

THE 6th STS FORUM ASEAN-JAPAN WORKSHOP IN SINGAPORE

EXECUTIVE SUMMARY

- HUMAN RESOURCE DEVELOPMENT
AND BRAIN CIRCULATION
- FUTURE OF MANUFACTURING



23 April 2019
Grand Copthorne Waterfront Hotel
Singapore

The 6th STS forum ASEAN-Japan Workshop in Singapore

Date: 23 April 2019 Venue: Grand Copthorne Waterfront Hotel, Singapore



On 23 April 2019, the 6th STS Forum ASEAN-Japan Workshop was conducted in Singapore. The Workshop was co-organised by Science and Technology in Society Forum (STS Forum) and the Agency for Science, Technology and Research (A*STAR) and supported by the Japan External Trade Organisation (JETRO), and Embassy of Japan in Singapore.



Discussions at the 23 April 2019 Workshop further advanced the conversations from the 15th Annual Meeting of the STS forum, which took place from 7 – 9 October 2018 with the participation of more than 1,400 global leaders in science and technology, policymaking, business, and media from nearly 80 countries, regions, and international organizations. From the statement of the 15th Annual STS Forum Meeting, open dialogue and continuous participation from all stakeholders was highlighted as a fundamental element to enhance the societal and economic benefits (*lights*) and alleviate challenges (*shadows*) which have been brought forth by rapid technological progresses and shifts in global conditions.

127 senior government officials, academic professionals, industry leaders, in the areas of science, technology and innovation from ASEAN countries (Cambodia, Laos, Indonesia, Malaysia, Philippines, Singapore, Thailand, Viet Nam) and Japan actively participated in the Workshop. This year, the 6th ASEAN-Japan Workshop hosted in Singapore was guided by the two themes of “Science and Technology Cooperation between ASEAN and Japan: human resource development and brain circulation” and “Future of Manufacturing”.

H.E. Mr. Jun Yamazaki, Ambassador of Japan to Singapore hosted a welcome reception at the Ambassador’s Residence on 22 April 2019 in honour of STS forum Chairman, Mr. Koji Omi’s visit to Singapore and to welcome delegates of the 6th STS Forum ASEAN-Japan Workshop. Following the successful conclusion of the Workshop, a post-event networking reception on 23 April 2019 was hosted by A*STAR at Grand Copthorne Waterfront Hotel Singapore.



OPENING ADDRESS

- **Mr. Koji Omi**, Founder and Chairman, Science and Technology in Society Forum (STS Forum), Japan
- **Ms. Chan Lai Fung**, Chairman, Agency for Science, Technology and Research (A*STAR), Singapore

To commence the Workshop, Mr. Koji Omi, Founder and Chairman of STS Forum, and Ms. Chan Lai Fung, Chairman of A*STAR, delivered the opening addresses and welcomed all the distinguished speakers and participants to the sixth edition of the STS Forum ASEAN-Japan Workshop.



Mr. Koji Omi started his Opening Address by stating that a common theme in the STS *forum* is the light and shadows of science and technology that must be strengthened and controlled respectively. It is necessary for scientists, policy makers, business leaders, and government officials worldwide to come together and discuss how to deal with science and technology issues. This workshop will explore how cooperation can be enhanced between the ASEAN region and Japan, looking at science, technology, and innovation (STI), human resources development, and the future of manufacturing. The cooperation between ASEAN nations and Japan supports strong growth in the region, and the STS *forum* and this workshop help facilitate this mutual relationship. ASEAN and Japanese leaders all recognize that STI are key drivers of sustainable economic development in the future, and cooperation between ASEAN nations and Japan is crucial.



Ms. Chan Lai Fung welcomed participants of the 6th STS forum ASEAN-Japan Workshop, and noted the long-standing and meaningful science, technology and innovation partnerships between ASEAN and Japan. The Workshop, which inaugurated in Singapore in 2014, continues to be an invaluable platform which gathers representatives from government, industry, and academia for open dialogue on shared topics of interest. Highlighting that it was timely for the 6th Workshop to discuss on the topics of “Human Resource Development and Brain Circulation” and “Future of Manufacturing”, Ms. Chan encouraged all attendees to participate actively and explore how science, technology and innovation cooperation could be harnessed to create opportunities for economic and societal outcomes.

