

**Addressing Global Issues  
With Collective and Concerted Actions:**

Indonesian Scholar Perspectives for the G20 Forum



Board of Professors  
Universitas Gadjah Mada



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**ADDRESSING GLOBAL ISSUES WITH COLLECTIVE AND CONCERTED ACTIONS:  
Indonesian Scholar Perspectives for the G20 Forum**

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## **FOREWORD**

### **RECTOR OF UNIVERSITAS GADJAH MADA**

*May peace, mercy, and blessings of Allah be with you*

**A**s the Rector of Universitas Gadjah Mada, I appreciate the Board of Professors for the initiative to publish a book entitled *Addressing Global Issues with Collective and Concerted Actions*. As an academic work and policy dialogue, this book is timely and of high importance as a significant contribution to the 2022 G20 Presidency of Indonesia. It is in line with the main theme of the presidency, “*Recover Together, Recover Stronger*” covering three key issues: Global Health Architecture, Digital Transformation, and Sustainable Energy Transition.

The Global Health Architecture is a relevant topic that gather countries in the world to work collectively towards equality of global health standards. This also encourages the global community to strive for resilience in anticipating any possible pandemic in the future. It is important to strengthen global health system to become more equitable, inclusive, and responsive to crisis. Learning from our experience in the past pandemic, we should prevent diseases and promote health, not only for human but also for general ecosystem of the planet. We have come to realize that curative treatments are too expensive and too late. So, prevention is a better approach. In doing so, it is important to promote education of public health and campaign for preventive health using digital technology and other new and alternative multimedia.

The implementation of digital transformation will inevitably stimulate rapid changes of the global economic landscape. Cooperation and collaboration will be stronger and more efficient with the advancement of digital technology. Digital transformation also ensures openness and inclusiveness to parties involved in global collaboration. Acceleration of small-scale economy to become a global-scale economy with the

involvement of digital ecosystem brings more opportunities to women, youths, and other marginalized parties to have significant role in the future.

With regards to Sustainable Energy Transition, we need paradigm shift in our development, especially since Indonesia is an archipelagic state with thousands of islands which are threaten by climate change. Huge efforts and great investment should be put in research and development in clean and renewable energy to fight the effect of global warming. Global commitment and collaboration of actions on sustainable energy transition will eventually improve life and sustain the future.

Universitas Gadjah Mada has many professors and young researchers with great interest in health and general issues of our planet in general. Their ideas, innovations, and implementations presented in this book need further scale up for more collective, concerted, and collaborative actions with global partners.

I understand that this book contains knowledge and competence from experiences written by the members of the Board of Professors in collaboration with lecturers and researchers in their respective fields. This book is published with hopes to contribute to the forum of the *Sherpa Meetings of Indonesia G20 Presidency*. We are hopeful that this will open more doors of opportunities for further cooperation and collaboration in education, research, and community services, in accordance with the expertise of professors and researchers at Universitas Gadjah Mada.

We are keen to see that the invaluable contributions in this book will eventually accelerate further research and add color and flavor to concrete cooperation in the development towards a better life. With its role through G20 Presidency, may Indonesia contribute significantly to inclusivity and justice for all actors and sectors of development towards sustainability. I am optimistic that this contribution of thoughts and ideas from Universitas Gadjah Mada will find their way to benefit readers so they can be part of changes for the better.

Yogyakarta, Indonesia, September 2022

Ova Emilia

**FOREWORD**  
**CHAIRPERSON BOARD OF PROFESSORS**  
**UNIVERSITAS GADJAH MADA**

*Assalamualaikum wr.wb.*

*(May the peace, mercy, and blessings of Allah be with you)*

**B**oard of Professors of Universitas Gadjah Mada supports Indonesia in the G20 Presidency with the main theme of “*Recover Together, Recover Stronger*”. Indonesia invites all the citizens of the world to help each other and work together in overcoming the pandemic and crisis towards resilience dan sustainably grow stronger.

That is the reason for Board of Professors of Universitas Gadjah Mada is to publish the book with the title of *Addressing Global Issues with Collective and Concerted Actions*. The topics of the book has been made into a seminar in June 2022 for a series of commemorations for the 50 years of the Stockholm Declaration, an accord to look after the environment for mankind. The book gives a global outlook and Indonesia’s experience regarding three key issues which are *Policy Notes for Indonesia G20 Presidency on Global Health Architecture, Digital Transformation, and Sustainable Energy Transition*.

This book contains knowledge and competence from experiences written by the members of the Board of Professors with lecturers and researchers in their respective fields. This book is expected to be able to give a contribution in the forum *Sherpa meetings Indonesia Presidency G20* and the opportunity of cooperation and collaboration in education, research and community service, in accordance with the expertise of the professors and researchers of Universitas Gadjah Mada.

The authors formulated a topic of discussion and contribution of ideas that involved a team of experts according to their fields. In this first part of this book is about *Global Health Architecture (GHA)* which is the authors’ creation that includes being active in education and research as well as

community service and health policies formulation and its relationship with mankind's wellness and planet earth. The second part is explaining *Digital Transformation (DT)* which consist of authors from researcher and lecturer who have many experiences in digital public policy and practices in government, business sector, and education. The third parts explain *Sustainable Energy Transformation (SET)* which transform economy and social development toward sustainable way.

This book is expected to accelerate further research, and also to add color to concrete cooperation in the development of a better life on earth. Through this cooperation, G20 gives contribution to inclusivity, collaboration and justice for all actors and sectors of development towards sustainability.

Hopefully this contribution of thinking from Universitas Gadjah Mada can be beneficial for the readers to make changes for the better.

*Walaikumsalam wr.wb.*

*(And peace be upon you and God's blessing)*

Yogyakarta, Indonesia, July 2022

Mochammad Maksun Machfoed

# **PREFACE**

## **THE INDONESIAN PERSPECTIVE ON THE ROLE OF G20 COUNTRIES**

Wahyudi Kumorotomo and Muhammad Baiquni

**T**his book comes under the auspices of Dewan Guru Besar (Board of Professors) of Universitas Gadjah Mada, which conducted scholarly discussions on the role of G20 countries for addressing global pressing issues. All the chapters are written by professors and researchers from various faculties at Universitas Gadjah Mada who wish to contribute on perspectives and actionable agendas for the G20 forum. We expect that the multi-disciplinary approach among the university scholars would provide a comprehensive understanding on what to be considered by the G20 country leaders. G20 was initiated by seven developed countries in response to the financial crisis in late 1997. Since then, G20 has been expanding in terms of its membership and agenda. The recurring financial crisis in 2008 has influenced the expansion of membership from mostly developed countries to the emerging economies such as Brazil, China, Indonesia, India, and South Africa based on an argument that global economic issues need to be addressed by involving countries both from the North and the South hemisphere. At the same time, G20 agenda has been expanding beyond financial and core economic issues to incorporate other pressing issues such as climate change, digitalization, sustainable development, and women's empowerment. Therefore, this book is expected to enrich discussions under the sherpa track, the non-financial track of the G20 that recently has been involving various elements such as academia, community activists, private companies and non-governmental organizations.

There are two lines of argument to be presented in this volume. First, we would argue the importance of equality, inclusiveness and concerted

actions for any global issues. There are many global issues that can only be addressed with collective and concerted actions among global stake-holders, communities and citizens. Lesson learnt from the global Covid-19 pandemic and the current G20 theme of “Recover Together, Recover Stronger” emphasized the inter-dependency among countries and that all delegates in the G20 should bring up the spirit of respect and togetherness in finding long-term solutions. Second, in line with the three focal points that have been set up for the G20 agenda, we would like to present the Indonesian scholar perspective. The Indonesian Government has accentuated that G20 forum should not only resulted in formal agreements and communiques, but it should also drive pragmatic and real actions. Therefore, we divide this book according to the three focal points for the G20 forum in Indonesia, i.e. global health architecture, digital transformation, and sustainable energy transition. It is expected that the analysis and arguments in this book would help to understand the issue, to map out the inter-connectivity among issues, and to provide alternative solutions. Most of the analysis in chapters are based on the Indonesian experience and probably represent typical developing economies, but the idea of inclusiveness would add the strength of the arguments.

In 2022, with Indonesia being entrusted to assume G20 presidency under the post-pandemic outlook and many geo-political shifts, there have been a bunch of both hopes and challenges. Unlike formal international organizations such as UN, IMF, and World Bank, G20 does not have a permanent secretary. Meetings and agendas are determined by the so-called triumvirate system, a form of leadership or congregation held by three countries with the same role. This year, it includes Indonesia as the current president, Italy that previously has served as the president, and India that will become the president next year. The triumvirate system of leadership has its advantages and disadvantages. The circular leadership system would definitely assure equality and inclusiveness among the G20 members both from industrial and emerging economies. The spirit of deliberation in the global governance and the continuity of issues being discussed are also supported by the circular leaderships. However, as G20 is a kind of “loose club of countries” (Luckhurst, 2016: 3) that is based on consensus and involving various non-government elements, its accountability and compliance are frequently questioned. The involvement of “engagement

groups” including the youth organizations in Y20, businesses in B20, think-tanks in T20, civil society communities in C20, urban planners in U20, labour organizations in L20, scientists in S20, members of parliaments in P20, and women in W20 are added complexity in terms of focus and prioritized actions.

Some experts are sceptical about the effectiveness of G20 in implementing its formal agreements. However, as a group of countries that represents around 75 percent of global trade and 80 percent of world GDP, any kinds of agreements within the G20 would have an impact to the respective countries. While Indonesia might not be considered as powerful enough in convincing leaders of developed countries, as the third biggest democracy after the USA and India and the fourth rank of world population with an emerging economy, Indonesian presidency in G20 remains a good opportunity to tackle current global issues. Indonesian Government has a privilege to set the agenda for the meetings and determine which countries that will be invited for the leaders’ summit in mid November 2022. As such, Indonesia can take up the role of balancing the frequently conflicting interests between developed and developing countries.

The Indonesian Government has stated that the theme for G20 in 2022 is “Recover Together, Recover Stronger” and it is apparent that many decision makers and community members in the country are enthusiastic to work with delegates and representatives who will come to Bali. Unfortunately, the diplomatic task for urging all the G20 country members to work together is facing an uphill battle when the world is shocked by the war between Russia and Ukraine, which resulted in deepening rift among the countries and a dire consequence on food security and energy supply for Europe and other parts of the world. Mister Joko Widodo, the Indonesian President, has stated that initial communication with leaders in developed countries had to be followed by a delicate diplomatic communication with the president Vladimir Putin of Russia and President Volodymyr Zelensky of Ukraine to consider ending the war and to ensure that G20 summit would be held as planned and attended by all the G20 head of states (Secretary of State Ministry, 29 April 2022). This book will not discuss how such international political changes would have a consequence to the G20 forum, but it would argue that the agenda for economic recovery and the global challenges are still there.

## **THE CHALLENGE OF FUTURE WORLD: TOWARDS EQUAL AND INCLUSIVE GLOBAL GOVERNANCE**

The Covid-19 pandemic has heavily influenced the global agenda in the last three years, including that of the G20 summit in 2021 when Italy was the president. The four strategic priorities for creating transformative resilience against global pandemic were formulated as: (1) healthy and sustainable recovery, (2) building one health resilience, (3) coordinated and collaborative response, and (4) accessible vaccines, therapeutics and diagnostics (Anonymous, 2021). It is obvious that health issues with a global magnitude like Covid-19 had significantly changed the global leaders' perception on global governance. At the very least, the importance of collaborative response and accessibility of vaccines for all citizens in all countries have been admitted by most leaders although their actual responses to the issues of global health might not follow suit. For the 2022 presidency, the Indonesian Government has expected the so-called "lighthouse deliverables" in which health issues and the need for collaborative efforts remain a concern. The three lighthouse deliverables are formulated as: (1) development of global health resilience systems, (2) harmonization of global health protocol standards, and (3) expansion of global research and manufacture hubs for preventive and mitigation responses (Anonymous, 2021). Again, all these formulae for handling global health issues have called for coordinated policies and collaborative measures beyond the borders of countries.

The general agreements among leaders in the G20 may not imply immediate benefits for the containment of the pandemic. All the aforementioned declarations and communiques would not have a significant impact until they are followed with more technical measures. The G20 initiatives would have a real impact when it was agreed in Riyadh, for example, the deferral of foreign debt repayments among low-income countries, a USD 5 trillion injection of funds for Covid-19 containment efforts, the reduction or removal of import duties and taxes on vaccines, hand sanitizers, and medical equipment. Therefore, it is important to ensure that, as a loose club of countries, the G20 forum would not end up only with agreements, communiques, declarations, and other formalized results. Skeptical analyst would say that, as G20 does not rest on a constitutional treaty and its procedures are not written, its governance often reproduces oligarchic tendencies and is heavily dependent on evolutionary practices



rather than collective enterprise (Cooper and Pouliot, 2015) and, for that reason, it would not imply substantial changes.

Given the fact that G20 was initiated in after the global financial crisis in late 1990s, in which developed countries realized that exclusive G7 was no longer capable of managing a global crisis, many would argue that G20 is also structurally biased in favor of Western powers. The contention is that even a more inclusive G20 would only start paying close attention to developing world problems when the issues begin to have an impact on the interests of the rich and powerful countries. However, such contention might be too simplistic if one considers the process within the G20 meetings. The G20 gatherings do not only involve head of states, cabinet ministers, and government staffs, but also representatives of non-state actors such as business, labor, think-tanks, youths, and other civil society grouping of the 19 states and the EU. The Indonesian secretariat for G20 forum stated that there are 437 events to be held, comprising 184 meetings and 253 side events, before the Bali summit on November (Susiwijono, 2022). While experts are frequently questioning the effective participation of the “engagement groups”, it is worth noting that G20 is one of the most inclusive fora in the world.

