as to address the COVID-19 pandemic and strengthen the support for innovation and digitalization.

- Enhance partnership among public and private sectors as well as academia to strengthen digital health in general and AI applications in particular. Examples of actions could be the implementation of joint projects and events.

- Build a smart and resilient digital health network across borders to provide better quality and cost-effective healthcare service against uncertainties like COVID Pandemics.

Introduction

In 2021, under the ABAC Digital Working Group (DWG), the Emerging Technologies Task Force coordinated the digital heath case study that collected cases of firms' technologies and provided recommendations. The COVID-19 pandemic had impacted the global healthcare systems tremendously. Therefore, the collaboration on digital health transformation had become more important. The main recommendation was that there existed the need to advance human-centered digital health through the building of digital health systems that support technological innovation.

This year, the DWG is undertaking the ABAC Digital Health Project under the coordination of Dr. Ted Chang who is serving as a Co-Chair of DWG. The emphasis on digital health for this year is on the value creation from real world data through AI in specific areas: 1) Precision health; 2) Smart medicine; 3) Telemedicine from hospital to hospital; 4) Telehealth from hospital to community and home; and 5) Aging in place. This report provides an overview of the work of Asia-Pacific Economic Cooperation (APEC) on digital health and the views of Organization for Economic Cooperation and Development (OECD) on health data governance. In addition, the summary of the 2022 ABAC Digital Health Forum is presented in this report, as the Forum is a major deliverable of the Project. Another important output of the project is the collection of cases and they are described in this report. Finally, this report provides recommendations for APEC to advance digital health.

Recent Digital Health Development

APEC's Work on Digital Health

In 2020, APEC Leaders announced the APEC Putrajaya Vision 2040 which will guide the work of APEC in the years ahead. The Declaration stated three main economic drivers: 1) Trade and Investment; 2) Innovation and Digitalization; and 3) Strong, Balanced, Secure, Sustainable and Inclusive Growth. With regard to innovation and digitalization, Leaders stated that APEC will seek to enable the people and businesses to participate in the interconnected global economy. APEC will advance an environment that is market-driven with support from digital economy and innovation. In addition, APEC will enhance digital infrastructure, accelerate digital transformation, reduce the digital divide, and cooperate on facilitating data flow. On the economic driver of strong, balanced, secure, sustainable and inclusive growth, APEC will promote quality growth that provides benefits, health and wellbeing to all. Moreover, APEC will support inclusive human resource development as well as economic and technical cooperation, so that the people will have the skills and knowledge (APEC, 2020). From these points on strengthening digitalization and growth, it can be said that they are

applicable for the enhancement of digital health. The reason is that the advancement of the digital health environment needs to include elements related to innovation and digitalization. Furthermore, the progression of digital health also necessitates inclusive human resource development and economic and technical cooperation.

The Aotearoa Plan of Action (APA) was developed in 2021 to serve as the plan for implementing the Putrajaya Vision 2040. With regard to the economic driver of innovation and digitalization, APEC economies will implement the action of supporting resilience and recovery through using science, technology and innovation systems as well as promoting capacity building. Most importantly, APEC will enhance deployment of digital technologies for inclusive and sustainable growth in areas such as trade, finance, public services and healthcare. On the economic driver of strong, balanced, secure, sustainable and inclusive growth, APEC will undertake the action of enabling quality and equitable health access and strengthening health systems through the utilization of digital technologies that promote health system innovation, such as telemedicine and digital health (APEC, 2021).

Furthermore, an important part of APEC's work on health issues has been the holding of the annual High-Level Meeting on Health and the Economy. In 2021, the 11th APEC High-Level Meeting on Health and the Economy (HLM11) was held to make the economic case for health equity in the era of COVID-19 pandemic. According to the Joint Statement from the meeting, Ministers and delegates deliberated on effects of the COVID-19 pandemic on vulnerable groups, as they were most at risk to health or economic shocks. The meeting participants also discussed issues, such as the equitable distribution of vaccines, medical products and other health technologies. Most importantly, Ministers and delegates were cognizant that the COVID-19 pandemic had accelerated the utilization of digital technologies and the need to enhance digital infrastructure. In addition, they welcomed efforts to advance an enabling, inclusive, and non-discriminatory digital economy that promotes new technologies, allows businesses and entrepreneurs to flourish, and assists with the flow of data that will enhance APEC economies' capability to face COVID-19 and health challenges in the future (APEC, 2021a).

OECD and Digital Health

The OECD has stated the importance of health data in the report called "Health Data Governance for the Digital Age." According to the OECD, it is necessary to have the right data infrastructure to generate health statistics and to measure health care quality. The report seeks to provide a roadmap to enable the achievement of an integrated health information system for the digital age. In addition, the report has mentioned that emerging technologies can consist of Big Data analytics which can be used to improve patient-care and to provide disease-specific solutions. Emerging technologies will also be able to strengthen privacy and data security (OECD, 2022).

The aforementioned report has recommended the establishment of a health data governance framework for the purpose of encouraging the utilization of personal health data to serve health-related public interests. As part of the recommendation, twelve principles are presented: 1) Promote engagement and participation, such as

through public consultation; 2) Support coordination within government and promotion of cooperation among organizations; 3) Review the capacity of public sector health data systems; 4) Enable the clear provision of information to individuals; 5) Ensure informed consent and appropriate alternatives; 6) Establish review and approval procedures of requests to process personal health data; 7) Advocate transparency through public information of health data governance framework; 8) Enhance the development of technology that allows the re-use and analysis of health data; 9) Develop monitoring and evaluation mechanisms to ensure personal health data have met the intended public interest purposes; 10) Strengthen training and skill development in privacy and data security measures; 11) Build controls and safeguards for accountability; and 12) Require organizations to show that they meet expectations for health data governance. In addition, the report has recommended the advancement of cross-border cooperation in the administering of personal health data for health system management, research, statistics and other health related purposes. Finally, the report has suggested that governments should work with experts and organizations to create mechanisms to facilitate the exchange and interoperability of health data (OECD, 2022).