WELCOME REMARKS

- **H.E. Mr. Jun Yamazaki**, Ambassador of Japan to Singapore
- **Mr. Yasukazu Irino**, Executive Vice President, Japan External Trade Organization (JETRO), Japan

H.E. Mr. Jun Yamazaki, Ambassador of Japan to Singapore, and Mr. Yasukazu Irino, Executive Vice President, JETRO, gave the welcome remarks and set the stage for active participation and lively exchanges from the participants.



H.E. Mr. Jun Yamazaki began his remarks by stating this workshop provides a valuable experience partly due to the diversity of the participants. The ASEAN region and Japan are dedicated to harnessing science and technological advancements in order to fulfil societal needs, and the STS *forum* plays an important role as a platform, such as providing this workshop between ASEAN nations and Japan. Between Japan and Singapore, there is close cooperation with organizations which has resulted in further collaborations. This workshop will provide fruitful discussions and deepen ASEAN-Japan cooperation.



Mr. Yasukazu Irino noted that JETRO has cooperated with the STS forum around the world since the forum's founding. Recently, JETRO has positioned innovation-related activities among its most important in its mid-term plan, which are in line with the topics of this workshop. It has enhanced support linking overseas start-ups including Singaporean ones with Japanese companies (in what JETRO calls "open innovation support") and support for Japanese start-ups developing business overseas. JETRO also has started to support the capacity building of Japanese corporate employees for global business. JETRO hopes to continue contributing to science and technology through the STS forum.

SESSION I:

Science and Technology Cooperation between ASEAN and Japan: Human Resources Development and Brain Circulation

Chair:

- **Prof.Dr.Ir. Bambang Subiyanto**, Vice Chairman, The Indonesian Institute of Sciences (LIPI), Indonesia

Speakers:

- **Mr. Yoshio Yamawaki**, Senior Deputy Minister of Education, Culture, Sports, Science and Technology, Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan
- **Mr. Has Bunton**, Secretary General, The National Science and Technology Council (GS-NSTC), Cambodia
- **Dr. Kayo Inaba**, Executive Vice-President for Gender Equality, International Affairs, and Public Relations, Kyoto University, Japan
- **Dr. Mohd Nor Azman Hassan**, Deputy Secretary General (Science, Technology and Innovation), Ministry of Energy, Technology, Science, Climate Change and Environment, Malaysia
- **Dr. Yoshimasa Goto**, Executive Director, Japan Science and Technology Agency (JST), Japan
- **Mr. Lien Choong Luen**, General Manager, Go-Jek, Singapore
- **Prof. Motoko Kotani**, Executive Director, RIKEN, Japan
- **Prof. David Chan**, Director, Behavioural Sciences Institute, Singapore Management University, Singapore
- **A/Prof Jeremy Lim**, Partner, Health and Life Sciences Consulting Practice, Oliver Wyman, Singapore

The topic for Session I was “Science and Technology Cooperation between ASEAN and Japan: human resource development and brain circulation”. Prof. Dr. Ir. Bambang Subiyanto (The Indonesian Institute of Sciences (LIPI), Vice Chairman) gave an overview of the topic and introduced the nine speakers of the session.



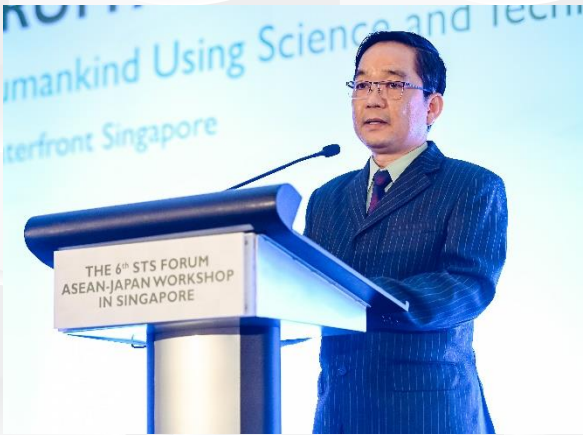
The Session Chair, Prof. Dr. Ir. Bambang Subiyanto opened the session by pointing out that ASEAN nations and Japan have a long history in regards to human resources development, such as with Japan-ASEAN Science, Technology and Innovation Platform (JASTIP). Success in human resources development and brain circulation depends on the

situations in each country and policy direction for human development. There is room for enhancement of human resources and brain circulation between the ASEAN region and Japan, and this workshop could provide for improvements in these areas.