Certainly, it would be an over-statement that the inclusive nature of G20 would also result in effective global decision-making process. In the aftermath of global financial crisis in 2008, there was a strong statement of the national leaders that G20 was the “premier forum for international economic cooperation” ([www.dart.deloitte.com](http://www.dart.deloitte.com)). Having been conducting regular meeting in different countries, however, the G20 has not been able to set up a solid groundwork on how to prevent global financial crisis in the future. In spite of all the hard work that goes into the summit preparation, the actual focus of the gatherings is likely to be determined by any issues happen to be capturing the leaders’ attention along the years. Moreover, it is not clear whether the remedy for global financial crises was because of the systematic approach formulated from the governments’ agreement or simply because the peak of crisis was over and things began to return back to the normal equilibrium. And when the acute phase of the financial crisis was over, developed countries are obviously opted to return back to traditional international organizations such as the IMF and the World Bank, in which they have more prerogatives and controls.

It is fundamental, therefore, to consider what the G20 means for developing countries and for global governance in the future. G20 is definitely far from ideal with regards to memberships, mechanisms, and effective implementation of its agreements. However, although G20 has insofar failed to reach substantial agreements on fundamental agenda such as climate change and energy crisis, it has been able to provide functional communication among leaders and decision-makers during the financial crises. For some experts, G20 is a kind of necessary evil that we must tolerate (Bradlow, 2017) before the establishment of more inclusive and effective global governance. Emerging economies and less developed countries should not aspire for ambitious goals from the G20 forum, but there are rooms for extracting some value for more participatory and inclusive engagements.

The demands and expectations that G20 would take the lead in deepening the global agenda remain exist and members of countries, both from the developed and the emerging economies, remained sufficiently engaged. One would find that the “club nature” of G20 in global governance constitutes its weaknesses in terms of lack of binding rules and organizational fluidity in its operational mechanisms. Yet these unique characteristics can become sources of strength if countries are seeking alternatives for international arrangements. The absence of permanent secretariat and its rotating presidency ensure that no country could dominate the G20 agenda (Berger et al., 2019). The involvement of various engagement groups are also additional values that cannot be found in other formal establishments or international groupings. If the engagement groups can actually extend the formal agreements into more operational and collective actions in respective countries, that would be a significant progress for the more useful and sustainable policy impact.

## **THE TRILOGY OF PERSPECTIVES AND PRAXIS: GLOBAL HEALTH ARCHITECTURE, DIGITAL TRANSFORMATION, AND SUSTAINABLE ENERGY TRANSITION**

The values of collective and inclusive collaboration among countries of both North and South hemisphere have been repeatedly stated in many G20 forum. Today, the world needs such values more than ever. As global pandemic has fundamentally affected nearly all aspects of human life—from health, education, working environment, to international trade—the

gap among the countries' capacity to cope with the crisis has been a real hurdle for recovery. As most countries are beginning to be able to control the contagion, the Indonesian organizing committee for G20 believes that it is the time for international communities to work together in regaining and promoting productivity, enhancing resilience and stability, and reaping a sustainable and inclusive economic growth.

Under the theme of “Recover Together, Recover Stronger”, the Indonesian organising committee for G20 has stated three prioritized issues, namely: global health architecture, digital transformation, and sustainable energy transition. Having been struggling with Covid-19 pandemic for almost three years has taught a hard lesson that the quickly spread virus could only be contained if the governments and communities are working together to comply with social distancing measures, to collaborate in developing the vaccines, and to quickly distribute vaccines and medical equipment across the affected countries. The phenomena of digital divide has also taught us that technological gap can be a real fundamental threat to global justice and equal prosperity. The world economy is undergoing major disruption together with multi-faceted challenges of digitalization, leaving no option but adapt with faster pace of changes. And unfortunately resource and capacity of all countries, including those of the G20 members, are not shared evenly. Also, the issue of catastrophic climate change can be addressed only if countries and communities are working together to reduce the use of fossil fuel, coal and other carbon-dioxide emitting energy and replace them with solar, wind, hydro, and other renewable resources. There have been hopes that all these global issues can be addressed in the G20 forum.

The issue of global health architecture is actually ranging from the health industry, global health financing, and drug development and distribution. The unprecedented Covid-19 pandemic revealed just how deep are the structural problems at the international level, which partly explained why there have been waves of uncontrollable contagion in many parts of the world, including that of high income countries (Sarkees et al., 2020). In response to global health system inequality, Indonesia as Chair G20 country in 2022 proposes three priorities to build the global health architecture and governance (Antaranews, 2022). This proposal is based on a shared vision to address challenges and strengthen global health systems and partnerships for global health emergency preparedness and response

capacities (Leaders of G20 and other States, 2021). First, to emphasize the need for a global policy and instrument on health protocols that will ensure safe and standardized cross-border interconnectivity, be it according to one's vaccination status, testing results, or health status in general. Second, to work on genomic materials with a new initiative that includes genomic handling and data sharing. Preparing for the threat to global health in the future necessitates enhancing the genomic diagnostic skills and information platform. Third, to equalize and to expand the global resource for future pandemics and health crises, including the manufacturing center for genome response (i.e. vaccine production) and readiness for the future pandemic. These three elements have covered all the necessary formula for immediate recovery from the global pandemic. However, as we would argue, the root issue of global health architecture might not entirely be addressed by all pragmatic responses.

Given the fact that digitalization is disrupting many aspects of the economy in almost all countries, the second priority issue is related to the digital transformation. At the beginning of its development, the digitalization has disrupted media, radio, and television, which fostered easier access to information from various media, anywhere and anytime for consumers. The second phases of disruption was in retail and travel, including logistics, followed by foods and beverages, finance, and education. Slowly, all economic sectors would be disrupted, including automotive, property, and health services. It is predicted that all sectors and industries will gradually become digitalized because of the immense benefits (World Economic Forum Survey, 2021). Digitalization has the potential to enhance progress and prosperity that is more equitable. This is in part attributable to the flexibility in term of space and time, as long as access, literacy and/or digital talent are assured, especially for developing countries with large population such as Indonesia. Yet digitalization also has the potential to increase inequality unless proper anticipation are put in place. To that end, cooperation among G20 members plays an important role in creating enabling conditions that should make digital transformation foster recover together and stronger from the pandemic, both at the international and domestic level. This especially so considering the fact that some members of the G20 are digital pioneers. Nevertheless, the actual praxis on digital transformation is not only tell us with success stories but also all the sad stories about aggravated gaps

among the rich and the poor, socially divisive digital technology, and other challenges that must be responded invariably by the decision makers. That is why, documented cases from Indonesia as a representative of developing and emerging democracy are particularly relevant.

The third priority issue is energy transition, which conceptually is quite simple: the pathway to transform energy system from unsustainable fossil-dominated fuel to those that are more environment-friendly and more sustainable. It is also the way in implementing crucial mission to prevent or at least to optimally minimize inter-generation-transfer of externalities in developing energy system. Managing various challenges, especially in addressing a framework of energy trilemma (energy security, energy access/affordability and environmental aspect) is the key for success for energy transition. Each aspect has a target to be met. However, these three aspects are often conflicting with one another. The energy transition process is determined by multi variables involving a wide range of stakeholders. The transition is a gradual process as its intensity and speed are heavily dependent on the capability to manage the multi variables within the system. Such variables include source of funding, business and industry readiness, and technical detail on the energy network, both for renewable fuel and electricity. The challenges are unique to each country, even to each region. In Indonesia, for example, the dependence of electricity generating system on coal is a complex challenge. All decision makers understand the need to expedite the phasing out of coal powerplant should be carried out. But the pace for electricity system in absorbing collaborative use of rooftop photovoltaics is something that cannot be predicted. The Indonesian households are facing systemic and technical difficulties for installing photovoltaics for alternative sources of energy.

The transition to a low-carbon system is aimed at mitigating the climate change, a fundamental common goal that goes beyond national priorities as it is ultimately linked to the future of human life in the planet. As the chapters in Part-3 will explain, however, there are so many variables and factors that need to be considered when it comes to the policy implementation. It is necessary to give all international stakeholders a time to adapt to the dynamics, relationships, and various uncertainties of the new energy system (Mundaca in Anonymous, 2018). We all wish that the time for adaptation would not be too long as the actual impact of the climate change has been

experienced in many parts of the world. Cases of transition efforts towards sustainable energy from Indonesia is deemed as important contribution to the G20 forum to ensure that concerted actions among developed and emerging economies can be formulated and implemented accordingly.

## **STRUCTURE OF THE BOOK**

After the preface section, the first part of the book contains four articles that are related to the issue of global health architecture. **Laksono Trisnantoro** explains that Global health architecture (GHA) is vastly expanded over the past few decades. Using industrial lens, the health sector has now become a global industry. In 2015 DFID found that the GHA condition had been crowded and poorly coordinated. Based on the current situation, there is a big expectation to G20 Movement for transforming the current GHA which emphasize more resilience and inclusivity for every country in the world to face the possibility of future pandemic. A stronger commitment to all people being healthy is needed. It is clear that, a new system for channelling resources from developed to developing countries, global public goods technology transfer, and international law reforms in pharmaceutical regulation are needed due to fix the strange and uneven relation between actors in global health architecture.

A similar argument is put forward by **Siswanto Agus Wilopo**. As countries work together to end the pandemic, we must draw on the lessons we have learned to help prepare the world for the next global health emergency by rebuilding global health architecture. A reform of the global financial architecture is needed. Developing countries deserve more and better financial support from the international community that is aligned with their needs. Strong political leadership, commitment, and domestic investments are equally critical. The Covid-19 pandemic has highlighted the importance of coordinated action in fighting global threats like pandemics and other similarly widespread crises by strengthening the global health system and advancing the health care industry.

On the issue of drug industry and development, **Mustofa** and **Dwi Aris Agung Wijayaningsih** write about the fact that discovering and developing a new drug is time-consuming, extraordinarily costly, and high risk, with very little chance of a successful outcome. As they explain about innovations conducted in all stages of drug discovery and development using

advanced biomedical science and technology. These all involve academia, pharmaceutical industry, and the support of government policy. Several strategies to solve the challenges in drug discovery and development were also proposed including the improvement of drug research and development (R & D) resources both in universities and pharmaceutical industry, strengthening translational research from the basic to clinical sciences, development of international collaborations involving all stakeholders, and focussing in development of unmet drugs need and drugs for new emerging diseases. With spirit to recover and rise together after Covid-19 pandemic, G20 countries should lead in implementing these strategies in order to enhance efficiency and productivity in drug discovery and development.

All countries need to increase the financing of health services in all aspects. If all international and domestic financing strategies are focused on the development of UHC (Universal Health Coverage), as argued by Siswanto Agus Wilopo, then most the countries will have better equity in their health services. Policymakers need to be realistic in the planning of programs and strategies which prioritize creating a resilient health system. Three priorities should be considered on this issue: investment in primary healthcare services, adequate funds for health promotion and disease prevention, and strengthen public financial management on health.

The second part contains seven chapters that are related to the issue of Digital Transformation (DT). It starts with a piece from **Sri Adiningsih** on digital economic transformation that has been changing many aspects of human life not only in develop countries but also in emerging economies. Taking the case of Indonesia, she explains that despite the challenges, there are positive factors that point to a robust development of Indonesian digital economy. Such factors include but are not limited to the overwhelming support and acceptable of Indonesians of the digital economy; the country's large population is at the peak of the demographic bonus; the digital savviness of the majority of the population, especially the young generation that is enthusiastic about digitalization; and support provided by government authorities to the development of digitalization. Besides, Indonesian consumers are quick to adopt new technologies and the fact that Indonesian are in digital life leaders compared to citizens of other ASEAN members. Such factors underscore the existence of strong factors to support

digitalization which will pave way for deriving all benefits it has to offer to society and economy.

Further explanation about the impact of digital transformation to the Medium, Small and Micro Enterprises (MSMEs) is presented by **Syaiful Ali**. A critical factor that distinguishes MSMEs' readiness for digital transformation is the extent to which digital technology is ready at the country level. The Network Readiness Index is one of the indexes used to assess the extent to which a country's digital transformation readiness can be used as a parameter of a country's digital transformation readiness. NRI data for the last three years shows the inequality between nations, for example, in the ASEAN region, and between countries in the G20. If this inequality is not addressed, it will cause the economic recovery process due to Covid-19 to be uneven. Countries with an adequate level of readiness for digital transformation will be better at improving their economy than countries with a lower level of readiness for digital transformation.

The necessity of governments to adapt with digital transformation was discussed in the next two chapters. **Wahyudi Kumorotomo** writes about issues on public policy, digital governance and digital public services in Indonesia. Disruptive environment has changed the context for public governance substantially. Unfortunately, many decision makers in developing countries failed to understand how things should be changed due to digital innovation in such disruptive environment. The role of government in using ICT and the new digital environment to provide better services for the society is fundamental in any forms of digital transformation. While explaining the government initiatives for digital governance in Indonesia, the author maintained that the basic issue on digital transformation is whether or not information technology would improve public services in the country. It is expected that the Indonesian experience might be referred to as a lesson for the G20 member countries, of which many are still struggling to formulate the best policy for harnessing the new digital environment in order to provide the best for the society.

**Ahmad Djunaedi** writes about the fact that digital transformation remains emphasizing on the use of information technology instead of understanding that it requires organizational change and business processes. He argues that the central government should develop, among other things: the integration policies digitalization, data integration, and policy



coordination. Local governments need the flexibility to innovate and to formulate the best strategy for transforming into digital governance. It would be fundamental that local governments have adequate leadership and commitment that are crucial for planning, institutional development, human resource development, and change management while encouraging participatory approach for creating digital society and digital culture.

On digital society and digital literacy, **Hermin Indah Wahyuni** argues that inclusiveness towards a digital society requires a comprehensive approach at the upstream and downstream levels. Digital transformation may start with infrastructure development, but strengthening the ecosystem is much more essential. Political ecosystem needs to be strengthened towards a robust national vision so that a solid policy is formed and the business utilization of digital technology can be adequately facilitated. Also, the community ecosystem must be built through a vibrant strengthening of digital literacy. Digital transformation is a broad landscape that has extra dimensions and complex intra-relationships in ecosystems. The world national leaders should work together to unravel the problems, otherwise the digital divide and digital inequality will get deeper and wider.