Summary of 2022 ABAC Digital Health Forum

Opening Remarks

ABAC Digital Working Group (DWG) Chair for 2022, Ms. Janet De Silva underscored the necessity of developing and deploying innovative solutions for resilient health systems, as well as facilitating health interoperability and open standards across the APEC region during the opening remarks of the 2022 ABAC Digital Health Forum. The Chair noted that the ABAC DWG has made accelerating the development of the physical, digital, and data infrastructure a priority this year, adding that the use of data in conjunction with these technologies will create significant value. These include health insights, improvements in supply management, tracking and diagnosis, among others.

As COVID-19 has challenged health systems worldwide, APEC Senior Official Sharon Wu highlighted digital health technologies as a key to overcoming the challenges in ensuring medical access for all without overwhelming hospitals. Senior Official Wu cited Chinese Taipei's accomplishments in leveraging digital technology to improve healthcare services, notably in pandemic prevention efforts, recognizing it as a global pioneer in medical innovation. She then added that going forward, Chinese Taipei will continue to share relevant best practices with all economies as part of its commitment to build a resilient region, noting that eight workshops on digital health were held at APEC last year.

Meanwhile, Quanta Computer Chief Technology Officer Dr. Ted Chang who currently serves as Co-Chair of DWG shared Quanta’s commitment to smart healthcare development. With a focus on new forms of information communication technology, including medical IoT devices, cloud computing, big data, and artificial intelligence. Dr. Chang reiterated that Quanta aims to give patients access to 'anytime-anywhere' healthcare – often referred to as Quanta’s ABCDEF strategy, namely AI, Big Data, Cloud, Device, Edge, and FinTech.

Session on Digital Health Transformation

The purpose of this session was to explore the potential of digital health transformation through value creation of real-world data by advanced technologies, like AI, Big Data, IoT, Cloud Computing and 5G. Successful digital solution cases were shared to address the real-world medical and healthcare problems with focus on the following health domains: 1) Precision Health and Smart Medicine; 2) Telemedicine and Telehealth; and 3) Aging in Place.

Kicking off the discussion on advancing AI for digital health, Professor Victor Zue provided an overview of MIT Computer Science and Artificial Intelligence Laboratory (CSAIL) and Quanta Computer's joint research projects over the years. He stated that Quanta and MIT have been collaborating since 2005 on innovative technologies and products aimed at enhancing and enriching people's life, such as the T-party project focused on mobile information technologies and the QMULUS project, which placed an emphasis on cloud computing. Professor Zue said that the present phase of the joint research venture involves exploring the use of AI, specifically machine learning, and how it can help to treat diseases and improve health care. He welcomed distinguished speakers to share insights on how convergence of artificial intelligence and precision medicine is revolutionizing health care.

Professor Regina Barzilay of MIT CSAIL presented on "Sybil: A Validated Deep Learning Model to Predict Future Lung Cancer Risk from a Single Low-dose Chest Computed Tomography." She stated that low-dose computed tomography (LDCT) for lung cancer screening was effective, though most eligible people were not being screened. Multi-pronged strategies to improve screening were needed and tools that provided personalized future cancer risk assessment could focus approaches toward those most likely to benefit. Professor Barzilay and her team hypothesized that a deep learning model assessing the entire volumetric LDCT data could be built to predict individual risk. They developed a model called Sybil using LDCTs from the National Lung Screening Trial (NLST). Sybil required only one LDCT and did not use clinical data or radiologist annotations. Sybil was validated on three independent datasets: a held-out set of 6,286 LDCTs from NLST participants, 8,821 LDCTs from Massachusetts General Hospital and 12,280 LDCTs from Chang Gung Memorial Hospital, which included non-smokers. Sybil also predicted risk significantly and accurately. She stated that Sybil can accurately predict future lung cancer risk from a single LDCT scan, enabling personalized screening intervals that reduce missed cancers and unnecessary scans. To the best of their knowledge, it was the first deep learning model for lung cancer risk prediction to be validated across diverse patient populations. Professor Barzilay suggested that it was possible Sybil or other similar tools could be used to explore novel strategies to reach those who were not currently being screened but were at high risk for lung cancer.

Professor Marzyeh Ghassemi of MIT CSAIL presented on "DML+Diabetes Can Improve Patient Health." She mentioned that the HealthyML Lab focused on creating and applying machine learning to understand and improve health in ways that were robust, private and fair. She said that health was important, and improvements in

health improved lives. However, she stated that the meaning of healthy was not fundamentally understood. The same patient could receive different treatments across different hospitals or clinicians as new evidence was discovered, or individual illness was interpreted. Professor Ghassemi gave an overview of the HealthyML group, focusing on some of the novel technical opportunities for machine learning in health, and the work in Deep Metric Learning and diabetes that they planned to complete.