Mr. Yoshio Yamawaki stated that although ASEAN nations and Japan face different brain circulation challenges, international brain circulation could be utilized to contribute to the development of both regions. In order to reduce ASEAN's brain drain issues, possible measures, such as reinforcing a network of young researchers by encouraging them to participate in joint research



activities and fellowship programs, and providing opportunities to contribute to solving social problems through Science, Technology and Innovation (STI) could be considered. It is important to promote further STI collaboration between the ASEAN region and Japan in achieving Sustainable Development Goals (SDGs) in order to enhance brain circulation and the partnership between the ASEAN region and Japan.



Mr. Has Bunton noted that an unconventional inclusive education and training on knowledge transfer has been enhanced due to the advancement of STI. YouTube plays an important role in inclusive knowledge sharing, balancing demand and supply, and the barrier of language differences is disappearing due to AI technology. It is vital to facilitate and encourage

knowledge sharing at the supply side, and to promote effort that reaches out broadly at the demand side.

Dr. Kayo Inaba began by emphasizing the key role that universities play in developing STI to work towards the SDGs. She highlighted some of Kyoto University's ongoing efforts to utilize research outcomes for the benefit of society in the ASEAN region, such as a long-term research project on peatland in Indonesia. She also discussed the Japan-ASEAN Science, Technology, and Innovation Platform (JASTIP), an initiative that promotes sustainable development research collaboration between the ASEAN nations and Japan.



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Dr. Mohd Nor Azman Hassan noted that Malaysians working abroad are building the Malaysian brand while developing their experience and strengthening their professional networks, especially in Australia, Britain, Canada, and the U.S. in various sectors. In addition, Malaysians are returning to Malaysia with the knowledge and skills they gained abroad. Malaysia is engaged in efforts to enhance brain circulation, promote talent

mobility within the region, better benefit the unity among ASEAN citizens, and enhance collaboration between industry and science. Regarding collaboration, a platform for the STI community was approved to create a new generation of young ASEAN scientist leaders.

Dr. Yoshimasa Goto pointed out the Japan Science and Technology Agency (JST) is executing initiatives in order to promote human resource development. Science and technology in Japan is under threat because young researchers are not provided an environment in which they can thrive, and it is vital to protect and train young people who engage in scientific



research. Regarding brain circulation, JST is conducting research in close collaboration with ASEAN nations through various programs. JST is committed to strengthening ASEAN-Japan cooperation and being proactive in promoting human resource development and international research programs.

Mr. Lien Choong Luen started pointing out that investing in valuable human resources is the driving force behind Go-Jek. Brain circulation enhances cultural sensitivity for Go-Jek which in turn drives the deeper product value. Cross-cultural ability and cultural interface is something that is very difficult to train, but vital for ASEAN nations. Having people who are willing to

circulate themselves is what will make the technologists most effective, cross-culturally fluent, and it is something that Singapore and Japan can both engage in.



Prof. Motoko Kotani explained that Society 5.0 concerns how we realize a human-centric society in the digital revolution, and human resources and brain circulation are the most important ingredients. RIKEN is engaged in activities across Asia that enhance human interaction, human resources, and brain circulation. RIKEN established programs to

accept domestic and international researchers, especially for young researchers, which include a diversity of members.

Prof. David Chan proposed adopting a "3M" approach to address issues concerning ASEAN-Japan collaboration in science and technology, both within and across countries. This approach involves a mindset consisting of "multidimensionality", "multidisciplinarity", and "mutuality". Multidimensionality is about looking at each issue in its context and appreciating how it relates to other issues. Multidisciplinarity is about thinking and seeing things outside one's own disciplinary training and perspective. Mutuality is about moving away from zero-sum and win-lose thinking to appreciating how differences and disagreements can be construed as diversity and constructively integrated into strengths, by focusing on commonalities and complementarities of various interests.



A/Prof. Jeremy Lim pointed out that in Thailand, a hospital was created that was the first JCI accredited hospital and employed Thai doctors who were board certified in the U.S. In Vietnam, a Vietnamese-American professor was more than eager to return to Vietnam and assist universities in any way that he could. In Singapore, a

doctor went to the U.S. to learn a new technique which proved to be useless back in Singapore because his colleagues were not ready to accept doctors crossing disciplines. These three stories fall back on mutuality and the question of what people want. In order to bring talent back to their home countries, their self-centred interests should be aligned with the organizational, regional, and national interests.