A specific issue on the impact of digitalization on tourism industry is presented by **Muhammad Baiquni**. The chapter explains digital transformation in global tourism with special focus on recovery and resilience after pandemic Covid-19. The global pandemic has inevitably devastated tourism industry. However, it has also altered tourism industry with new ideas for sustainable tourism development and digital transformation as exemplified by the Go Digital programs. Digital transformation in global tourism may create disruptions and risks. But on the other side it also created new opportunities to work in more inclusive and equitable ways in producing more quality and sustainable tourism. It should be understood that tourism is a complex ecosystem with high diversity of actors and sectors involving national and local governments, several ministries and agencies, small and big companies, communities and private sectors. Each has their roles in playing certain function in such complex ecosystem. The government has pivot point role in conducting the orchestra of sectors and actors while the industry entrepreneurs are trying to innovate and to make actionable breakthroughs in providing alternative tourism services.

The case of digital transformation on education is presented by **Sri Hartati**. She explain that the concept is related to digital learning, academic environment transformation, new learning methods and smart education. In Indonesia, the e-learning prototypes has emerged in early 2000 and continues to grow today. It was then followed by the smart campus movement in 2017. Unfortunately, both of these movements are still emphasizing on the use of information technology instead of the ultimate goal of smart education. Most of decision makers failed to acknowledge that digital transformation requires a change in mindset and educational business processes. It is recommended that decision makers start to consider equal distribution of quality education across the regions, to create robust plans for smart campuses, to improve the change management for smart education, and to generate a digital culture.

Finally, the third part of this volume contains articles on the issue of Sustainable Energy Transition (SET). **Wangi Pandan Sari** explains how energy transition from fossil based fuels to renewable energy resources is central to addressing the threat of climate change. Strategies have been put in place and actions have been implemented to phase out fossil fuels and increase the use of renewable energy resources. However, in this current condition where we face severe global challenges from Covid-19 to the crisis in Ukraine, it is questionable whether the target set in the Paris Agreement can be achieved. The progress of energy transition is far from being on track, pressing the needs even more for countries to accelerate the energy transition agenda. There is an urgency for short-term intervention to address the current energy crisis. Such intervention should also be accompanied by and aligned with resolute mid and long term strategies of the energy transition as to meet the climate change goals. Accelerating energy transition is also vital to address energy trilemma, i.e. finding the balance among the three core dimensions of energy sustainability—energy security, affordability, and environmental sustainability. The writer than explains about the issue with the case of Indonesia.

**Dwi Novitasari, Sarjiya, and Deendarlianto** discuss about Indonesia's energy demand and supply from several sectors, such as the power generation, industry, and transportation sectors, all that is also related to the greenhouse gas (GHG) emissions in the country. Such analysis is expected to give a clear idea about what should be considered by the government, the private companies, and the community at large. The disturbing fact is

that although a country is bestowed with abundance supply of renewable energy, the demand is still on the fossil and mostly polluting sources of energy. It is obviously due to lack of commitment, the tendency to take an easy path of policies, and lack of collection and concerted actions on the parts of the society.

Therefore, it is important to understand how the commitment for renewable sources of energy is realized in the actionable praxis. **Deendarlianto, Samsul Kamal, Tumiran, Sarjiya, and Ekrar Winata** argue that, via the G20 forum, Indonesia has the opportunity to increase the readiness of country members to implement global energy transition through the G20 meeting. As part of its action plan, officially the Indonesian government has committed to achieving the energy transition by formulating a target of 23 percent energy mix by 2025 and committing to achieving Net Zero Emission (NZE) by 2060 or sooner. The availability of renewable energy resources and technological innovation will have an impact on reaching the renewable energy target and achieving Net Zero Emissions (NZE). Therefore, this chapter will use a Geographic Information System (GIS) to examine the availability and accessibility of new and renewable energy resources (hydro, solar, wind, and biomass energy) and the development of environmentally friendly technology for the electrical and household sectors in Indonesia (clean cooking stoves).

**Ardyanto Fitriady** argues that energy transition requires changing the behaviour of actors or agents of the economy including the government, private companies and community elements there are four main economic principles that must be considered: (i) It is driven more by policy than technology, (ii) It disrupts the liberalization of the electricity market, (iii) It is meant to maintain economic growth according to the existing industrial structure, and (iv) Consumer preference for green electricity will change and will lead to changes in current demand and business models. This means that old business model in the electricity sector must change to respond to these changes. Therefore, the success of the energy transition is determined by the incentives received by each economic agent involved, both producers and consumers. Beside price intervention, the government might take regulatory approach in one of three forms: fiscal incentives, carbon tax, and cap-and-trade policy.

The regulatory analysis is elaborated further by **Mailinda Eka Yuniza** and **Irine Handika**. Given the pressing issue of global climate change, all countries are urgently need to enact laws on New and Renewable Energy (NRE). It is recommended that setting a zero emission target must be stated clearly so that it would legally bound. The government of Indonesia has ratified the Paris Agreement through Law 16/2016. Consequently, the next tasks are: (1) To increase the protection of the territories that are most vulnerable to the impacts of climate change; (2) To follow up the national commitment in reducing emissions with actual actions in forest conservation by expediting the use of renewable energy and encouraging the participation of local communities and indigenous peoples; (3) To encourage collective participation of all stake-holders and communities in the development of modalities, procedures, and guidelines for the implementation of the Paris Agreement on climate change; and (4) To expand the access for funding sources, transfer of technology, and capacity building for mitigating the actual impacts of the use of NRE.

To ensure that all the government regulations are implemented effectively, **Derajad Sulisty Widhyharto** and **Maharani Hapsari** discuss about the importance of involving all the social and political stake-holders and the community at large. It is essential for the Ministry of Mineral and Energy Resources to scale up Indonesian progress in using renewable energy resources. By all means, Indonesia remains overly dependent on fossil fuel. Also, efforts are needed to strengthen cultural and institutional basis for the use of NRE beneficiaries. Taking the case from South Kalimantan, it is recommended that regional trade integration is fundamental. This aspect needs to be studied carefully to map the potential of national businesses to upgrade the NRE production chain. As an agenda that also involves contesting democratic political aspirations, the energy transition cannot be monopolized by one particular stakeholder's position and role nor can it be weakened by certain stakeholders. Awareness to open up social and political space for inclusive dialogue is a crucial foundation for Indonesia's sustainable energy transition.

**Alva Edy Tontowi** and **Bertha Maya Sopha** reiterate the notion that renewable energy transition requires collective and concerted efforts from diverse aspects, i.e., technology, economy, socio-culture, institutions, and governance. The chapter provides insights on the Indonesian industry

readiness to support the development of three renewable energies, i.e., solar, wind, and wave energy. It is unfortunate that for Indonesia, and probably for many developing countries, there are still many barriers to intensively use such sources of energy. Domestic industries have not yet been able to produce the required components entirely although the raw materials have been available in the country. For example, the current domestic component level of the PV (photovoltaic) module for solar energy in Indonesia is only 43% and that of the wind energy system is 33%. Hence, decision makers have to understand the issue from the perspective of supply chain in order to develop domestic industrial capability. The industry should be able to process supporting materials at the lowest possible cost so that the use of NRE would become more feasible alternative. Also, the government should provide financial incentives in the forms of the feed-in tariff, investment subsidies or tax breaks to domestic industries. A target of production capacity should be fixed with government regulation so that any progress for the use of NRE can be monitored accordingly.

As energy transition is determined by multi variables involving a wide range of stakeholders, **Rachmawan Budiarto** describes that transition is a gradual process and its intensity and speed are heavily dependent on the capability to manage the multi variables within the system. The capability covers sources of funding, business and industry readiness as well as technical detail on the energy network, both fuel and electricity. These challenges are unique to each country. The writer also talks about how Indonesian dependence on coal for generating electricity is a complex challenge. Any efforts to phase out coal powerplant are related to collaborative networks for using electricity from roof-top photovoltaics. Aside from relatively expensive costs, there are still too many procedures and limitations for people who would like to install photovoltaics. Therefore, the concern includes government regulations, incentives for investment, and public campaigns for the use of New and Renewable Energy. The transition to sustainable energy needs bold commitment, intensive bargaining among stakeholders, and converging interests among various parts of the society so that new configuration of the energy system can be firmly established.

In the Epilogue, the editors provide important notes from the chapters and reflections on what have occurred in terms of global issues, what are the challenges ahead, and what kind of policy options and actions to be

undertaken in the future. Parallel to the three prioritized agendas for the G20, critical reviews on Covid-19 global pandemic, the changing economic activities and lifestyle, and the transition towards sustainable energy will be presented. We would argue that interdependency and partnership among countries are inevitable facts that have to be understood and acknowledged more than ever. Consequently, all the critical global issues—health, poverty, climate change—can only be addressed with collective actions of all individuals in developed as well as developing countries. The collective awareness of the new world order for healthy, smart, and green lifestyle is essential to the future living in the planet. Around 65 percent of the world population and 80 percent of the world economy are represented in G20 forum. If all the G20 leaders come up with agreements that are consistently implemented in their respective countries, such concerted actions would definitely have a substantial positive impact on any of the critical global issues. These are what we mean by collective and concerted actions.

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## TABLE OF CONTENTS

FOREWORD,	RECTOR OF UNIVERSITAS GADJAH MADA ....	v
FOREWORD,	CHAIRPERSON BOARD OF PROFESSORS UNIVERSITAS GADJAH MADA.....	vii
PREFACE	THE INDOONESIAN PERSPECTIVE ON THE ROLE OF G20 COUNTRIES.....	ix
	<b>Wahyudi Kumorotomo and Muhammad Baiquni</b>	
<b>PART-1</b>	<b>GLOBAL HEALTH ARCHITECTURE.....</b>	<b>1</b>
Chapter-1	The Global Architecture of health: Toward Resilience and Inclusivity .....	3
	<b>Laksono Trisnantoro</b>	
Chapter-2	Global Health System and the Advancement of Health Care Industry .....	21
	<b>Siswanto Agus Wilopo</b>	
Chapter-3	Drug Discovery and Development: Problems and Pitfalls.....	41
	<b>Mustofa and Dwi Aris Agung Nugrahaningsih</b>	
Chapter-4	Global Health Financing Architecture and Sustainable Development Goals .....	57
	<b>Siswanto Agus Wilopo</b>	
<b>PART-2</b>	<b>DIGITAL TRANSFORMATION.....</b>	<b>77</b>
Chapter-5	Digital Economic Transformation for Accelerating Inclusive Development in Developing Countries: The Indonesian Case.....	79
	<b>Sri Adiningsih</b>	

Chapter-6	Digital Transformation for Micro-Small-Medium Enterprises (MSMEs): Indonesia Readiness Among ASEAN and G20 Countries .....	101
	<b>Syaiful Ali</b>	
Chapter-7	Understanding Digital Transformation in Public Organizations: Disruptive Environment, Government Policy, and Public Services in Indonesia .....	125
	<b>Wahyudi Kumorotomo</b>	
Chapter-8	Digital Transformation and Local Governance.....	149
	<b>Achmad Djunaedi</b>	
Chapter-9	Digital Literacy and the Issues of Inclusiveness and Equality .....	163
	<b>Hermin Indah Wahyuni</b>	
Chapter-10	Digital Transformation in the Global Tourism: Resilience After Pandemic Covid and Crisis.....	181
	<b>Muhammad Baiquni</b>	
Chapter-11	Digital Transformation in Indonesian Education Sector.....	197
	<b>Sri Hartati</b>	
<b>PART-3</b>	<b>SUSTAINABLE ENERGY TRANSITION.....</b>	<b>221</b>
Chapter-12	Pathways to Energy Transition in Indonesia.....	223
	<b>Wangi Pandan Sari</b>	
Chapter-13	Energy Demand and Supply from a Multisectoral Perspective .....	241
	<b>Dwi Novitasari, Sarjiya, and Deendarlianto</b>	
Chapter-14	Technology and Resources to Accelerate Energy Transition.....	261
	<b>Deendarlianto, Samsul Kamal, Tumiran, Sarjiya, and Ekrar Winata</b>	
Chapter-15	Accelerating Energy Transition from an Economic Perspective .....	289
	<b>Ardyanto Fitriady</b>	

Chapter-16 Regulation Mapping to Support Sustainable Energy Transition..... 303  
**Mailinda Eka Yuniza and Irine Handika**

Chapter-17 Social and Political Aspects of Energy Transition: The Dynamics of Regional-National Stakeholders and Area Constellation..... 329  
**Derajad Sulistyo Widhyharto and Maharani Hapsari**

Chapter-18 Domestic Industry Readiness Supporting Net Zero Emission 2060: A Supply Chain Perspective ..... 347  
**Alva Edy Tontowi and Bertha Maya Sopha**

Chapter-19 Towards Sustainable Energy Transition ..... 367  
**Rachmawan Budiarto**

EPILOGUE THE NEED FOR COLLECTIVE AND CONCERTED ACTIONS..... 391  
**Muhammad Baiquni and Wahyudi Kumorotomo**

ABOUT THE AUTHORS ..... 397



## LIST OF TABLES

Table 6.1	Network Readiness Index Rank 2019–2021 ASEAN Countries .....	114
Table 6.2	Network Readiness Index 2021 Rankings by Pillar—ASEAN Countries .....	114
Table 6.3	Overall Rank NRI 2019–2021 G20 Countries .....	115
Table 6.4	Comparison of Score Values for the 4 Pillar NRI 2019–2021—G20 Countries.....	117
Table 7.1	Policy Multiple-Rationalities on App-Based Transport Services .....	132
Table 8.1	Proposed Transformation of Smart Cities in Indonesia..	157
Table 12.1	Updated Changes from NDC 2016 to NDC 2021 .....	229
Table 12.1	Updated Changes from NDC 2016 to NDC 2021 .....	230
Table 14.1	The Comparison of Potential Calculations and Existing Power Plants in Indonesia .....	264
Table 14.1	The Comparison of Potential Calculations and Existing Power Plants in Indonesia .....	265
Table 14.2	The Details of the Solar Energy Magnitude in Indonesia .....	270
Table 14.2	The Details of the Solar Energy Magnitude in Indonesia .....	271
Table 14.3	The Details of the Wind Energy Magnitude in Indonesia .....	276
Table 14.4	Biomass Potential from Several Sources.....	279
Table 14.4	Biomass Potential from Several Sources.....	280
Table 14.5	Biofuels Potential in Indonesia.....	286
Table 14.6	Ethanol Resources in Indonesia According to the Area and the Production.....	286
Table 17.1	New Renewable Energy Plant Development Plan .....	332
Table 17.2	The Contest of Ideology, Actors, and Processes .....	333