Professor John Guttag of MIT CSAIL gave a presentation on "AI, Infectious Disease, and Public Health." He stated that Infectious disease was a leading cause of mortality and morbidity. The World Health Organization estimated that Covid-19 alone caused approximately 7 million deaths in 2020. Recent advances in AI offered the possibility of reducing the burden of established and emerging infectious diseases. He further discussed how machine learning can be used to build models that predict who was likely to contract specific diseases, who was likely to have an adverse outcome if they contracted a specific disease, and the role of testing in reducing the spread of communicable disease. An important finding was that many models were unlikely to be universally applicable across geographies, diseases, and settings.

Professor Collin Stultz of MIT CSAIL's presentation title was "Personalized Cardiovascular Care using Portable Monitoring Devices." He mentioned that machine learning and data science had the potential to revolutionize the treatment of patients with cardiovascular disease, both in the inpatient and outpatient settings. Indeed, portable monitoring devices that can acquire physiologic data, such as ambulatory electrocardiograms (ECGs), provided a platform for the development of computational models that can guide personalized patient care. As an illustration, he described his work using portable ECG monitors to non-invasively estimate quantities that were typically only available using invasive tests. The method allowed clinicians to monitor patients at home and identify those who were at high risk of being admitted with heart failure. The approach provided actionable information that clinicians can leverage to prevent the onset of heart failure symptoms in high risk patients. The methodology exemplified the power of using portable devices to infer clinically important information that cannot be obtained in an ambulatory setting. Portable monitors, coupled with state-of-the art machine learning methods, provided a platform for truly realizing precision health care. Professor Stultz suggested that it was important to establish a platform to easily test new machine learning algorithms across different economies and populations.

Dr. Stephanie Seneff of MIT CSAIL made a presentation called "Artificial Intelligence to Uncover Links between Chemical Exposure and Disease." Dr. Seneff related that she focused on two related topics in health and disease: (1) Prescription drug side effects, and (2) Toxic chemical exposure and disease. The first part described how natural language processing techniques can be used to analyze consumer-provided drug side effect reports in order to uncover potential side effects that might had been missed during drug trials. The second part illustrated an investigative process by which a link can be uncovered between an environmental chemical exposure and a disease. She utilized the example of the toxic chemical glyphosate, widely used in agriculture to control weeds. She said that toxic synthetic chemicals were pervasive in

today's world, and they were a primary driver behind many modern diseases. The medical system needed to focus more on the issue of toxic exposures as drivers behind disease, and to advise the patient on how to live a lifestyle that minimized toxic exposures. She said that statistical correlations in both space and time between chemicals and disease can yield clues of a potential causal relationship. Social media sites can be a valuable resource of unstructured medical data provided by patients suffering from a particular disease or taking a particular drug. Computer science techniques involving statistical language modeling, applied to both patient-based unstructured data and the medical research literature, can help the researcher to fill in the details explaining a likely causal relationship.

Professor Ovid J. L. Tzeng of Academia Sinica presented on “Cognitive Wellbeing in the Digital World: The Future is Now!” he said that people had doubled their life expectancy as the world became increasingly complicated with respect to both social and physical living conditions. Medicare for all people today was undoubtedly much advanced with respect to disease diagnosis and treatments. However, health-care for the elderly nowadays was not about guaranteeing immortality, rather, it was concerned with how to stave off the diseases of old age. Thus, cognitive wellbeing should be defined in terms of conditions that ensured old age was enjoyed and not endured. The goal of emphasizing cognitive wellbeing was about increasing healthspan, not lifespan. Many old people were suffering from disability and loss of quality of life due to aging. As powerful computation was brought to bear on biology, psychology, cognitive neurosciences, and cyber engineering, we should be able to detect human ailment before it happened by arranging human intervention. Professor Tzeng suggested that there was the need to design performance measures that revealed the efficient cognitive functions, such as attention working memory, cognitive control, action observation, language, decision making, emotion, and social cognition like daily planning. He also suggested the creation of AI models that could compute the normality of performances in various cognitive tasks and sense abnormality due to aging for each individual person who wore the various sense detectors.

Professor Pan-Chyr Yang of Academia Sinica made a presentation on “Value Creation of Digital Health: The Challenges and Opportunities.” He stated that precision health was the current trend of healthcare reform and healthcare industry. Big data and digital health were the key platforms for implementation of precision health. He said that Chinese Taipei’s goal was to leverage the outstanding performances and strengths in ICT industry and medicine, utilization of excellent biomedical research and clinical trials activities, and niche biomedical devices and products to become a major hub for the biomedical R&D industry in the Asia-Pacific region. He related about the movement from precision medicine to precision health as well as the establishment of the digital health platform by integrating the big data from various organizations, such as the cancer registry, health data from medical centers, and the precision health projects for the development of future precision health and biopharmaceutical industries. He mentioned that the Act for the Development of Biotech and Pharmaceuticals Industry was extended for another 10 years in December 2021 which also emphasized the importance of new biomedical technologies, such as digital

health, cell therapy and others. Professor Yang stated that challenges were how to implement these new technologies in the medical care system to promote precision health and create values for economic development. He suggested that there was the need to focus on how to develop a model and incentives to implement the digital health related device or software in the healthcare system. He also called for the establishment of guideline for the regulatory and approval process of digital health related software as a service (SaaS) or software as a medical device (SaMD). He further suggested that there was the need to address how to create a self-sustained business model for digital health in the current medical insurance system.