Report Back

The rapporteur of table 1 reported that their group discussed collaboration among ASEAN and Japanese scientists; the challenge in terms of translations of research; Japan's ability to develop technology, Japan's strong regulations, the need for Singapore as a venue for launching technology, the need for ASEAN's market, and mutuality; the development of the translation of science in ASEAN nations; and networks.



The rapporteur of table 3 reported that their group touched on the challenge of translating SDGs which is a multidisciplinary and multisectoral issue; how to use science, technology, innovation, and sustainable development to solve issues in water, energy, healthcare, food security, and biodiversity loss; the resources required to market a new invention; and necessities from the entrepreneurial side.



The rapporteur of table 5 reported that their group mentioned practical issues of brain circulation; brain circulation being an aspirational goal; to change from brain drain to brain circulation, we need to have a common platform in terms of language, skills, and outlook to achieve the appropriate level of communication and brain circulation among

different stakeholders; not only economic incentives but also other issues are key to achieve brain circulation; and clearer ideas of economic outcome of SDGs are needed.

The rapporteur of table 7 reported that their group spoke on talent, collaboration, and how to use R&D to assist the economy; even though there are different challenges in different countries, one common challenge is recruiting and retaining talent; enhancing collaboration by circulating human resources in ASEAN nations; and utilizing research and capitalizing on it.



The rapporteur of table 9 reported that their group highlighted human mobility as an important factor for brain circulation, and human mobility in Latin America is becoming increasingly difficult; the importance of political stability among collaborating countries; the impact of airports on mobility; women participation as a driving force; and enhancing the younger generation's involvement in science and engineering



The rapporteur of table 11 reported that their group went over issues facing Malaysia, such as low wage, healthcare, and the economy; the focus on primary and secondary layers of the economy in Malaysia; boosting the Malaysian economy through technology and manufacturing; an increase in entrepreneurship in universities and various parts of Malaysia; and collaboration to enhance brain circulation.

The rapporteur of table 13 reported that their group discussed developing science and engineering talent which is a common challenge across countries; how to generate interest in science and engineering careers; how to improve the image of engineering; how to showcase the impact of technology in the younger generation; how to create a sense of need to develop products in a short period of time; how to create platforms to bring together engineers, business people, and different groups of expertise; the value of company internships; tackling the challenges of multidisciplinary work; and how to evaluate social science work.



The rapporteur of table 15 reported that their group talked about the importance of human resources and brain circulation in Japan and ASEAN nations; multidisciplinary and multi-sectoral aspects of human resources development; the importance of exchange programs from the government and private sectors for brain circulation; networking in forums like the STS forum; and issues surrounding researchers who leave their home countries and never return.



WRAP-UP by Commentators

- **Dr. Maria Cynthia Rose Banzon Bautista**, Vice President for Academic Affairs, Office of the Vice-President for Academic Affairs, University of the Philippines, Philippines
- **Dr. Chadamas Thuvasethakul**, Executive Vice President, National Science and Technology Development Agency (NSTDA), Thailand

Finally, the session was summarised and wrapped up by two commentators.

Dr. Maria Cynthia Rose Banzon Bautista mentioned the important points touched on by the rapporteurs. She highlighted the need for collaboration among young researchers; utilizing existing networks of researchers and technologists in order to solve concrete problems related to SDGs; brain circulation among countries

which have similar progress in their development; incentives to attract talent back to their home countries; brain circulation utilized to solve regional issues; being more mindful of SDG goals through innovations; different markets and different technologies for different people in order to address SDGs; efforts to bring scientists into developing countries; different levels of brain circulation based on the countries; and networking and operating at different levels in order to realize SDG goals, enhance human development, and harness brain circulation.



Dr. Chadamas Thuvasethakul stated that science, technology, and innovation are key drivers for economic growth; having the right talents to drive innovation is the key; and ASEAN nations and Japan have strong needs to cooperate to endure regional sustainability using their unique strengths. She also touched on the importance of programs throughout the region, specifically mentioning the importance of the JENESYS program which creates a mutual understanding among young people; the promotion of higher education in engineering for sustainable socioeconomic development of the ASEAN region by the ASEAN University Network; the promotion of international joint research by SATREPS; the acceleration of research that will be a driving force to attain sustainable development by JASTIP; and adding the SDG dimension to these programs could prove to be more beneficial. Dr. Thuvasethakul also talked about two initiatives from Japan; one from JST and another on industrial human resources development. Japanese companies are investing in research facilities in ASEAN nations, and they demand more technical manpower so joint cooperation is necessary to support the development and technical manpower.