Table 17.3	The Dynamics of Local Stakeholder Interest on Energy Transition in South Kalimantan.....	336
Table 17.4	Social and Political Aspects That Drives and Constrain the Energy Transition in the Regional Constellation.....	340
Table 18.1	Domestic Industry Readiness for Solar Energy Supply Chain .....	355
Table 18.2	Domestic Industry Readiness for Wind Energy Supply Chain .....	358
Table 18.3	Domestic Industry Readiness for Wave Energy Supply Chain .....	359

## LIST OF FIGURES

Figure 1.1	The ideal of government policy on public and private goods .....	12
Figure 1.2	The Process of Developing New Drugs .....	14
Figure 5.1	Economic Growth Projection and Digital Competitiveness in G20 .....	80
Figure 5.2	Disruption and Digital Economy Scope .....	81
Figure 5.3	Digitalization Benefits .....	82
Figure 5.4	<i>South East ASIA Internet Economy GMV (US \$_B) ...</i>	84
Figure 5.5	Countries by Number of <i>Start-ups</i> and Value of <i>Indonesia Internet Economy</i> .....	85
Figure 5.6	Consumer Behavior Transformation Before, During, and After Pandemic .....	87
Figure 5.7	Digital Economic Future Development .....	88
Figure 5.8	Trend Work Landscape .....	89
Figure 5.9	Digital Literacy Indonesia .....	91
Figure 5.10	New Internet Users, <i>Digital Life</i> in ASEAN, Digitalization during Pandemic .....	92
Figure 5.11	Indonesia Digital Skill Value .....	93
Figure 5.12	Digital Training Gap in Asia Pacific .....	94
Figure 6.1	Building Blocks of the Digital Transformation .....	108
Figure 6.2	Overall Score NRI 2019–2021 ASEAN Countries .....	113
Figure 6.3	Overall Score Network Readiness Index 2019–2021 G20 Countries .....	116
Figure 7.1	The Architecture Framework of E-Government .....	136
Figure 7.2	The Institutional Framework of the Electronic Government (SPBE) .....	138
Figure 7.3	The 4.0 Architecture of SPBE .....	139
Figure 7.4	Partnerships in Building Smart Cities .....	142

Figure 8.1	Frameworks for the Dimensions of a Smart City in Europe and Indonesia .....	154
Figure 8.2	Future Vision towards Smart Nation .....	160
Figure 9.1	Four Stages of Access to Digital Technology .....	165
Figure 10.1	Potential Winners and Losers in Pandemic Covid-19 .	185
Figure 10.2	International Tourism, 2000–2021 Real Percentage Change (Local Currencies, Constant Prices).....	186
Figure 10.3	Three Focus of Tourism from Crisis to Transformation .....	188
Figure 11.1	Cloud-based Big Data Enabled Smart Education System .....	217
Figure 12.1	Guiding Framework of World Energy Transition Outlook Theory of Change.....	224
Figure 12.2	Reducing Emissions by 2050 through Six Technological Avenues .....	229
Figure 12.3	BAU Projection and GHG Emission Reduction from the Five Contributing Sectors.....	227
Figure 12.4	Energy Security Model.....	231
Figure 12.5	Assessment of Indonesia Energy Security 2019 .....	234
Figure 12.6	National Energy Mix Target 2025 and 2050 .....	235
Figure 12.7	Development of the National Primary Energy Mix in 2015–2019.....	236
Figure 12.8	Electricity Mix in Indonesia in 2020.....	237
Figure 13.1	Final Energy Consumption Indonesia .....	242
Figure 13.2	Primary Energy Supply in Indonesia.....	242
Figure 13.3	Final Energy Consumption.....	243
Figure 13.4	Kebutuhan Listrik di Indonesia .....	244
Figure 13.5	Final Energy Consumption in the Industrial Sector .....	245
Figure 13.6	Final Energy Consumption in the Transportation Sector.....	247
Figure 13.7	Primary Energy Supply .....	248
Figure 13.8	RE Installed Capacity and Potential.....	251
Figure 13.9	Installed Capacity of Powerplant in Indonesia.....	254
Figure 13.10	Energy Production based on Resources in Indonesia (PLN dan Non-PLN) .....	255
Figure 13.11	Emission Contribution in Each Sector in 2019 .....	256



Figure 14.1	The Map of Hydroenergy Potential in Indonesia .....	263
Figure 14.2	The Distribution of Hydroenergy in Indonesia .....	266
Figure 14.3	The Growth of Hydropower Installation in Indonesia .	267
Figure 14.4	The Map of Global Horizontal Irradiation (GHI) in Indonesia .....	269
Figure 14.5	The Magnitude of Solar Energy in Indonesia .....	270
Figure 14.6	The Growth of Solar Power Installation in Indonesia..	272
Figure 14.7	The Cutting Provincial Boundaries Process as an Input for GIS Analysis based on Administrative Boundaries	274
Figure 14.8	The Map of the Wind Velocity for All Regions of Indonesia .....	274
Figure 14.9	The Magnitude of Wind Energy in Indonesia .....	275
Figure 14.10	The Growth of Wind Power Installation in Indonesia..	277
Figure 14.11	The Map of Biomass Potential in Indonesia .....	278
Figure 14.12	The Distribution of Biomass Potential in Indonesia ....	281
Figure 14.13	The Map of Biomass Power (MW) in Indonesia .....	281
Figure 14.14	The Growth of Biomass Power Installation in Indonesia .....	283
Figure 14.15	The Growth of Clean Fuels and Polluting Fuels for Cooking .....	284
Figure 14.16	Regional Use of Polluting Fuels as The Main Fuel for Cooking .....	285
Figure 14.17	National Trend in Household Cooking Fuel Use 2005– 2010 .....	285
Figure 15.1	Carbon Tax .....	295
Figure 15.2	Cap-and-Trade .....	298
Figure 16.1	National Energy Policy Achievement Target .....	312
Figure 16.2	General Plan of National Energy Achievement Target	313
Figure 18.1	A Framework for Renewable Energy Supply Chain....	350
Figure 18.2	The Photovoltaic Supply Chain.....	352
Figure 18.3	The Wind Energy Supply Chain.....	353
Figure 18.4	The Wave Energy Supply Chain .....	354
Figure 18.5	Spatial Distribution of Domestic Industries for Components of the PV System.....	356
Figure 18.6	Spatial Visualization of Domestic Industry Readiness for Solar Energy Supply Chain .....	357

Figure 18.7 Spatial Visualization of Domestic Industry Readiness  
for Wind and Wave Energy Supply Chain ..... 360

**PART-1**  
**GLOBAL HEALTH ARCHITECTURE**



# CHAPTER-1

## THE GLOBAL ARCHITECTURE OF HEALTH: TOWARD RESILIENCE AND INCLUSIVITY

Laksono Trisnantoro

Global health vastly expanded over the past few decades. The architecture of global health has developed more complex in terms of its structure and challenges, especially in the context of Covid-19 pandemic. Global health architecture (GHA) is defined as “the relationship between the many different actors engaged in global health and the processes through which they work together” by Kickbusch et al. Covid-19 pandemic fuels the debate on how the actors who have different values, interest, and ideology can work together for improving health of global citizen.

Using industrial lens, the health sector has now become a global industry, although there are some regions in the world which are not transformed to industrial ecosystem. Technology development rapidly change the health sector became industry. The health care industry, or medical industry, is a sector within the economic system that provides goods and services to treat patients with curative, preventive, rehabilitative, and palliative care.<sup>1</sup> The health care industry is one of the world’s largest and fastest-growing industries.<sup>2</sup> Consuming over 10 percent of gross domestic product of most developed nations, health care can form an enormous part of a country’s economy. With this kind of development and growth, the role and position of each actor in health care industry should be clear. However, the fact is the other way around.

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1 Health Care Industry, <https://www.definitions.net/definition/health+care+industry>:

2 <https://policyadvice.net/insurance/insights/healthcare-statistics/>

In 2015 DFID mapped the current health architecture and identifying drivers that will influence the future architecture.<sup>3</sup> This report was prepared to inform DFID on the strengths and weaknesses of global health architecture, and of the relevance and responsiveness of the health architecture for the post 2015 agenda. The report finds that the current architecture is crowded and poorly coordinated. The current system fails to provide sufficient justification for an obligation to assist in meeting the health needs of others. Transnational and national actors too often pursue their own interests.

In this condition of global health architecture, Covid-19 struck in 2020 and the pandemic has been more than 2 years. On January 30, 2020, the World Health Organization declared the Public Health Emergency of International Concern. Up until now, there are 576 million cases were reported, and it's still going on (Our World in Data, 2022). There were shortages of pharmaceutical products, the lockdown impact to global pharma industry supply chain which clustered in northern hemisphere, which raised the question on the effectiveness of GHA.

This pandemic raises the question on how a country's resilience: the capacity to recover quickly from the pandemic. Some countries have good resilience, some do not. More over there is a concern on the global situation of equal access or inclusivity to vaccines and drugs in term of availability and production. The facts show that all pharmaceutical manufactures which are ready for the global pandemic locate in the developed countries in the northern hemisphere. Therefore pandemic experiences raised the concern of this un-balanced technology development and manufacturing. In the context of resilience and inclusivity issues of Covid-19 pandemic, this paper analyse the global health architecture through the lens of technological development in pharmaceutical products.

The discussion in this paper starts with the paradox situation of pharmaceutical products in the pandemic. Then an analysis of global pharmaceutical industry will be presented using the complex process of producing the products. The complex situation has been in favour for the existence of private pharmaceutical companies as major actor which dominated the health sectors for decades. Government and pharmaceutical companies have strange and conflicting relationship. There is a conflict

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3 <https://www.socialscienceinaction.org/resources/global-health-architecture-current-and-future/>

of values between humanity principles of health sector with the profit maximizing behaviour of pharmaceutical industry.

Based on the current situation, there is a big expectation to G20 movement for transforming global health architecture which emphasize more resilience and inclusivity for every country in the world to face the possibility of future pandemic. A stronger commitment to all people being healthy is needed. It is clear that reform is needed due to fix the strange and uneven relation between actors in health sector.

## **1.1 PARADOXES IN THE HEALTH SECTOR: THE CASE OF THE PHARMACEUTICAL INDUSTRY IN THE COVID19 PANDEMIC**

This section discusses the pharmaceutical industry which is an important complement to the industry in the health sector. Interestingly, the behavior of the pharmaceutical industry as one of the main health sector actors actually refers to maximizing profits. This behavior is certainly included in the health service sector which is traditionally has humanity values. Why is pharmaceutical product so special?

Based on the nature of pharmaceutical products, some have substitutes, but some do not. For example, for people who need slimming drugs, there are substitute products in the form of fitness equipment to maintain weight. However, many pharmaceutical products in hospitals do not have substitutes and are complementary goods for medical procedures. For example, surgery in the operating room requires narcotic drugs. In this case there is no substitute for narcotic drugs. The absence of substitute goods makes medicines as goods that must be purchased by patients who want to recover from an illness or require certain actions. Cases often arise where there is no substitute medicine or alternative action, so that certain life-saving medicines become very expensive because there is no other choice. Thus, the demand for drugs can be very inelastic. An example of a very large demand for pharmaceutical products occurred during the Covid-19 pandemic.

Covid-19 pandemic is very different, compared to previous one like Ebola virus or Dengue virus. The Covid-19 pandemic is lethal and the mortality rate is high. Covid-19 pandemic resulted in widespread and unprecedented institution of mandated societal lock down. Covid-19 pandemic resulted in widespread and unprecedented institution of mandated

societal lock down.<sup>4</sup> Covid-19 obviously can be called a ‘sudden threat’, as the virus can kill healthy adults and highly spreadable.<sup>5</sup> These resulted in lowering a nation’s productivity. Covid-19 makes many of developing countries faced with high burden in health care and infrastructure. Here, the pharmaceutical industry plays a crucial role. This industry provided new drug, and vaccines for overcoming the pandemic . That is why the demand for new vaccine and drug in Covid-19 is huge. This demand provides big profit for pharma industries across the world.

Kollewe (2022) reported that in 2021, Pfizer, a giant pharma company reached \$37 billion USD in Covid-19 related sales, making it one of the most lucrative products in history.<sup>6</sup> The COVID jab Comirnaty, which the New-York based pharma firm developed with the much smaller German company BioNTech, brought in \$12.5 billion in revenues in the final quarter of 2021, taking the total for the year to \$36.8 billion. Pfizer said it had exceeded its target of manufacturing 3 billion doses of the vaccine last year. The net profit increased nearly \$22 billion last year, up from \$9.1 billion in 2020. Moderna as small pharma company recorded nearly \$18 billion USD in revenue for the company in 2021.<sup>7</sup> It brought \$13 billion in pre-tax profits, \$36 million a day throughout 2021. The profit margin around 70%. AstraZeneca (AstraZeneca PLC, 2022) had total revenue increased by 41% and Core EPS by 32%.<sup>8</sup>

In this case, there is indeed a first impression that the pharmaceutical industry is taking advantage of the opportunity when humans experience misfortune due to Covid-19 and have no choice. This opportunity provides huge profit for the pharmaceutical industry, and ironically the production and the availability of vaccines is still uneven across the globe. According to ourworldindata.org (March 2022) the share of the population fully

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4 Qureshi, A., Saeed, O. and Syed, U. 2021. *Coronavirus Disease: From Origin to Outbreak*. 1st ed. Massachusetts: Academic Press.

5 Almurisi, S., Khalidi, D., Al-Japairai., et al. 2020. *Impact of COVID 19 Pandemic Crisis on the Health System and Pharmaceutical Industry*. 10(2): 2298–2308.

6 Kollewe, J. 2022. "Pfizer Accused of Pandemic Profiteering as Profits Double". [online] Available at: <<https://www.theguardian.com/business/2022/feb/08/pfizer-covid-vaccine-pill-profits-sales>> [Accessed 4 July 2022].