Professor Pui-Yan Kwok of Academia Sinica presented on "Incorporating genetic profiles into clinical practice for optimal healthcare." He mentioned that genetic factors affected health and disease in numerous ways. They played important roles in determining our susceptibility to disease, the way we responded to medications, and our longevity. With new technologies and better understanding of genetic variations, it was now possible to perform tens of thousands of genetic tests and obtained genetic profiles of a person in one study to generate a health profile of an individual. Armed with this knowledge, one can pursue an optimal strategy for his/her health maintenance that focused on prevention and early detection of disease while avoiding side effects of medications and minimizing disease severity. Key to the success of this precision health approach was to build disease risk prediction algorithms based on genetic and clinical data. He suggested that there was the need to invest in building large reference cohorts and in developing disease risk prediction algorithms. He also called for the creation of a precision health ecosystem where those with similar health profiles encouraged each other to pursue optimal health maintenance strategies. Another suggestion was the need to move medical practice from sick care (treating diseases) to heath care (keeping one healthy and free of disease) by focusing on prevention tailored to one's genetic profile.

Professor Huey-Jen Su, President of National Cheng Kung University (NCKU), presented on "Enabling Data-Driven Smart Medicine Service Network for Cities of the Future." She stated that a smart medicine service network was proposed to consolidate medical resource of hospitals and professional caregivers from different cities, through advanced ICT and AI technology, to provide precision medicine and digital healthcare as a service from the cloud across the walls and borders for the whole journey of patients. In addition, Professor Su supported the development of a public private partnership (PPP) collaboration model, based on real world medical data and advanced machine learning, among university researchers, hospital practitioners and Industry engineers. She said that an outstanding example was the collaboration among NCKU, NCKU hospital network and Quanta Computer.

Professor Ming-Shiang Wu, Superintendent of National Taiwan University Hospital, gave a presentation called "Paradigm Shift of Medicine: Provision of a More Precise and Warm Healthcare with Digital Technologies and AI." He said that the new emphasis in medicine was to provide more precise and warm care (better care with less cost). In order to promote personalized medicine, the focus will be on individual treatments and evidence based. Furthermore, precision health will also be enhanced.

He said that precision health was about taking personal differences in genetic, environmental and lifestyle factors into consideration for prediction, prevention and intervention of diseases. The emphases will be on prediction and prevention. Therefore, it will be about enabling the right care to be tailored to the right person at the right time. Professor Wu mentioned that the paradigm shift in healthcare was about the capacity to generate new knowledge more quickly than traditional scientific approaches, unbiased collection and analysis of data, and holistic understanding of biology and pathophysiology. The future of medicine will be about the linkage of big data, digitalization and AI.

Professor Shou-Yen Kao, Vice Superintendent of Taipei Veterans General Hospital, made a presentation on "The Current Status of Medical Artificial Intelligence Development in Taipei-Veterans General Hospital." He stated that the momentum of AI developing was propelled by all specialty departments, assisted by the medical artificial intelligence development center and AI committee in the hospital to promote various plans. He said that the high technology industry was important for the medical AI development. He further stated that a smart hospital will need to build AI medical and provide inward care on the roadmap of AI development. To cope with this, time, manpower, brain storming and investment will be necessary. The future development of the medical AI needed more engagement of talented manpower, cross-field cooperation to gain more resources from government and industry support which was the key to cultivate the younger generation of medical AI experts. Furthermore, he called for building a consortium to assist with efficient administrative processing to increase the speed of any novel idea to project, project to patent, product to verification of AI based software as medical device (SaMD) and global market analysis.

Professor Tomohiro Kuroda of Kyoto University Hospital presented on "Bridging between Patient and Hospital -DX challenge of KUHP." He said that Kyoto University Hospital (KUHP) continuously addressed challenges to provide better services for patients with power of information and communication technologies (ICT). The key technology was the Internet of Things (IoT) which enabled information system and clinical staffs to estimate patient current condition and to provide smart and salient context aware services. ICT had started to embed hospital into our daily life environment, which was called the social hospital. Essentially, he presented on how KUHP was implementing IoT service into daily life environment. Professor Kuroda mentioned that the Internet of Things (IoT) was key technology to bridge between human beings and the information systems. As communication over the information network hid surrounding contexts of communicating people, the information system which mediated communication should equip the IoT to know the context. In order to make us "social," the hospital information system should equip application programming interface (API) for cloud services to enable IoT devices at home including smart phones to connect to the hospital.

Professor Randy McIntosh of Simon Fraser University gave a presentation called "Following the Evolution of TheVirtualBrain's Computational Modelling Approach." He stated that TheVirtualBrain (TVB) was introduced to the neuroscience community over a decade ago as the first open source platform to make dynamic models of the human

brain. The singular feature of TVB was the ability to create personalized models using brain imaging data from individuals, whether healthy persons or patients with neurological challenges. He sketched out the evolution of the platform, from the first stages to define fundamental aspects of brain function, to the current status where TVB was emerging as a backbone for international cloud-based services for prognosis and diagnosis of many brain disorders, such as stroke, dementia and epilepsy. He further mentioned that TVB was a compelling example of a successful partnership between academia and industry, using foundational science to build a validated platform, and business discipline to build a useable product with extensive user support. He suggested the provision of flexible support for such partnerships that will enable co-development within an open innovation framework. He called for the engagement of broad stakeholder meetings to ensure platform adoption early in the planning. He also encouraged academia to consider parallel streams for training that will support facile interaction of academia and industry.