SESSION 2: Future of Manufacturing

Chair:

- **Dr. David Low**, Chief Executive, Advanced Remanufacturing and Technology, Agency for Science, Technology and Research (A*STAR), Singapore

Speakers:

- **Dr. Ir. Hammam RIZA, M.SC**, Chairman, Agency for the Assessment and Application of Technology (BPPT), Indonesia
- **Mr. Shoji Watanabe**, Deputy Director-General, Industrial Science and Technology Policy and Environment Bureau, Ministry of Economy, Trade and Industry (METI)
- **Dr. Alpesh Patel**, Director of Digital Capability Center, Mckinsey & Company, Singapore
- **Dr. Satoshi Sekiguchi**, Vice President, National Institute of Advanced Industrial Science and Technology (AIST), Japan
- **Mr. Wouter Van Wersch**, President & CEO, General Electric ASEAN-ANP, Singapore
- **Mr. Fumio Otani**, Director, Senior Vice President, Corporate Strategic Planning Division, Toshiba Energy Systems & Solutions Corporation, Japan
- **Dr. Wilaiporn Chetanachan**, Principal Innovation Advisor, Office of the President and CEO, The Siam Cement PLC, Thailand
- **Dr. Evert Helms**, Managing Director & Technical Director SEA, Pepperl+Fuchs Asia Pte. Ltd., Singapore
- **Dr. Rezal Khairi Ahmad**, Chief Executive Officer, CEO's Office, NanoMalaysia Berhad, Malaysia
- **H.E. Bui The Duy, Deputy Minister**, Viet Nam Ministry of Science and Technology, Vietnam

For Session 2, the “Future of Manufacturing” was the thematic focus of discussion. Dr. David Low (A*STAR, Chief Executive, Advanced Remanufacturing and Technology Centre) opened the session with an introduction and invited the ten speakers of the session to share their insights on the topic.



The Session Chair, Dr. David Low opened Session 2 by noting that Industry 4.0 was slow to gain popularity, however, now every company has a strategy around it. The term was originally coined for cyber physical systems. However, it is broader today, covering advanced robotics, artificial intelligence (AI) and more. Globally, countries have recognized that manufacturing

brings benefits to society. ASEAN nations and Japan are engaged in various projects around this space. The future of manufacturing in Singapore is to create a public-private partnership platform to enhance technology, and to invest in unique and impactful 4.0 technologies.

Dr. Ir. Hamman Riza M.Sc explained that Indonesia has entered Industry 4.0 by launching Making Indonesia 4.0 which is a roadmap integrated with Industry 4.0. In Indonesia, 4.0 is based on five ideas in the industry sector; food and beverage, automotive, electronic, chemical, and textile. As part of Indonesia's effort to adopt Industry 4.0,



Sustainable Development Goals (SDGs) must be in each of these sectors, strengthening industrial supply chains, human capital improvement, digital infrastructure, innovation and ecosystem, fiscal incentives for innovation, industrial zone development, and improving industrial policies and investment climate. In order for small and medium economies to adopt Industry 4.0, they need a strategic plan to transform their manufacturing production and innovation must be a factor. The Indonesian government has to put forward a better strategy in effort to increase its capacity and capability and building technology and human capital to prepare small and medium-sized enterprises (SMEs) for Industry 4.0.



Mr. Shoji Watanabe started his presentation by stating The Internet of Things (IoT) provides for easy access to data which can be utilized to improve manufacturing. The fusion of manufacturing and emerging technology will solve various social issues, such as energy and environmental issues, and will realize sustainable

economic growth. Japanese manufacturing industries and various organizations should access to a large amount of data that could be shared, which promotes the concept of 'Connected Industries.' The Japanese government has created several policies around this concept, such as a tax reduction plan for companies to invest in IoT to gather and connect data. They also support SMEs to implement robots and information technology (IT) tools.