7 Dearden, N. 2022. "Moderna's Profits Show Why Big Pharma Can't Meet Our Health's Needs". [online] Available at: <<https://www.aljazeera.com/opinions/2022/3/16/modernas-profits-show-why-big-pharma-cant-meet-our-health-needs>> [Accessed 4 July 2022]"

8 AstraZeneca PLC. 2022. Full Year and Q4 2021 Results". [online] Available at: <<https://www.astrazeneca.com/content/dam/az/PDF/2021/full-year/Full-year-2021-results-announcement.pdf>> [Accessed 4 July 2022].



vaccinated against Covid-19 is varied across countries.<sup>9</sup> South Korea is 86.7%, China 85.9%, European Union 73.0%, USA 65.4%, Indonesia 56.5%, South Africa 29.5% Africa (as a whole) is only 14.9%. Gonsalves and Yamey (2021) mentioned that rich nations that have plentiful doses of Covid-19 vaccines, the public is feeling optimistic that life will return to normal soon, called “vaccine euphoria”.<sup>10</sup> But, only 0.3% of total doses have gone to low income countries, a grotesque inequity that executive director of UNAIDS calls “vaccine apartheid”. Van De Pas et al. stated that the global Covid-19 vaccine rollout has highlighted inequities in the accessibility of countries to Covid-19 vaccines. Populations in low-and middle-income countries have found it difficult to have access to Covid-19 vaccines. This is actually a paradox in global health landscape. Something is going wrong in the Covid-19 pandemic. The question is why there is a paradox.

## **1.2 PECULIAR NATURE OF PHARMACEUTICAL INDUSTRY**

The paradox can be track back to the values owned by actors in health care industry. In principle, the pharmaceutical industry in the world is a sector that operates like other industries. In this nature, it must be understood that the pharmaceutical industry operates with a profit-maximizing values, starting from manufacturers, distributors to retail pharmacies. It has long been noted that the profit performance of the pharmaceutical industry is very large, greater than the industry average, although it is still lower than the software industry. By nature, the pharmaceutical industry relies on high-tech inventions which is in favor for developed countries. The work pattern for producing drugs with the latest technology in the pharmaceutical industry can be divided into two stages. The first stage is basic research and development in the laboratory and the community. The second stage is after the launch of pharmaceutical products in the community.

The first period is an investment that has a high risk of scientific failure. This makes drug research very expensive and can only be handled by developed countries. The pre-pandemic Covid-19 structure involved significant public funding for basic science research combined with

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9 Our World in Data. 2022. “COVID-19 Data Explorer”. [online] Available at: <<https://ourworldindata.org/explorers/coronavirus-data-explorer>> [Accessed 1 July 2022].

10 Gonsalves G. and Yamey, G. 2021. “The Covid-19 Vaccine Patent Waiver: a Crucial Step towards a “People’s Vaccine”. *BMJ*. 373: 1249.

significant private funding to undertake clinical drug development and to scale-up manufacturing in order to translate new discoveries into a marketable medical product. The infrastructure for research and development in developed countries has been established centuries before Covid-19 pandemic. The mRNA research had been implemented in US decades before Covid-19 pandemic.

It is interesting that the Covid-19 pandemic has changed the distribution of labour in funding pharmaceutical innovation.<sup>11</sup> There has been significant public, private, and philanthropic investment and new models of cooperation between public-private, private-private, and multilateral partnership. Thus, a large proportion of funds have been devoted to clinical drug development and production, until its distribution from many financial resources. However the vaccine production sites are in the northern hemisphere, including China and dominated by big pharmaceutical company. In this phase, the patent ownership had been secured as well.

Meanwhile, the second period also has risks in sales. Interestingly in the second period, the patent law protects the pharmaceutical industry from competitors. This mechanism creates an opportunity for the pharmaceutical industry to make a lot of profit. After discovering a new drug and having a patent, the pharmaceutical company can make maximum tariffs for the new product. Tariffs can be set as high as possible without worrying about competition.

The mechanism for obtaining this benefit is influenced by various characteristics of the pharmaceutical industry that are not found in other industries. One of these characteristics is the presence of Barriers to Entry which will affect drug prices. Barriers to entry into the pharmaceutical industry at least take 2 forms: (1) drug regulation; and (2) patent rights.

The first barrier to entry into the pharmaceutical industry is the very strict regulatory aspect in the pharmaceutical industry. In the United States the main regulator is the Food and Drug Administration (FDA), while in Indonesia it is held by the Food and Drug Administration (BPOM). The drug testing process in the United States (including period 1) is long, it can take up to 15 years and is a very complex process. The pipeline of making pharmaceutical product is long. Pipeline consists of identification and screening of compounds, laboratory analysis, testing in animal, human

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11 La Caze, A. 2022. "Determining the Obligations of the Pharmaceutical Industry during the Pandemic". *Anaesthesia Critical Care & Pain Medicine*. 41(1): 100988.

clinical testing, approval from government and professional association. Successful progression in time allocation will establish a new way of pipeline, a new strategy such as collaboration between pharmaceutical industry, researcher (educational institution), and government. Also, a new regulation for drug development.

During Covid-19 pandemic the use of EUA (Emergency Use of Authorization) by FDA opened the opportunity of pharmaceutical industry making new drugs or using the known drugs although did not meet standards of evidence medicine.<sup>12</sup> There is also EUA for vaccine development. This privilege is only used by pharmaceutical company in the developed countries.

The second inhibiting factor is the patents granted by the government to the pharmaceutical industry which has succeeded in discovering new drugs. Logically, patents are indeed an industry strength to face competitors. In Covid-19 pandemic, there was a debate about the patent waiver vaccine. This debate took place during the Covid-19 pandemic. In July 2022, The World Trade Organization approved a politically important deal to water down intellectual property restrictions for the manufacture of Covid-19 vaccines after an almost two-year effort involving scores of high-level meetings and much political arm twisting.<sup>13</sup> WTO ministers approved a package of agreements that included the vaccine patent waiver, which Director-General Ngozi Okonjo-Iweala previously said was necessary to end the “morally unacceptable” inequity of access to Covid-19 vaccines. The deal delivers a significant blow to vaccine manufacturers such as Pfizer Inc., Moderna Inc. and AstraZeneca Plc, which fought hard to prevent nations from undermining the intellectual-property framework that enabled them to produce multiple viable Covid-19 vaccines in record time—saving countless lives.

There are many sceptical views on this patent-waiver. Rutschman and Barnes-Weise (2021) explained the mechanics of patent waivers and argue that waivers alone are the wrong policy tool in the context of the Covid-19 pandemic.<sup>14</sup> They agree with supporters of the waivers in their ultimate

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12 Sarkees, M., Fitzgerald, M. and Lamberton, C. 2020. “The Pandemic Ripple Effect: Understanding Marketing and Public Policy Opportunities in the Pharmaceutical Industry”. *Journal of Public Policy & Marketing*. 40(1): 103-104.

13 <https://www.bloomberg.com/news/articles/2022-06-17/wto-approves-vaccine-patent-waiver-to-help-combat-covid-pandemic>.

14 Santos Rutschman, A. and Barnes-Weise, J. 2022. “The COVID-19 Vaccine Patent Waiver: The Wrong Tool for the Right Goal”. [online] Available at: <<https://ssrn.com/abstract=3840486>> [Accessed 7 July 2022].

goal—that of scaling up the manufacturing of Covid-19 vaccines, and then distributing them according to more equitable models than the ones adopted thus far. However, they doubt that the particular types of goods at stake here can be easily replicated and produced in substantially larger quantities simply through a waiver of intellectual property rights.

Following the WTO agreement, a key proponent for the IP waiver—Indian Trade Minister Piyush Goyal—publicly acknowledged that “not a single plant to make manufacturing of vaccines will come with this” agreement. India blamed powerful nations for dragging out the negotiations for so long that it finally lost its relevance as pharmaceutical manufacturers were ultimately able to produce an oversupply of vaccines. “What we are getting is completely half-baked and it will not allow us to make any vaccines,” Goyal said in a statement posted on his ministry’s website. “Vaccines have already lost relevance,” he said. “It’s just too late; there is no demand for vaccines anymore.”

### **1.3 THE STRANGE ROLE OF GOVERNMENT IN THE PHARMACEUTICAL INDUSTRY**

The role of government in the pharmaceutical industry is analyzed using the principles of public goods. A pure public good is a good or service that can be consumed simultaneously by everyone and from which no one can be excluded.<sup>15</sup> The first feature of a public good is called non-rivalry. A good is non-rival if consumption of one unit by one person does not decrease available units for consumption by another person. The example is listening music from public radio station. The second feature of a public good is that it is non-excludable. A good is non-excludable if it is impossible, or extremely costly, to prevent someone from benefitting from a good who has not paid for it. An example of this is public park. Government runs the public park using budget from tax revenue. Not everybody pays tax. However public park can be used by people who do not pay tax. The third nature, the existence of positive externalities, namely public services to someone will have an influence on others who do not use it. An example of a positive externality is that providing immunization services to one child will reduce the risk of transmitting the disease to another child.

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15 <https://www.economicdiscussion.net/goods/public-good-and-private-good-difference-economics/26182>

Private goods have the opposite nature. A private good, by contrast, is rival. A good is rival if consumption of one unit by one person does decrease available units for consumption by another person. A private good, by contrast, is also excludable. A good is excludable if it is possible to prevent a person from enjoying the benefits of a good if they have not paid. An example of an excludable good is toll-road. Pharmaceutical product can be in the form of public goods such as Covid-19 vaccine, or private goods such as personalized medicine for aging therapy.

Public and private goods classification is relevant in the procurement process. In Indonesia influenza vaccine as an illustration, in the pre-Covid-19 pandemic was sold as private goods. Influenza vaccines was not included in the vaccine program funded by the central government. During the pandemic: vaccines and medical services according to the law are pure public goods, and must be funded by the government. The government of Indonesia financed most of the health expenses related to the pandemic. This means that Government of Indonesia comply to the Law that during a pandemic all medical service is paid by government as public goods. Since the onset of the pandemic, the central government budget is used to provide support to the health care system, households, and firms. In this situation, Government of Indonesia becomes purchaser of drugs and vaccines which are the product of pharmaceutical industry.

Governments usually fund the pure public goods because there is no market. Government investments in basic scientific research aim to produce pharmaceutical or diagnostic and therapy tool as public goods. This is the argument that government financing for medical research will benefit society. However, the ultimate result is not always according to the expectation. The case of government funding in US tells interesting in-sight history. US government largely has relinquished to universities and the private sector any intellectual property (IP) interest in the technologies that result from its funding in the hope that this will stimulate market activity. The assumptions are clear: innovation, by its very nature, is socially beneficial, and the government's role is to foster innovation through research, translation to the private sector, and a robust patent system.<sup>16</sup> But innovation isn't benefiting everyone, and sometimes it amplifies inequality. Whether the internet or

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16 Parthasarathy S. 2022. "Innovatiob as a Force for Equity". *Issues in Science and Technology*. Winter 2022.

insulin, many people in the United States lack access to crucial innovations. This clear that public goods in pharmaceutical product has problems. The failures of governments that underprovide public goods are amplified when it comes to global public goods. Global institutions—where they exist—often lack the legal authority to enforce regulation and taxation or the institutional capacity to coordinate the needs of all citizens in the world and across generations.<sup>17</sup>

Why it is happened? There is mechanism described in the following diagram. The noble and humanity objective of government fund for public goods investment is given to universities or private pharmaceutical companies. Using the patent law, university or private pharmaceutical company may make the privilege for their own interest. Patent policies and practices give private pharmaceutical company monopoly over inventions and the charge high prices of the products. Moreover patent structure may block the further development by other parties.

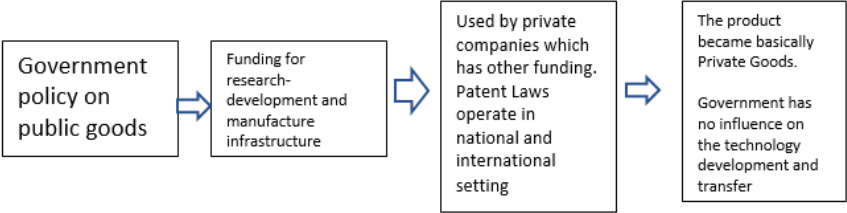


Figure 1.1 The Ideal of Government Policy on Public and Private Goods  
 Source: Adapted from Various Sources

As the result, the patented innovative product owned by private companies. The new product can be sold at very high prices which limit the access. This means the financial support for public goods investment is transformed to produce private goods. For securing the public goods access for the needs, government will purchase the product with a certain profit margin for the private company. As purchaser, in big bulk, government can call the price as low as possible. But the pharmaceutical company will resist for some percentage of profits. In this context Pfizer declared a new deal called Accord which is not purely commercial. Pfizer will provide all its current and future patent-protected medicines and vaccines available in the

17 <https://www.imf.org/en/Publications/fandd/issues/2021/12/Global-Public-Goods-Chin-basics>

U.S. or EU on a not-for-profit basis to 45 lower-income countries. Rwanda, Ghana, Malawi, Senegal, and Uganda are the first five countries to commit to join the Accord.<sup>18</sup>

The question in the case of US: Is there any attempt by US government to influence pharmaceutical industry, except as purchaser? Beyond this pricing agreement, government looked has no influence. One of the most controversial issue is the technology transfer from developed countries pharmaceutical company to manufacture sites in the developing countries. This effort is important for improving equity for vaccines and drug access, and to strengthen resilience across the globe. However the effort is not easy.

In the mid of pandemic (2021) many scientists and campaigners who helped persuade Joe Biden to back an intellectual property waiver for covid vaccines are urging the US president to go further and force vaccine makers to hand over their technology.<sup>19</sup> The technology can be used for manufacture in developing countries. In 2021 the Biden administration would back a move at the World Trade Organization to waive patent rights on covid vaccines, in the hope that it would allow manufacturers in the developing world to make their own vaccine copies. But this effort went slowly, although pharmaceutical company received subsidy from the US federal government. Finally WTO members agreed for patent-waive, but it is too late as mentioned above.

The failure of US federal government to speed up patent waiver is somehow ironic. Health Affairs Reports in 2021 stated that actually it was the government that produced Covid-19 vaccine success (Frank et al., 2021). The success of the US Covid-19 vaccine effort didn't happen on its own; it was enabled by decades of long-term investments by the federal government, followed by additional federal investment in the development of the Covid-19 vaccines themselves. The government invested extensively in every aspect of the basic science, preclinical development, and clinical trials for the vaccines; it executed procurement contracts that were critical to creating successful vaccines and ensuring they were available to the US public.