Professor Po-Chang Lee, Director-General of National Health Insurance Administration (NHIA), presented on "Digital Health and Smart Medicine." He stated that the National Health Insurance (NHI) was a single-payer and mandatory program. It offered a comprehensive and uniform benefits package to all those covered by NHI. There were over 93% medical care facilities contracted to NHIA. Based on the updated medical data, the "NHI MediCloud System" was built for sharing individual's medication and examination reports, and this system received high praise from the medical professions. Moreover, the "My Health Bank System" was built for the public. He suggested that the new frontier of digital health should involve big data, machine learning and artificial intelligence, as well as collaboration with the ICT and biotech industry. He further called for the need to nurture manpower as they will play an important role to promote digital health and smart medicine. He encouraged his colleagues not only to do their daily jobs but also to pay attention to innovation research.

Professor Yi-Chang Su, Director of National Research Institute of Chinese Medicine (NRICM), shared clinical big data research on the integration of traditional Chinese medicine (TCM) and modern medicine, Professor Su discussed the influence of precision medicine on current medical directions, the benefits of TCM in disease treatment, and the development of integrating traditional and western medicine. He emphasized how integrating traditional and modern medicine could provide patient-centered holistic medical services, adding that the development of an individual-optimized integrated medicine model is necessary, which can be achieved by: 1) Compiling clinical diagnosis and treatment data of traditional and modern medicine; 2) Establishing a medical integration database for data analysis; and 3 Developing an applicable model as the foundation for precision medicine. In addition to continuous effort and collaboration across fields, Professor Su underlined the need to enhance international academic exchanges as part of efforts to integrate traditional and modern medicine.

Panel Discussion for Digital Health Transformation

The panel session moderated by Dr. Ted Chang gathered major local hospital

executives to make recommendations for advancing digital health transformation and public-private relationships regarding this issue. Here are some insights provided by the executives:

- Enhance partnership among public and private sectors as well as academia to strengthen digital health and AI applications through joint projects and events.
- Promote physicians' interests in advancing AI and medical innovation, and opening the mindset of embracing new technologies is a key.
- Support education and training of professionals to advance IT industry-medicine link.
- Standardize data, training, and data governance to improve interoperability as well as data privacy and protection, considering diverse medical developments in the Asia-Pacific region.

Digital Health Cases

In 2022, the DWG is continuing with the work on digital health under the supervision of Dr. Ted Chang who is serving as one of the Co-Chairs of DWG. The work for this year is emphasizing the value creation from data through AI in specific areas: 1) Precision health; 2) Smart medicine; 3) Telemedicine from hospital to hospital; 4) Telehealth from hospital to community and home, and 5) Aging in place. For more information, please check our website (https://digital-health.site/) as a reference. We have collected companies and institutions that focus on digital health domains and are shown below:

Acer Healthcare Incorporated utilizes AI and big data analysis to develop intelligent medical products as well as provide AI-driven solutions to improve patient care and outcome. One of the key products, VeriSee DR, is an AI-assisted diagnostic software for diabetic retinopathy (DR). The system uses AI to analyze images of the retina for signs of DR, a complication of diabetes that can cause blindness. VeriSee DR can effectively assist diabetes specialists in interpreting retinal images for diabetic retinopathy and output the results within seconds. This medical equipment is mainly targeting the worldwide diabetes problem, to discover the symptoms earlier so the treatment could be in time. Yet, there are a few issues that hinder the developments, such as the lack of access to medical data and the relatively slow regulatory process.

Apart from the medical equipment, Acer TeleMed allows doctors to organize or consult through real-time video anywhere. Telemedicine and telecare technologies allow patients with restricted mobility to consult with physicians and their professional teams without physically going to the hospital. This eases the issue of uneven distribution of medical service resources between urban and rural areas. Acer TeleMed can be fully deployed on-premise, such as at hospitals, for enhancing security as personal data and images do not go through the cloud.

Aurora Tele-Oncology is a Hong Kong telemedicine start-up specializing in remote consultation in the area of oncology. Co-founded by Prof Tony Mok, Aurora now engaged over 50 oncologists and healthcare professionals, aiming at providing consultation services to support cancer patients remotely, especially during the pandemic situation.

Aurora deployed AI to categorize a series of patients' reports and summarize patient data for oncologists to review. An ongoing pipeline is under development on AI-assisted image analysis on tumor assessment. On top of teleconsultations, experts from different regions participate in multi-disciplinary teams further refine the optimal treatment for patients in local institutions. Sensitive data were stored in a dedicated cloud in either an encrypted or unidentified manner to comply with regulations. The platform was launched in collaboration with UMP Healthcare Group in Greater Bay Area in Aug 2020.

Automate Medical, based in Toronto, focuses on AI medicine and health software infrastructure with the mission to liberate closed silos of health data. The company intended to deal with the lack of interoperability of health data across hospital departments, hospitals, provinces, and similar lack of access for both patients and digital health companies. Healthcare spending continues to spiral out of control, and there is finally a move towards value-based care in both Canada and the United States.

It necessitates real-time exchange of health data and this is only possible with the necessary software infrastructure in place. An open-source developer tool for health care standards like FHIR (Fast Healthcare Interoperability Resources) is built with modern languages and frameworks. The company has identified that healthcare providers with sufficient budget and buying authority can quickly purchase and integrate new software tools. However, providers that do not have sufficient budgets face limited options.

To sum up, the advancement of AI and big data analysis opens up endless possibilities in the medical and healthcare industry. However, the research and development of AI products related to healthcare and medicine have been hindered by limitations to accessing medical data, and regulatory issues. Furthermore, the healthcare industry is conservative and slow to adopt new technologies. As a result, to roll out a successful digital transformation in medical institutions, not only the accessibility and interoperability of medical along with a more efficient regulatory system are essential, changes in the mindsets of healthcare professionals and industry stakeholders are necessary as well.