Dr. Alpesh Patel pointed out that digital manufacturing shows especially high potential in the ASEAN region. As a manufacturing hub, ASEAN is currently overshadowed by countries such as China. Leveraging Industry 4.0 technologies can help ASEAN manufacturers to increase their competitiveness and achieve their goals. On the



other hand, the advent of Industry 4.0 can also become a threat if the region's manufacturers do not act fast to address the risk of being left behind. The issue they face with Industry 4.0 lies in implementation. Only a few companies have been broadly successful with Industry 4.0 because the vast majority lack proper roadmaps to turn promising pilots of Industry 4.0 ideas into sustained impact. As a result, people start seeing digital transformation as a mere technology exercise, and get stuck in what we call a "pilot trap" from the beginning of their transformation journey. Thus, it is important for companies to adopt a holistic, business-backed approach to Industry 4.0 transformation from the start. This perspective informs the design of clear priorities and incentives that spur widespread adoption.



Dr. Satoshi Sekiguchi noted that Southeast Asia and Japan share the same vision for the future of manufacturing. Innovation in the AI industry is necessary to realize a human-centred and sustainable society based on the new ecosystem. The National Institute of Advanced Industrial Science and Technology (AIST) is

developing research facilities to integrate IoT, AI, and robotics which aim to realize an optimized AI manufacturing industry. High quality data must be utilized in order to realize a manufacturing industry around AI. To create innovation in the future AI manufacturing industry, multiple viewpoints, integration, and challenges are essential.

Mr. Wouter Van Wersch started his presentation by stating additive manufacturing (AM) is a revolution that we are currently going through, using 3D printing technology to create objects. Some advantages include accelerating innovation, increasing product performance, and reducing supply chain



costs and timing. General Electric is present in the aviation, energy and healthcare industries and has created an advanced turboprop engine which uses additive manufacturing. He also shared how the healthcare industry could use AM for dental restorations or hip replacements. AM is changing the world, disrupting industries, and accelerating the way products are designed and manufactured.

Mr. Fumio Otani pointed out that 5G technology is becoming realized and the manufacturing industry could benefit greatly if taken advantage of. Through AI, the production line could utilize self-monitoring, self-optimization, automatic value setting, self-protection from failure, self-awareness, and more.

5G technology will provide reliability and stability of communication between machines. For the future of Japan, considering to be a manufacturer or service provider is necessary for the future of manufacturing. Dealing with special skills required in manufacturing is an issue in which keeping it or transferring it to the next generation needs to be considered.



Dr. Wilaiporn Chetanachan started by stating the history of manufacturing has embraced producing as much as possible for as cheap as possible, which is no longer the most positive model. Four factors influence the future of manufacturing which are customer demand, nature of products, economy of production, and economy of the value chain. In the future

of manufacturing, we will see an increasing proliferation of niche markets instead of mass-market products. Consumers will be able to buy or create products which suit their individual needs. The manufacturing landscape is facing dramatic change. Rethinking business models is one of the necessities for the future of manufacturing.

Dr. Evert Helms pointed out that Pepperl+Fuchs is a small manufacturing company that handles high-mix, low-volume production. This type of production provides unique set of challenges including the availability of appropriate robots for manufacturing. In order to move forward with regards to manufacturing and Industry 4.0, Pepperl+Fuchs

is implementing collaborative robots, utilizing highly-automated warehouses, different technologies to increase the production flow, and data technology to understand the production process better. Special requirements of high-mix and low-volume productions are challenging and unique and can be enhanced by the use of advanced technology.



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Dr. Rezal Khairi Ahmad started by noting the widespread adoption of cyber physical systems (CPS) will naturally give rise to smart manufacturing which in turn is the convergence of automation with sensors, connectivity, analytics, and enhancement by AI. Most technology advances have been driven by nanotechnology. For example,

the ultra-wideband allows for communication between machines and sensors without interference. The right technology must be adopted to realize smart manufacturing. In the context of Malaysia, NanoMalaysia Berhad provides a private-public open innovation platform congregating technology developers, intellectual property management, project investment, business solutions, and joint venture advisory for start-ups and SMEs. This platform welcomes international collaborators to jointly develop new ideas and create new business ventures.

H.E. Bui The Duy stated his belief that the fourth industrial revolution will change the current manufacturing system. In order to see growth and innovation in the future, decisions must be made around which sectors and value chains in the manufacturing industry will be prioritized based on comparative advantages.



Viet Nam has much work and many challenges to overcome in regards to Industry 4.0, with focus on the restructuring of its manufacturing systems and promoting new technology in the manufacturing sector. Viet Nam realizes it needs to encourage and facilitate SMEs to participate in the transformation and application of Industry 4.0 into manufacturing and strengthening multilateral and regional cooperation especially within the ASEAN region. Viet Nam also has to enhance its innovation system, and its digital infrastructure.