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18 <https://www.pfizer.com/news/press-release/press-release-detail/pfizer-launches-accord-healthier-world-improve-health>

19 <https://www.ft.com/content/9408223f-0a6c-43b7-9f67-c7e4697005c2>

Noted that in the era of Covid-19 the government’s role was even more central than usual. The government essentially removed the traditional industry risks related to vaccine research and development. In the risk and development there are many risk such as scientific failures, and failures to demonstrate safety and efficacy. In the downstream process there are risk of manufacturing risks and market risks related to low demand. The graphic below shows that government support can be from end-to-end to reduce the risk in the complex pharmaceutical product development.

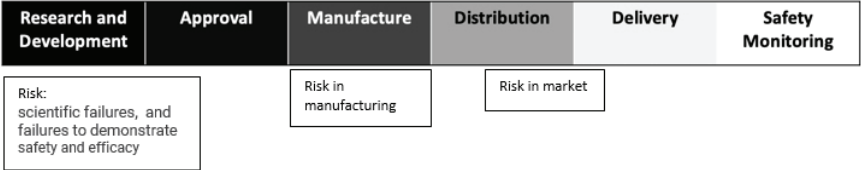


Figure 1.2 The Process of Developing New Drugs  
 Source: Adapted from Various Sources

How much the US federal government pays in the Covid-19 process? Lisa Cornish projected \$39.5 billion in US spending for research and development.<sup>20</sup> These funds had been allocated for HIV vaccines long time ago which became successful Covid-19 vaccine. The investment of basic research for Covid-19 reported by Harris in which between 2000 and 2019, \$15.3 billion was spent on HIV vaccine research. Eighty percent of this was paid for by the federal government, an additional 11 percent by philanthropy. BARDA estimates that the government spent more than \$900 million dollars supporting non-clinical studies and research to accelerate movement of candidate vaccines into clinical trials at companies such as Johnson and Johnson, Sanofi, Merck, and Moderna.<sup>21</sup> Human Testing Risks Related To Safety And Efficacy: Johnson and Johnson, Moderna, Sanofi, and AstraZeneca together are estimated to have received more than \$2.7 billion from the federal government to cover expenses related to human trials. The bulk of money was directed at Phase III trials, which compare new treatments against standard care and where most human test costs are incurred.

20 <https://www.devex.com/news/interactive-who-s-funding-the-covid-19-response-and-what-are-the-priorities-96833>  
 21 <https://www.medicalcountermeasures.gov/app/barดา/coronavirus/COVID19.spx?filter=vaccine>



For supporting manufacturing investment and lowering its risk, the US government issued a \$53 million contract to build manufacturing capacity to Moderna in May 2020. Market Risk had been reduced by US government. Johnson and Johnson had a \$1 billion contract for 100 million doses of their vaccine. Moderna had contracts totaling \$4.95 billion to produce 300 million doses. Pfizer, a firm that claims to not have received funding from the government, had advance purchase contracts totaling \$5.97 billion for 300 million doses.

Brooking Institute support the justification of government support for private Pharmaceutical Corporation. They argue that there is a strong economic case for continued federal investment in Covid-19 vaccines and therapeutics. In brief, the private sector on its own will invest too little because Covid-19 vaccines and therapeutics generate enormous benefits for public health and the macro economy that private firms can only very partially capture. This argument is very interesting that private pharmaceutical corporation cannot sell the public goods such as vaccines without any government subsidy.

Using this pattern, government support the development of innovative products but cannot intervene except at the market stage of pharmaceutical product by procuring in a big bulk. The technology transfer and development by other parties are monopolized by private company which directly or in-directly benefited from government funding. Therefore, the technology innovation became the property of private sector. Government can only bargain for a good price which should give profit for private companies. In the case of Covid-19 vaccines, the profit is extremely high and enjoyed by private pharmaceutical companies.

The relationship between the United States federal government and pharmaceutical companies is interesting. This is an example of the unclear role and position of actors in the American Health Architecture. It is noted that during Covid-19, NIH has program for technology transfer to developing countries<sup>22</sup>. IH has licensed Covid-19 technologies arising from NIH intramural research to the Medicines Patent Pool (MPP) for access through the World Health Organization's (WHO) Covid-19 Technology Access Pool (C-TAP). The technologies include the stabilized spike protein used in currently available Covid-19 vaccines, research tools for vaccine, drug,

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22 <https://www.techtransfer.nih.gov/policy/ctap>

and diagnostic development as well as early-stage vaccine candidates and diagnostics.

Although the federal government has provided a lot of assistance and financial support, it is not easy to influence pharmaceutical companies for transferring technology to developing countries, including in the patent waiver program. This shows that private pharmaceutical companies are very independent institutions with values that are certainly based on profit maximization. This situation shows that there are 2 extreme different values in the public health sector. The first value owned by the state is in the form of humanity values. With this value, the government will provide funds for activities that have great benefits for its people. Of course, this is in the form of financing public goods for domestic or global needs. The second value is the behavior to maximize profits in the pharmaceutical industry.

In the context of these two values, government provides funds to private corporations for research and development, reducing manufacture cost, and securing market. This government's humanity value then goes to private companies, which have profit maximization principles. The result of these two combined values turned out to have a strange impact, where the government has a lower position for having the technology. Government humanity principle is hindered by the profit maximization value owned by private corporations. This happens because the pharmaceutical industry has a patent that gives power not to provide technology to various parties. This is one of the reasons why the pharmaceutical industry which is assisted by government only exists in developed countries because of the availability of research and development fund. The technology then controlled by pharmaceutical companies who patented their inventions and are not willing to transfer technology. This is a paradoxical reality in the health sector.

Beside government who has regulation power, there are also international organizations which have influences. The Medicines Patent Pool (MPP) is a United Nations-backed public health organisation working to increase access to, and facilitate the development of, life-saving medicines for low- and middle-income countries. Through its innovative business model, MPP partners with civil society, governments, international organisations, industry, patient groups, and other stakeholders, to prioritise and license needed medicines and pool intellectual property to encourage generic manufacture and the development of new formulations.

In 2020, The World Health Organization set up a fund called COVAX, under which richer countries fund poorer ones to pay for doses of vaccines. But vaccine doses are in limited supply across the world, and many rich countries secured supplies early on by paying billions of dollars to help with their development. Since the first Covid-19 vaccines were approved late last year, production has increased quickly, but still in richer countries such as the UK and US, and has lagged in poorer ones. Also there are other international organizations such as UNICEF, Global Fund, which have procurement power to influence the industry.

#### **1.4 EXPECTATIONS FOR A NEW GLOBAL HEALTH ARCHITECTURE INITIATED BY G20 MOVEMENT**

As conclusion in the post Covid-19 era, Global Health Architecture is becoming more complex structure. The global actors become more and more numerous. There are many global organizations working in health sector and pharmaceutical industry. The government multilateral organizations such as WHO, World Bank, and WTO. New global organisations such as GAVI, CEPI, and many others. Major philanthropic such as Bill and Melinda Gates, Rockefeller, Wellcome Trust. Developed countries donor agencies such as USAID, DIFD, and also financing agencies for health. There are some pharmaceutical and medical devices industries associations such as IFPMA, DCVMN, and FIND.

However the basic structure of global health architecture is basically just following the path of historical development. Related to the needs for improving new health technology for resilience and inclusivity, global health architecture governance still use the traditional pattern. Research and development funds from developed countries are widely available but is not easy to be channeled to developing countries. As a result, most research funds are used in developed countries and trapped in patent regulations owned by international pharmaceutical companies. Under these conditions, it is impossible for researchers in developing countries to reach the same level as in developed countries.

What will be in the future if this structure is not changed. The concentration of technology developments and manufacturers nests in small number of organizations in developed countries. Noted that the role of private pharmaceutical company in developed countries increases after pandemic.

The economic strength of the pharmaceutical industry is enormous, including receiving tremendous profits during the pandemic and obtaining research funding. For future development, business risk for developing new product is much reduced. This causes pharmaceutical companies to have sustainable power, and can practically and logically supply supplies worldwide quickly. This situation will not provide opportunities for pharmaceutical manufacture development in developing countries.

The patent law will exist regardless of whether the development funds come from public funds (taxes) or private (market) resources. Mastery of technology by using patents that originated long before the pandemic period will continue to be carried out. Patent-waiver agreements continue to be problematic. As a result, the equity and inclusivity principle will be neglected.

From this point, there is big expectation for G20 movement which is concerned with Global Health Architecture. Therefore there is a big hope that G20 forum can change the GHA by nurturing and strengthening pharmaceutical manufacture in the southern hemisphere. There are three working groups in the G20 agenda. One of working group on “Global Health System Resilience” has three main issues: financial resource mobilization, equitable access to medical countermeasures for pandemic prevention, preparedness, and response (PPPR), and the optimization of genomic surveillance and strengthening trusted data sharing mechanisms. On the financial resource mobilization, the working group aims to have Financial Intermediary Fund (FIF) establishment. On the Financial Intermediary Fund (FIF), the objectives are to build and strengthen regional and national PPPR efforts. In June 2022 the working group had organised meeting which discussed equitable access to medical countermeasures for pandemic prevention, preparedness, and response (PPR) through the pursuit of a permanent structure for access to medical countermeasures and essential supplies for future health threats. The budget should be concentrated for supporting the research and development of VTD research and manufacture in less developed countries.

The other Health Working Group, aims to discuss efforts to increase the global capacity for Vaccines, Therapeutics, and Diagnostics (VTDs) manufacturing and research to guarantee regional and global equity. This is important for preventing the negative impact of lockdown.

In this regard, some low-middle income countries in the southern hemisphere (including Argentina, Brazil, India, South Africa, and Indonesia), are willing to create a collaborative ecosystem for VTDs manufacturing and research hubs to strengthen global health resilience. Thus far, this initiative has received positive feedback from various International Organizations, specifically WHO, CEPI, FIND, GAVI, IFPMA, DCVMN, and MPP. Such a collaborative ecosystem, supported by a strong regulatory framework will ease technology transfer. All G20 countries, partner countries and international organizations are invited to this collaborative ecosystem for global public goods VTDs manufacturing and research hubs—to ensure equitable access and development across the globe.

As a closing remark, the G20 movement is trying to change the pre-pandemic global health architecture. It is not easy in the context of the historical developed countries government subsidy to pharmaceutical industry through research and development, patent-law, and the experience of waiving the law. There is a big hope for G20 movement to be successful in changing the structure of global health architecture for more equitable technology development in the world, to ensure resilience and inclusivity by nurturing the pharmaceutical industry in lower and middle income countries.

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## CHAPTER-2

# GLOBAL HEALTH SYSTEM AND THE ADVANCEMENT OF HEALTH CARE INDUSTRY

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### 2.1 INTRODUCTION

An extraordinary event in the last two years challenged the global health system. Covid-19 has exposed the devastating impact of lack of preparedness and funding for health systems, especially in developing countries. The pandemics produce the health system inequities that prevent some countries to achieve the sustainable development goals (SDGs) on time. At the same time, the Covid-19 pandemic has forced governments to rebuild health systems to cope with the problems that arise. Advancing in the health care industry can also take this opportunity that will contribute to a better structure for the global health system. Dual goals to sustain the global health system and advance of health care industry are challenging tasks for the future global communities after the pandemic ended.

According to WHO (2000), the health system:

“is defined as comprising all the organizations, institutions, and resources that are devoted to producing health actions. A health action is defined as any effort, whether in personal health care, public health services, or through intersectoral initiatives, whose primary purpose is to improve health”.

Szlezák et al. (2010) define the global health system as:

“the constellation of actors (individuals and/or organizations) whose primary purpose is to promote, restore or maintain health, and the persistent and connected sets of rules (formal or informal), that prescribe behavioral roles, constrain activity and shape expectations among them. Such actors may operate at the community, national, or global levels, and may include governmental, intergovernmental, private for-profit, and/or not-for-profit entities”.

The global health system has been challenged by the Covid-19 pandemic and brought to light the weakness and inequality of our health system in dealing with public health emergencies. Responding to future pandemics and health care crises should be prioritized by rebuilding global health systems and renewing the global health architecture to build long-term health system resilience. Failure to invest in global health system strengthening (GHSS) risks wasteful past significant gains in global health development and leaves health systems less equipped to respond to future pandemics and health care crises.

To respond to global health system inequality, Indonesia as Chair G20 country in 2022 proposes three priorities to build the global health architecture and governance (Antara, 2022). This proposal is based on a shared vision to address challenges and strengthen global health systems and partnerships for global health emergency preparedness and response capacities (Leaders of G20 and other States, 2021). First, to emphasize the need for a global policy and instrument on health protocols that will guarantee safe and standardized cross-border interconnectivity, be it according to one’s vaccination status, testing results, or health status in general. The second is how to work on genomic materials with a new initiative that includes genomic handling and data sharing. Preparing for the threat to global health in the future necessitates enhancing the genomic diagnostic skills and information platform. The third priority revolves around equalizing and expanding the global resource for future pandemics and health crises, including the manufacturing center for genome response (i.e.: vaccine production) and readiness for the future pandemic.

Rebuild the global health architecture and governance needs strong human resource of health (HRH) as the main pillar of quality health systems (WHO, 2000). Addressing the millions HRH requires investing



in infrastructure, capacity building, and a fair policy of remuneration for paid and unpaid health workers, including voluntary health cadres (The Global Health Summit Scientific Expert Panel, 2021). This task will only be successful if all stakeholders—governments, multilateral organizations, academia as my university, communities and civil society, philanthropists, and the private sector—contribute to the efforts (Barron and Koonin, 2021) Governments in the developing countries alone will not be able to fulfill this goal and they need the G20 countries and other development partners to assist them (McKibbin and Vines, 2020).

In the rebuilding of the global health architecture, the G20 leaders should act urgently in three priority areas: (1) equitable access to the health care system and industry, (2) preparedness for future pandemics, and (3) improving the effectiveness of universal health coverage (UHC). The G20 leaders should mobilize their political will, commit additional financing, take collective action, and show their responses to secure political commitment and action for stronger global health governance and investment in stronger advance of the global health systems (Barron and Koonin, 2021). The key questions are how to resolve these three priorities, especially in a global economy under sluggish growth. This paper discusses our UGM's thinking in resolving these issues which emphasizes equitable access to the country's health system and the advancement of the health care industry.