Belun Technology, an HK-based Medtech startup, focuses on developing wearable devices for vital signal monitoring. With an FDA-510(k)-clear hardware device, (measuring blood oxygen, pulse rate, and sleep apnea index) and new incorporated hardware monitoring body temperature, posture, breathing effort, Belun developed the vital sign monitoring system enabling healthcare providers to monitor users' real-time physiological parameters through a web portal remotely, especially during the pandemic situation. It showcases the value creation from data through AI in telehealth from hospital to community and home.

The startup has established extensive collaboration with local clinicians and clinics in different parts of the world to access large cohort data establishing the company's own vital sign data bank. The company's proprietary technology on hardware and in-house developed algorithm ensures the quality of data feed for machine learning and AI-based respiratory risk management solution. The system has been incorporated into an App in collaboration with Quality Healthcare Medical Centers for implementation in March 2022.

Digital Supercluster, located in Vancouver, endeavors in AI medicine, elderly health, and virtual care. It addresses some of the health systems' biggest challenges by bringing together industry, academia, research, government, public sector, and SMEs together in a collaborative innovation model to develop, deliver and scale Canadian-made digital solutions.

The portfolio is currently comprised of over 40 different digital solutions to issues as diverse as wound care, mental health, indigenous health, and opioid use, all with the common thread that these are issues that can be addressed through digital solutions developed collaboratively. Yet, adoption and differences between or within provinces can deter the development. In terms of the interoperability issue, it can be addressed easily if there is a willingness to do so and adopt the technology. Having the jurisdictions at the table during development is the most effective way to address this.

Several projects in progress can demonstrate the value creation from data through AI in precision health, smart medicine, and aging in place. Raven2, an AI Platform for Novel Drug Discovery, harnesses AI to make accurate predictions on effective drugs against COVID-19. The project is led by **Variational AI** with the support of adMare BioInnovations and the Vancouver Prostate Centre (affiliated with the University of British Columbia). Variational AI gathers a team of experienced AI/machine learning and business specialists applying state of the art generative AI to drug discovery.

Imagia Canexia Health pairs the latest advances in oncology with machine learning to provide oncology professionals with the insights needed to inform targeted treatment decisions. The company works in partnership with BC Cancer Research, DNAstack, Microsoft, Queen's University and University Health Network, will develop a precision oncology software called CanDETECT. Project CanDETECT uses AI, ML, and big data to better predict patient response by integrating and analyzing multimodal patient data for cancer recurrence monitoring. Also led by Canexia Health, project ACTT is in partnership with Queen's University, AstraZeneca Canada, the Eastern Ontario Regional Laboratory Association, Genolife, Semaphore Solutions, emtelligent, Xtract AI, Novateur and Illumina. The project offers an alternative to surgical tissue biopsies, providing access to cancer testing & treatment in response to COVID-19, which aims to speed up testing during the pandemic through a minimally invasive DNA test available for cancer patients.

Industrial Technology Research Institute (ITRI), a world-leading applied technology research institute based in Taipei, its mission is to drive industrial development, create economic value, and enhance social well-being through technology R&D. Relating to digital health, the institute has developed wireless mobile ultrasound device has allowed medical imaging equipment to go out of the hospital, which can provide systemic examinations and improve access to point of care. It also can implement early screening diagnosis and follow-up treatment strategies.

ITRI believes current digital technology and the Metaverse have provided an opportunity for home-based and personalized medical care. The ongoing projects including to reduce neurological disease-related medical care costs, by promoting the use of digital service platforms in Asia through international technical cooperation, such as collection and analysis of medical data, and providing real-time medical guidance, rehabilitation, and treatment of neurological diseases.

Insilico Medicine, an AI-powered drug company, aims to accelerate drug discovery and development by inventing and deploying new AI tech. AI solutions are provided to enable streamlined R&D efforts and transform the way therapeutics and materials are discovered. In the context of the COVID-19 pandemic, the time in inventing drugs could be shortened substantially. The company plans to publish structures of small molecules targeting the key protein SARS-CoV-2 3C-like protease. It will synthesize and

test up to 100 molecules to contribute to the global effort.

However, it has identified the bottleneck which is the ability to synthesize and test the molecules quickly. For synthesis and screening, Insilico has joined forces with many functions of the largest international open research platforms, and the company will make its staff and resources available to support the drug discovery process to contribute to the global fight against this new health threat.

NEC, a multinational information technology and electronics company based in Tokyo, provides thermal temperature screening and facial recognition technology at Hawaii's public airports. The emerging technologies used in this case include high-throughput thermal cameras, surface-to-core medical infrared algorithms, face and body detection algorithms, and anonymous face recognition software. The goal of the project is to implement a tool that can be combined with additional measures the State of Hawaii is providing to help prevent the spread of the novel coronavirus, while helping rebuild the economy and protect the community by identifying passengers with a potentially elevated body temperature, as an indicator of possible illness.

The project team is deploying a high-throughput, multi-person thermal screening solution that aims to automate the screening process with minimal impact on the traveler experience in terms of processing speed, avoiding the introduction of bottlenecks. It addressed the tedious manual process of elevated body temperature detection at airports. The solution provides a more streamlined elevated body temperature detection method that avoids creating bottlenecks for passengers. In addition, bottlenecks preventing digital transformation include public hesitancy in adopting new technologies, lacking ICT infrastructure and other resources in remote locations, and needing to prove emerging technologies before large-scale deployment.

As ICI is only one of two infrared camera manufacturers that have U.S. FDA 510K clearance to market infrared cameras as class 1 medical devices as approved thermal detection devices in compliance with the ISO 13154-2017 guidelines for elevated body temperature thermal imaging, there are no regulatory barriers in adopting this technology.