Report Back

The rapporteur of table 2 reported that their group discussed the constraints around how to transform businesses, including the reskilling the workforce; making a societal opportunity to reskill and augment individuals and technology rather than replace them; rethinking about how learning is being done; utilizing start-ups in new business models; and integration of Industry 4.0.



The rapporteur of table 4 reported that their group touched on how companies organize data and its impact on the development of AI; data sharing from private companies to the public; government-organized data sharing; and AI replacing human laborers or skilled workers.



The rapporteur of table 8 reported that their group spoke on automating experimental machines; the time-consuming technical skills needed for analytical instruments such as electron microscopy which could be assisted by AI; and the realization of these concepts would enhance the progress of research.

The rapporteur of table 10 reported that their group talked about data sharing in order to advance the new manufacturing industry; the differences between each country about data sharing; collaboration with industry and international partners; and data managed under copy write issues.



The rapporteur of table 12 reported that their group mentioned the speed of technological advancement; the demand of the future; companies looking at the customers' needs rather than looking at supply; the uncertainty of the future of manufacturing; and investigating consumer needs.

WRAP-UP by Commentators

- **Dr. Mohd Yusoff Sulaiman**, President & Chief Executive Officer, Malaysian Industry-Government Group for High Technology (MIGHT), Malaysia
- **Dr. Raphael Guerrero**, Acting Dean, School of Science & Engineering Dean's Office, Ateneo de Manila University, Philippines

Finally, the session was summarised and wrapped up by two commentators.

Dr. Mohd Yusoff Sulaiman started his wrap-up by pointing out that various perspectives were explained in the workshop such as the global, national, industrial, and individual perspectives. In order to address the future of manufacturing, not just technology needs to be addressed but also funding, institution, regulation and policy, and skilled people. Utilizing 3D printing could dramatically reduce wait time for manufacturing. Increasing the top line and reducing the bottom line are other benefits in the future of manufacturing to achieve. How to get to that point needs to be explored, such as having an index to measure factors of manufacturing in the future. In conclusion, regarding the future of manufacturing, we must not forget the future of public service, future of work, and future of manufacturing ethics.





Dr. Raphael Guerrero noted that Industry 4.0 is a new concept for Filipinos, including key words such as additive manufacturing. Through IoT, Filipinos have the potential for better productivity through accessing data from users. In order to realize this, the Philippines needs a roadmap for a holistic

approach and the availability of tools such as sensors and 3D printing. Industry 4.0 seems focused on made-to-order manufacturing as opposed to mass production, which 3D printing will play a significant role. The table discussions touched on the need to have a rescaling of the workforce, emphasizing not to replace humans with technology regarding the threats of Industry 4.0, and learning from start-ups in terms of business models could prove to be valuable.

CONCLUDING REMARKS

- **Mr. Frederick Chew**, Chief Executive Officer, Agency for Science, Technology and Research (A*STAR), Singapore
- **Mr. Koji Omi**, Founder and Chairman, Science and Technology in Society Forum (STS Forum), Japan

In wrapping up the successful event, the closing remarks delivered by Mr. Frederick Chew (A*STAR, Chief Executive Officer) and Mr. Koji Omi (STS Forum, Chairman) reaffirmed the importance of continuing the cooperation between ASEAN and Japan in science, technology and innovation.

Mr. Frederick Chew thanked all participants and organisers for their active contribution for the completion of another successful edition of the STS forum ASEAN-Japan Workshop. The open exchange of ideas and concepts at the 6th Workshop reaffirmed the robust science and technology networks



between ASEAN and Japan. Mr. Chew expressed confidence that the 2020 Workshop hosted by Malaysia would continue to provide a valuable platform to enhance the science, technology and innovation cooperation between the ASEAN region and Japan.

Mr. Koji Omi expressed his gratitude to all participants who have contributed to the success of this workshop. Next year, the STS forum is hosting the ASEAN-Japan workshop in Malaysia. Each year continues to bring changes, such as women's roles in science and technology, but the importance of science and technology has maintained at the same level. We must continue to adapt in order to keep science and technology a priority.



Dr. Mohd Yusoff Sulaiman (Malaysian Industry-Government Group for High Technology (MIGHT) President & Chief Executive Officer) announced the next STS Forum ASEAN – Japan Workshop 2020 will be held in Malaysia, and all participants are welcome to attend.



We look forward to seeing you all at the ASEAN-Japan workshop in 2020.