## **2.2 EQUITABLE ACCESS TO THE HEALTH CARE SYSTEM AND INDUSTRY**

The spotlight on widespread politicization and discrimination over the availability of Covid-19 vaccines has recently been viewed as inequitable access to the global health care system. This has just been realized after the global pandemic Covid-19 strikes almost all countries in the world. However, other inequitable access to the global health system has many faces and is not only related Covid-19 pandemic. These include (1) global health system and health care industry, (2) gap in knowledge and skills of HRH, (3) global policy and regulation for the health system, including global governance of health system, and (4) allocation of the DAH budget. Each of these components needs appraisal with the best evidence-based available.

### **a. Global Health System and Development of Health Care Industry**

Requirements for a well-functioning global health system are having a well-maintained health infrastructure, trained and motivated health care workers, and a reliable supply of medicines and technologies, backed by adequate funding, strong health plans, and evidence-based policies. With the interconnectedness of our globalized world, health systems need to have the capacity to control and address global public health threats coming from any country such as epidemic diseases and other crisis events in the future (Labonté and Ruckert, 2019). Building equitable access to the health system can be approached with a good plan, policy, and coordination across the countries in the world and emphasize harmonization policy and program among the developing countries.

The global health system depends on the advancement of the health care industry. Building the global health system requires the synergy between the health care system and the health care industry. Indeed, the health care industry is the main component of the health care system, such as the provision of vaccines and drugs as well as financing health services (WHO, 2000). The health care industry contains a diverse array of industries, with activities ranging from drug development or research to manufacturing to facilities management. The health care industry includes drug production, medical equipment, managed health care, and health care facilities.

Up to now, many developing countries only become the market of the health care industry by developed countries, including G20 countries. The increasing global population and life expectancy demand more products for the health care industry. The production of the health industry today will not be able to accomplish the global health need when it considered the increasing global population and life expectancy. The G20 countries could help developing countries advance their health care industry to close the global needs gap.

One strategic approach to close global health needs is to build more collaboration in the health care industry between developed and developing countries. The model collaboration in other industry (i.e.: car and other electronic products) have been mushrooming in the last two decades but not in the health care industry. The main issue is not only the capital needed for this collaboration but the gap in knowledge and skill, including human resources relevant to health technology and services. For that reason, G20

leaders should put priority on the sharing technology in the health care industry and developing human capital for developing countries in this field. This is one of the forms the global health architecture needed in the forthcoming years.

### **b. The Gap in Knowledge and Skills of HRH**

The HRH has a vital role in building the resilience of communities and global health systems to respond to pandemics and health crises. The HRH is also critical to achieving health and wider development objectives committed to the SDGs. However, health systems can only be effective with HRH adequacy and improving health service coverage. Realizing the right to the enjoyment of the highest attainable standard of health is also dependent on the availability, accessibility, acceptability, and quality of HRH, the development of HRH is a precondition for developing the global health system and global health industry. Availability of HRH only is not sufficient except when HRH is equitably distributed and accessible by the population. Furthermore, the HRH should have the required competency and be motivated and empowered to deliver quality care that is appropriate and acceptable to the sociocultural expectations of the population. Only when the global health system is adequately supported by HRH, can theoretical coverage translate into effective service coverage (WHO, 2020).

Globally, investment in the HRH is lower than is often claimed, reducing the sustainability of the HRH for the functioning of health systems. Continuous shortages of HRH are caused by the chronic under-budget allocated for the education and training of HRH in some countries. Another reason is caused by “unlink and match” between education strategies and health systems as well as population needs. These are compounded by difficulties in deploying HRH to rural, remote, and underserved areas. Shortages and distribution challenges contribute to the international recruitment of HRH and their global migration from low-resource settings.

These persistent HRH challenges, combined with broader macro-economic trends, require the G20 countries to reappraise the effectiveness of past strategies on development assistance for health (DAH) for developing countries. They should adopt a paradigm shift in how to plan, educate, deploy, and manage the HRH of the recipient country with the full agreement between them. More effective use of existing DAH for the development

of HRH is needed through the adoption of inclusive models of health care systems that encompass promotive, preventive, curative, rehabilitative, and palliative services. Other efforts are by reorienting health systems towards a collaborative primary care approach built on team-based care and by introducing the potential of technological innovation such as e-Health. This is primarily through education and training relevant to developing countries.

### **c. Global Policy and Regulation for Health System**

Health systems are impacted by the processes of globalization, whether by the migration of health workers and patients, the health security risks of global pandemics, and other international health regulations and treaties. The health obligations under human rights treaties and the health care industry are regulated by international health law and regulations, including through trade and investment treaties. National health systems are also influenced by the diffusion of global norms, international DAH, and economic interests (Labonté and Ruckert, 2019). National public health law and public health policy are continued two fundamental tools that assist states in the task of protecting people from health threats, preventing disease, and striving for healthy populations. It is increasingly been recognized that their joint roles are impacting global health outcomes (Allan, 2017).

Global health law is essential in responding to the infectious disease threats of a globalizing world, such as the Covid-19 pandemic where no single country, or border, can prevent the epidemic of the disease and it has proven the essential legal foundations of the global health system (Gostin et al., 2020). As the Covid-19 spread across unprepared nations, national legal responses have demonstrated unable to prevent, detect, and respond to the pandemic. This has challenged the global health system, especially health law as never before.

The International Health Regulations (IHR) 2005 provide a framework of binding legal obligations for pandemic prevention, preparedness, and response (WHO, 2005). However, many countries do not comply with these regulations and there is no effective legal instrument to enforce this regulation (Spagnolo, 2017). There is a need to revise this international law and global collective action that ensures conformity with international regulations (Broberg, 2020). The revised law should be able to promote effective prevention and response to pandemic infectious diseases (Burci,

2020). Duff et al. (2021) propose recommendations to strengthen global public health governance and promote compliance with global health security regulations. Recommendations include greater authority for a global governing body (i.e., WHO's roles), more effective law enforcement mechanisms, an improved ability of the country to respond to pandemics, availability and sustainability funding, investment from multi-sectoral sources, and an objective evaluation system for national core public health capacities (Burci, 2020).

IHR has been the governing policy framework for global health security since enacted in 2007 (Jee, 2020). Declaring public health emergencies of international concern (PHEIC) is a cornerstone of the IHR (Wilder-Smith and Osman, 2020). This establishes a global surveillance and reporting system and sets national minimum mandatory controls to prevent disease and maximum permissible limitations on individual rights, state sovereignty, and other stakeholders' interests (WHO, 2005). Global health law remains crucial to preventing, detecting, and responding to Covid-19 so that WHO produces international guidelines on the implementation of this law (WHO, 2021). This IHR 2005 codified the category of a Public Health Emergency of International Concern (PHEIC) and not an only infectious disease, which includes:

“an extraordinary event which is determined, as provided in these Regulations: (i) to constitute a public health risk to other States through the international spread of disease and (ii) to potentially require a coordinated international response (WHO, 2005)”.

On the IHR 2005 article 4 described:

“WHO shall designate IHR Contact Points, which shall be accessible at all times for communications with National IHR Focal Points. WHO IHR Contact Points shall send urgent communications concerning the implementation of these Regulations under Articles 6 to 12 to the National IHR Focal Point of the States Parties concerned. WHO IHR Contact Points may be designated by WHO at the headquarters or the regional level of the Organization.”

Through National IHR Focal Points, states bear an obligation to notify WHO within 24 hours of all detected events within their territory which may constitute a PHEIC. Based on information received, the WHO Director-General has the authority to determine whether an event constitutes a PHEIC.

If it has been determined that a PHEIC is occurring, the Director-General shall issue temporary recommendations. Such temporary recommendations may be modified or extended as appropriate by the country. This recommendation is given after it has been determined that a public health emergency of international concern has ended, at which time other temporary recommendations may be issued as necessary for preventing or promptly detecting its recurrence. Temporary recommendations may be terminated at any time and shall automatically expire three months after their issuance. They may be modified or extended for additional periods of up to three months. Temporary recommendations may not continue beyond the second World Health Assembly after the determination of the public health emergency of international concern to which they relate (WHO, 2005).

The importance of PHEIC declarations is the ability to rapidly mobilize international coordination, streamline funding and accelerate the advancement of the development of vaccines, therapeutics, and diagnostics under emergency use authorization. The ultimate purpose of such declaration is to catalyze timely evidence-based action, to limit the public health and societal impacts of emerging and re-emerging disease risks while preventing unwarranted travel and trade restrictions (Wilder-Smith and Osman, 2020). Gostin et al. (2020) argued that:

“Global health law has proven unable to mitigate the threat of Covid-19, raising an imperative for international legal reforms to clarify state obligations, facilitate legal accountability, and realize global health security. Such holistic reforms of the global health law will require either the undertaking of fundamental revisions to the IHR framework or the development of a new international legal instrument to structure global health governance.”

To strengthen global governance, it will be necessary to ensure that WHO will be able to confront governments that do not comply with science-based recommendations. Gostin et al. (2020) suggest that it will

require critical reforms of global health law, including revisions to provide authority of WHO for: (1) enhanced surveillance and mandatory reporting which is allowing to use unofficial data sources, including from civil society and academic experts, and the independent collection data by WHO staff as recently guided by WHO (2021); (2) transparency in PHEIC deliberations which is allowing for open and independent emergency committee's (EC) decision-making and shifting from a binary trigger to a tiered system of multiple levels of public health emergency; (3) rapid and public monitoring of state measures with allowing for scrutiny of state decisions that do not comply with WHO guidance; and (4) global funding mechanisms through the development of new or reformed global governance institutions which able to pool international funding and bolster technical support for the development of sustainable national public health systems to prevent, detect, and respond to outbreaks. It is important to establish policymaking across sectors to improve the health of all communities and people (Health in All Policies or HiAP) (Green et al., 2021).

#### **d. Allocation of the G20 DAH Budget**

Indonesia as chair of G20 proposed to prioritize allocate budgets for the rebuilding of health architecture after the Covid-19 pandemic. This requires a new initiative in DAH for developing countries from the G20 which has a budget of about 85% of global gross domestic product which can benefit around two-thirds of the world's population. They can contribute to DAH to close the gap between developed and developing countries to build an equitable global health system (McBride et al., 2019). The G20 countries can become a leading role to play in helping other countries improve health outcomes. More than 70% of the world's elderly population lives in the G20 countries and most of these countries have high proportional mortality from non-communicable diseases (NCDs). Their member countries have already faced many issues associated with an aging society and increased prevalence of NCDs. These can become a lesson learned for other countries in confronting future health problems and not only as impacts of the pandemics.

Considering 78% of the world's top 50 pharmaceutical companies are in the G20 countries so there are ample rooms for G20 countries to pursue collaborative and cooperative approaches (Hanefeld et al., 2020). The

G20 could, for example, fund sharing experiences on dealing with aging and NCDs, ensuring the production of high-quality medicines, the use of standardized health care services, and delivering health information through e-Health. From the perspective of optimizing health outcomes, migration dynamics and their consequences also need budgets allocated by G20 leaders. The convening of high-level health meetings at G20 summits in Bali has the potential to facilitate such endeavors. Discussion on the financing modality of DAH is discussed in the next chapter.

## **2.3 PREPAREDNESS FOR FUTURE PANDEMICS**

The Covid-19 pandemic has had severe impacts on human health worldwide, causing a million deaths, and has revealed weaknesses in global health systems, health care services, information, and health education. It has disrupted peoples' livelihoods, including an increase in food insecurity and malnutrition, hunger, morbidity, and mortality. It is shaken our economies, hampered international travel and trade, and exacerbated existing inequalities and inequities among and within countries, driving increased levels of poverty (Wise, 2021).

Pandemics are rising unemployment, food insecurity, increased violence against women and girls, and constrained access to education as well as health services including sexual and reproductive health. These affect also mental health and well-being because of many problems that arise. The pandemic and its socio-economic consequences have a disproportionately heavy impact on a group of the population, especially on women and girls, older persons, persons with disabilities, young people, children, as well as the poorest and most vulnerable society. These impacts stimulate creative thinking on policy to prepare for a future pandemic of infectious diseases (Atkinson, 2020).

Strong global health systems and HRH are the first lines of defense against pandemics of any infectious diseases while preparedness and response should be core functions. Some countries managed to control their Covid pandemics, because of strong institutions developed partly following their experience epidemic, such as the SARS epidemic in Asian Countries.

A key determinant of successful responses is a combination of strong existing health systems, political leadership at the highest level, and a lesson learned from previous experiences in dealing with pandemics (The Global



Health Summit Scientific Expert Panel, 2021). In contrast, many countries have very weak public health institutions and leadership which causes insufficient and/or delayed response to the pandemic. Many countries also continue to suffer from severe shortages in capacities, including in health care professionals, hospital beds, intensive care units, diagnostics, laboratory material, medicinal products, and personal protective equipment. These sometimes are aggravated by the closure of borders (“lockdown policy”) and the disruption of global supply chains (Kandel et al., 2020).

The global community has a responsibility to ensure health equity is achieved globally. This can only be achieved if country leaders show their commitment and support to WHO and other parties to strengthen for preparedness of future health emergencies. At the Global Health Summit in Rome, G20 leaders reinforced commitments that will work towards equitable and global access to safe, affordable, and effective “Covid-19 vaccines and therapeutics, and diagnostics (VTDs)” (Leaders of G20 and other States, 2021). In line with the WHO, they support the goal to vaccinate at least 40% by the end of 2021 and 70% by mid-2022. They also committed to strengthening local and regional manufacturing capacity, developing regional regulatory capacity, and promoting minimum standards for medical product quality. In addition, they support collaborative works in this effort, especially the Access to Covid-19 Tools Accelerator (ACT-A) and its COVAX Facility (Brigante, 2022).