Quanta Computer Inc., the world's leading IT system provider and the largest notebook design and manufacturer has expanded its reach into medical industry. It has engaged in a range of issues such as elderly health, smart hospital, telehealth, and AI medicine. To support the grand vision of precision, prevention, personalization and participatory medicine anytime, anywhere for anyone, Quanta currently is on the path to develop AI medicine cloud platform (QOCA®AIM), AI Telemedicine platform (QOCA®ATM), AI Patient Care platform(QOCA®APC), together with many IoT enabled medical wearable devices by advanced technology of AI, Big Data, Cloud,

Device, Edge, and FinTech (ABCDEF), with human-centric technology as a core.

Since medical resources are limited, it is important to find a solution to assist radiologists to complete chest X-ray reports with greater efficiency as well as to reduce the time required for report production and forwarding. Hospitals produce a vast number of radiology images daily. The golden window is often missed as most chest X-ray reports are unable to achieve timely completion due to insufficient medical manpower and resources. The chest x-ray AI system (CXR AI) cooperation case has entered clinical practice. The system provides four levels of application functions, including health inspection, instant warning, disease classification, and automatic reporting, aiming at 20~30 common and important diseases. The technologies adopted in this case include a smart AI-powered proactive alarm, a convenient AI medical device to assist disease detection, a user-friendly DICOM image viewer, and integrated hospital systems.

Apart from the CXR AI, the Quanta AIoT platform (QOCA®) is developed by the collaboration among MIT Computer Science and Artificial Intelligence Laboratory (CSAIL), Quanta-NYCU Joint AI Center, and Quanta Computer. Quanta AIoT Platform is architected for smart applications and services in different domains like healthcare, education, smart city, agriculture, and transportation. Quanta AIoT Platform includes the Quanta IoT Platform, IoTtalk, and Quanta AI Cloud, along with a couple of projects that are already deployed in local major hospitals. For example, QOCA apc is a smart quarantine care solution to enable contactless monitoring, engagement, and care provisioning for patients in COVID-19 isolation wards. Based on a private cloud to ensure data security, QOCA aqc supports fully personalized care plans with user-friendly reminders and guidance through daily measurements and questionnaires, with easy-to-use wireless IoMT devices and sensors to automatically synchronize data to the cloud for real-time analysis.

At present, Quanta has established QOCA® 2.0 platform and actively collaborated with several local major hospitals to integrate smart medicine projects for future healthcare, future operating room, future film AI, home healthcare, emergency support, and hospice care.

Taiwan Mobile, a telecommunication provider, has launched an enterprise instant messenger and collaboration platform called M+. It replaces the legacy communication tools like SMS or email. With the integrated M+ Messenger communication platform with hospital ward management system by APIs, physicians can quickly respond to emergency cases with specific treatments. During the pandemic of COVID-19, M+ messenger enables the hospital to make emergency announcements, staff to report issues and share case information efficiently. It allows hospital staff in different branches to form task force groups that work together quickly and easily and significantly reduces transportation between branches.

Meanwhile, the M+ Messenger can be applied to smart healthcare and be the

critical middleware of an efficient telecare system shortly. While many medical instruments and ward systems are digitalized nowadays, the communication between medical workers also requires digital transformation. Nevertheless, even though many corporations have strong intentions, the lack of manpower and budget can lead to a low implementation rate.

Recommendations of the Digital Health Project

The development of recommendations on digital health is an important part of the 2022 Digital Health Project. In order to derive the overall recommendations, the report has synthesized the aforementioned suggestions of organizations, cases, and forum. Therefore, the following recommendations are considered to be essential for advancing digital health:

- Ensure the unceasing support of ABAC for the Aotearoa Plan of Action (APA) that calls for utilizing digital technologies for inclusive and sustainable growth in healthcare.

- Foster the interoperability of digital health systems through the utilization of common and open standards for realizing the safe, effective and efficient usage of technologies.

- Create an enabling environment for digital health technologies through establishing a regulatory framework for the safe, secure access for disaggregated medical data for analysis, and fostering greater investment for its development that will help build resilience in the region.

- Advance human-centered digital health through the development of digital health systems that support technological innovation, enable access to medical data, foster efficient regulatory process, enhance education and training as well as promote user-friendly design of technologies.

- Support OECD's call for the establishment of a health data governance framework to encourage the utilization of personal health data to serve health-related public interests. The OECD's framework has included twelve principles, such as public consultation, approval procedures, transparency, and skill development in privacy and data security measures.

- Promote the collection of cases and the holding of events on digital health to raise awareness of the value creation from real world health data through AI, so as to address the COVID-19 pandemic and strengthen the support for innovation and digitalization.

- Enhance partnership among public and private sectors as well as academia to strengthen digital health in general and AI applications in particular. Examples of

actions could be the implementation of joint projects and events.

References

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OECD. (2022). “Health Data Governance for the Digital Age.” file:///D:/2022%20ABAC/2022%20ABAC%20Digital%20Health%20Forum/Forum%20report%20materials/OECD%20Data%20Governance.pdf

Annex: 2022 ABAC Digital Health Forum Agenda and Photos

ABAC

APEC Business Advisory Council

2022 ABAC Digital Health Forum
July 1, 2022

Introduction:

In 2021, under the ABAC Digital Working Group (DWG), Dr. Ted Chang, Co-Convenor of the Emerging Technologies Task Force coordinated the digital health study to showcase how advanced technology and innovation at work in the real world and to provide recommendations. The COVID-19 pandemic had impacted the global healthcare systems tremendously. Therefore, the collaboration on digital health transformation had become more important. The main message in the recommendation is the strong need to advance human-centric digital health through both business model and technical innovation.

This year, the DWG is continuing with the work on digital health under the coordination of Dr. Ted Chang who is serving as one of the Co-Chairs of DWG. The work for this year is emphasizing the real value creation from real world data through AI in specific areas: 1) Precision health; 2) Smart medicine; 3) Telemedicine from hospital to hospital; 4) Telehealth from hospital to community and home; and 5) Aging in place. Therefore, the holding of the 2022 ABAC Digital Health Forum is another important deliverable of the DWG. The recommendations from the Forum will be placed in the 2022 ABAC Report to APEC Economic Leaders.

Time	Agenda Details	
08:00-08:30	**Registration**	
08:30-08:50	**Welcome Remarks**	● Ms. Janet De Silva, Chair, ABAC Digital Working Group ● Ms. Sharon Wu, APEC Senior Official
08:50-09:00	**On Digital Health Transformation**	Dr. Ted Chang, Co-Chair, ABAC Digital Working Group
09:00-09:10	**Group Photo**	
Session 1: Digital Health Transformation The purpose of this session is to explore the potential of digital health transformation through value creation of real-world data by advanced technologies, like AI, Big Data, IoT, Cloud Computing and 5G. Successful digital solution cases will be shared to address the real-world medical and healthcare problems with focus on the following health domains: 1) Precision Health and Smart Medicine 2) Telemedicine and Telehealth 3) Aging in Place		
Advancing AI for Digital Health		
09:10-09:15	Opening (5 min)	Prof. Victor Zue, MIT Computer Science and Artificial Intelligence Laboratory (CSAIL)
09:15-09:30	Speech 1 (15 min)	Prof. Regina Barzilay, MIT CSAIL
09:30-09:45	Speech 2 (15 min)	Prof. Marzyeh Ghassemi, MIT CSAIL
09:45-10:00	Speech 3 (15 min)	Prof. John Guttag, MIT CSAIL
10:00-10:15	Speech 4 (15 min)	Prof. Collin Stultz, MIT CSAIL
10:15-10:25	Coffee Break (10 min)	
10:25-10:40	Speech 5 (15 min)	Dr. Stephanie Seneff, MIT CSAIL
10:40-10:55	Speech 6 (15 min)	Prof. Ovid J. L. Tzeng, Academia Sinica
10:55-11:10	Speech 7 (15 min)	Prof. Pan-Chyr Yang, Academia Sinica
11:10-11:25	Speech 8 (15 min)	Prof. Kwok, Pui-Yan, Academia Sinica
11:25-13:00	**Lunch Break & Successful Digital Health Cases Video (95 min)**	
Digital Health for Now and the Future		
13:00-13:15	Speech 9 (15 min)	Prof. Huey-Jen Su, President National Cheng Kung University
13:15-13:30	Speech 10 (15 min)	Prof. Ming-Shiang Wu, Superintendent National Taiwan University Hospital

13:30-13:45	Speech 11 (15 min)	Prof. Shou-Yen Kao, Vice Superintendent Taipei-Veterans General Hospital
13:45-14:00	Speech 12 (15 min)	Prof. Tomohiro Kuroda, CIO Kyoto University Hospital
14:00-14:15	Speech 13 (15 min)	Prof. Randy Mclntosh Simon Fraser University
14:15-14:30	Speech 14 (15 min)	Prof. Po-Chang Lee, Director-General National Health Insurance Administration, MOHW
14:30-14:45	Speech 15 (15 min)	Prof. Su, Yi-Chang, Director NRICM of MOHW
14:45-14:55	Coffee Break (10 min)	
Session 2: Recommendations for Advancing Digital Health		
14:55-15:45	**Panel Discussion for Digital Health Transformation** An integral part of ABAC's work is to develop recommendations to APEC Leaders through the annual ABAC Report to APEC Economic Leaders. In this panel discussion, the panelists will make recommendations for the aforementioned ABAC Report. The panelist will examine interoperability issues when deploying across borders, governmental policies, and ways for enhancing APEC cooperation. Moderator: Dr. Ted Chang Panelist: Prof. Jeng Wei, Superintendent Cheng Hsin General Hospital Prof. Shih-Ann Chen, Superintendent Taichung Veterans General Hospital Prof. Meng-Ru Shen, Superintendent National Cheng Kung University Hospital Prof. Ming-Shien Wen, Vice Superintendent Linkou Chang Gung Memorial Hospital	
15:45-15:55	**Closing Remarks**	Chairman Barry Lam, Quanta Computer
16:00	End of Forum	


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Enabling Data-Driven Smart Medicine Service Network for Cities of the Future
Prof. Huey-Jen Su
President
National Cheng Kung University
ABAC
APEC Business Advisory Council
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1 July 2022
NCKU AI MEDICINE CLOUD
DIGITAL TWIN
SOFTWARE SaaS
PLATFORM PaaS
INFRASTRUCTURE IaaS
MEDICAL BIG DATA
A.I.
QOCA AIM


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for
Human-Centric Care
2022


Technical Work - Multi-DML Extension
Multi-label Outcomes
Multi-modal Health Data
DML+Diabetes Can Improve Patie
Prof. Marzyeh Ghassem
Assistant Professor
Department of Electrical Engineering and
Computer Science, MIT


Closing Remarks
Barry Lam
Chairman
Quanta Computer
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