They will also support the developing countries to build expertise and develop local and regional manufacturing capacities for tools, including by building on COVAX efforts, to develop improved global, regional, and local manufacturing, and handling and distribution capacities. Further, enable increased use of health technologies and the digital transformation of health systems. They will leverage synergies and build on the expertise of relevant organizations and platforms to facilitate data sharing, capacity building, licensing agreements, and voluntary technology and know-how transfers on mutually agreed terms. They will also enhance support for existing preparedness and prevention structures for equitable immunization against vaccine-preventable diseases, and surveillance and health programs for these and other diseases, including HIV/AIDS, tuberculosis, malaria, and others, and non-communicable diseases, as part of integrated service

delivery and ensuring that “no one is left behind” (Leaders of G20 and other States, 2021).

The country’s investments and response measures to address such future pandemics, including Covid-19 should have the greatest impact on the sustainability of the global health threat prevention, preparedness, and response (The Global Health Summit Scientific Expert Panel, 2021). However, Roberts (2021) has shown that the response of national governments to the Covid-19 pandemic has only served to reinforce existing global and domestic health system inequities. Many countries in the developing world have no resources allocated to the Covid-19 pandemics and they vary extensively in terms of their capacity to prevent, detect, and respond to outbreaks. Half of all countries analyzed by Kandel et al. (2020) have weak operational readiness capacities in place, which suggests that an effective response to potential health emergencies could be allowed, including Covid-19.

## **2.4 IMPROVE EFFECTIVENESS IN UNIVERSAL HEALTH COVERAGE**

Universal health coverage (UHC) is first and foremost a political choice. Health is a basic human right, and UHC is critical for achieving that right. It is also a moral imperative to guarantee the right to health for all. UHC is the aspiration that good quality health services should be received by everyone, when and where needed, without incurring financial hardship. This spirit was clearly stated as a target in the United Nations Agenda 2030 for Sustainable Development (United Nations, 2015) and reaffirmed when world leaders endorsed the Political Declaration of the United Nations High-level Meeting on Universal Health Coverage in September 2019 (United Nations, 2019). Beyond health and wellbeing, UHC also contributes to social inclusion, gender equality, poverty eradication, economic growth, and human dignity.

Guaranteeing access to affordable, quality health care and products for everyone is reliant on the provision of primary health care (PHC). Strengthening health systems based on strong primary health care (PHC) is essential to building back better and accelerating progress towards UHC and health security. Effective implementation of PHC-oriented health systems enables greater equity and resilience, with greater potential to deliver high-quality, safe, comprehensive, integrated, accessible, available, and affordable

health care to everyone, everywhere, but most especially the most vulnerable (WHO and World Bank, 2021).

The PHC guarantees routine access to strong essential health services, including early diagnosis and treatment, which ultimately promotes health, prevent disease, and ensure global health security. Under PHC, sexual reproductive health and rights (SRHSR) services must be strengthened, as women and girls have been disproportionately affected by the pandemic. During pandemics or health crises they face new barriers to access to reproductive health services which are fundamental for achieving gender equality. Resource allocations must be increased to make synergies of UHC, PHC, and health security. Particularly attention on women and girls, and the most key and vulnerable populations such as elderly persons, young people, migrants, and refugees (Global Health Summit—Civil Society Consultation, 2021).

G20 countries support strengthening pandemic preparedness and response as a part of the rebuilding of the comprehensive global health system. These efforts include creating a possible international instrument or agreement in the context of the WHO and strengthening the implementation of and compliance with the IHR 2005 (Brigante, 2022). In this context, the roles of multilateral organizations and governments can more effectively integrate into global health systems to maximize the impact of UHC on people's health. They can have a great contribution to accelerating Universal Health Coverage and the achievement of the Sustainable Development Goals (Halpaap et al., 2019).

## **2.5 RECOMMENDATION**

### **a. Strategy to Increase and Equitable Access to the Global Health and Industry**

1. G20 country is recommended to foster all-of-society and a collaborative approach that integrates and articulates health considerations into policymaking across sectors to improve the health of all communities and people (Health in All Policies or HiAP).
2. It is very important to ensure comprehensive health protocols of global standards. G20 countries should harmonize with the available global health standard, such as a standard that encompasses international travel

standards through digital applications acknowledged by cross-country citizens that could facilitate faster socio-economic recovery.

3. G20 leaders should promote a multilateral trading system i.e.: through WTO that is open, resilient, diversified, secure, efficient, and reliable global supply chains across the whole value chain related to health emergencies. This trading scheme is including the raw materials to produce vaccines, and for the manufacturing of and access to medicines, diagnostic, tools, medical equipment, non-pharmaceutical goods, and raw materials to address public health emergencies.
4. G20 countries should propose IHR 2005 revision towards and better support the full implementation and monitoring of and country's compliance with the IHR, and enhanced implementation of the multi-sectoral, evidence-based approach to address risks emerging from the human-animal-environment interface. This should regard and encourage a new global policy and instrument on health protocols that will ensure safe and standardized cross-border interconnectivity.
5. G20 countries should invest in the worldwide HRH with adequate resourcing, training, and staffing of diagnostic public and animal health laboratories, including genomic sequencing capacity, and rapidly and safely share data and samples during emergencies domestically and internationally.
6. G20 leaders should support and build the new multilateral health architecture for preparedness, prevention, detection, and response with an appropriately, sustainably, and predictably funded, including supporting the resilient recovery of the global health system and industry.
7. The G20 must support emergency and longer-term funding through international channels for developing countries with limited resources to respond to Covid-19. Most importantly, G20 leaders should push ahead with further economic and financial measures to combat the sharp contraction in the global economy that is now occurring.

#### **b. Building Preparedness and Respond for Future Pandemics**

1. To prepare for future epidemics, we recommend establishing a national standing multisectoral and multidisciplinary system and governance through strengthening National IHR focal points. This body should have

strong leadership at the highest level, which can be activated instantly during a health crisis to enable the rapid mobilization of surge capacity while preserving the continuity of essential health services.

2. All countries should empower national and regional public health institutions with the legal mandate, technical capacity, and received financial resources for effective response and networking. This includes undertaking massive efforts to boost capacity and sustain a well-supported workforce in areas such as public health, epidemiology, health care professionals, sequencing, data storage and analysis, and crisis management.
3. Countries must strengthen their capacity to prevent, detect, and effectively respond to the pandemic in a very coordinated manner by taking advantage of new development in genomic research in the global scientific community.
4. Developing and/or deploying educational tools and initiatives, including improving response in between crises by: (1) conducting regular active simulation exercises at all levels and across sectors or stakeholders; (2) developing rapid and reliable testing and tracing systems combined with suitable means for isolation and quarantine; (3) improve supply chain systems and ensure sufficient stockpiles for responding to health crises.
5. Coordinate pharmaceutical and non-pharmaceutical measures and emergency response, in the context of an equitable and sustainable recovery, with investment in health, preparedness, response, and policies informed by scientific advice.
6. Intensify the effectiveness of preparedness and response measures by supporting and promoting meaningful and inclusive communication with local communities, civil society, frontline workers, vulnerable groups, women, and other organizations and adopt lessons learned from the Covid-19 pandemic response and previous public health emergencies.
7. Deliver the need for enhanced, streamlined, sustainable, and predictable mechanisms to finance long-term pandemic preparedness, prevention, detection, and response, as well as surge capacity, capable of rapidly mobilizing private and public funds and resources.

**c. Improving Public Health Intervention through Universal Health Coverage**

1. Undertake health promotion and work on the social determinants of health to address other critical health issues such as non-communicable diseases, mental health, and food and nutrition, as part of efforts to enhance overall resilience to future pandemics and health crises.
2. Underline that sustained investments in global health, towards achieving Universal Health Coverage with primary health care at its center, ‘One Health’, and preparedness and resilience, are broad social and macro-economic investments in global public goods and that the cost of inaction is orders of magnitude greater.
3. The focus of global health from G20 countries should be broadened for the potential impact of ill-health not only on the economy and trade, these include:
  - (1) expanding focus to the neglected SDG 3 health targets;
  - (2) placing greater emphasis on upstream determinants of health;
  - (3) greater commitment to equity and “leaving no one behind”;
  - (4) adopting explicit commitments to rights-based approaches, and
  - (5) making commitments that are of higher quality and which include time-bound quantitative targets and clear accountability mechanisms.

As countries work together to end this pandemic, we must draw on the lessons we have learned to help prepare the world for the next global health emergency by rebuilding global health architecture. A reform of the global financial architecture is needed. Developing countries deserve more and better financial support from the international community that is aligned with their needs (Malpass, 2022). Strong political leadership, commitment, and domestic investments are equally critical. The Covid-19 pandemic has highlighted the importance of coordinated action in fighting global threats like pandemics and other similarly widespread crises by strengthening the global health system and advancing the health care industry.

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## CHAPTER-3

# DRUG DISCOVERY AND DEVELOPMENT: PROBLEMS AND PITFALLS

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### 3.1 INTRODUCTION

Since modern medicine's era in the 18th century, drugs have been playing an essential role in health care. They have been used to treat ailments, relieve symptoms, prevent disease development, and support the diagnosis. Success was shown with the discovery and development of some drugs in the 20th century. Penicillin was first discovered in 1928 and is now the most widely used antibiotic in the world. The discovery of penicillin is regarded as one of the most significant breakthroughs in modern medicine (Boyd et al., 2021) . With the development of penicillin, several infectious diseases that were previously severe and often fatal could be treated. Therefore, the morbidity and mortality due to infectious diseases can be reduced. In the 1980s, the introduction of statins in clinic contributed to reductions in cardiovascular disease mortality. Similarly, introducing protease inhibitors as anti-HIV in 1995 transformed HIV/AIDS fatal infection into chronic disease (Rosenblatt, 2013).

Since morphine was invented as a modern drug in 1804, approximately 24,000 prescription and OCT drugs have been introduced in clinics and the markets for various diseases ([https://www.drugs.com/drug\\_information.html](https://www.drugs.com/drug_information.html)). However, the number or the kind of drugs needed is increasing from time to time for some reasons. The prevalence of non-communicable diseases due to the increase in life expectancy and lifestyle changes lead to increased

drug use to treat the diseases. In 2021, International Diabetes Federation (IDF) reported that 537 million people were living with diabetes. This number is predicted to rise to 643 million by 2030 and 783 million by 2045 (IDF, 2019). Furthermore, the number of people living with hypertension doubled from 1990 to 2019, from 648 million in 1990 to 1.278 billion in 2019 (NCD-RisC, 2021). In addition, the global prevalence of dyslipidaemias has increased over the past 30 years. It became the 15th leading risk factor for death in 1990, rising to 11th in 2007 and 8th in 2019 (Pirillo et al., 2021). The high burden of infectious diseases also contributed to the drug needs. The prevalence of HIV/AIDS, tuberculosis, and malaria are still high in developing countries. The global connectivity era has increased the risk of these infectious disease outbreaks worldwide (Baker et al., 2022).

Due to the growing health care demand including drug demand and the emergence of new technologies, the pharmaceutical industry is a promising sector that is growing from time to time. The global pharmaceutical market volume was valued at USD 405.52 billion in 2020. It is estimated to grow at a compound annual growth rate (CAGR) of 11.34% from 2021 to 2028 (Market Analysis Report, 2018–2019). Indonesia is one of the fastest growing pharmaceutical markets in Asia. Indonesia's pharmaceutical market is the largest in the South East Asian Nations (ASEAN) regions, with the market size valued at USD 10.11 billion in 2021 (<https://www.cekindo.com/sectors/pharmaceutical-indonesia>). To strengthen the pharmaceutical industry and decrease the dependency on imported raw materials, the Indonesian Government issued Presidential Directive No. 6 of 2016 on the Acceleration of the Development of the Pharmaceutical and Medical Equipment Industry.

The discovery and development of a new drug are very time consuming, extremely costly and high risk, with very little chance of a successful outcome. It takes over 10–15 years with an average cost of over USD 1.5–2.6 billion for one new drug to be approved for clinical use (Hinkson et al., 2020). It is also complex process through multidiscipline approach involving the basic and clinical scientists who work from bench to bedside. Target identification initiates the screening process of thousands of compounds to obtain several lead compounds or drug candidates for preclinical study. However, there will be only one out of ten drug candidates that is valid to enter clinical studies that would be successful and approved by the national regulatory drug agencies. Meanwhile, the remaining drug candidates are

going failed during the clinical studies (Dowden and Munro, 2019; Takebe et al., 2018). Therefore, the failure rate of drug discovery and development is high.

This review discuss the problems and pitfalls in the discovery and development of a new drug that faced especially by academia, the pharmaceutical industry and the government. Some strategies to improve the success rate of these matters are also recommended.

## **3.2 DISCOVERY AND DEVELOPMENT PROCESS OF A NEW DRUG**

As mentioned, drug discovery and development is a long, costly and high-risk process. Generally, the main goal of the development of a new drug is to respond to a drug demand for treating, preventing and alleviating disease or disease symptoms. The unmet drug need will also boost the drug discovery and development. There are still some areas for which unsatisfied therapeutic needs persistently, although several innovative therapies were recently approved worldwide. For example, a high unmet clinical need was observed in patients with type 2 diabetes mellitus (T2DM), multidrug-resistant infection, acute lymphoblastic leukemia, Alzheimer's disease, etc. (Scavone et al., 2019).

### **a. Drug Discovery and Development Process**

Traditionally drug discovery has been chemical-driven (lead-driven). Natural or synthetic compounds from any source will be screened for their biological activities. Advances in biotechnology drug discovery have led to drug discovery becoming more biological-driven (target-driven). It is started with the identification of the best target for a new drug candidate. A target is a broad term that can be applied to a range of biological entity included proteins, genes and RNA. The target-driven has been the dominant approach in drug discovery over the past three decades. The selection of molecular targets based on a disease to be treated is the dominant paradigm. Researchers work to understand and to unravel the underlying cause of the disease to find molecular targets (Sun et al., 2022). A target is commonly a single molecule such as gene or protein, which is involved in a particular disease. Once a target is identified, validation of the target will be conducted.

The next step is screening of lead compounds and optimization to obtain drug candidates which adequate for preclinical study. Lead compounds can be found in a few ways such as natural sources, de novo, high-throughput screening (HTS), and biotechnology. Among thousands of compounds that screened, only tens will be potential compounds and will be optimized to make them more effective and safer. In step, structure modifications of lead compound are conducted and hundreds of their different derivatives will be synthesized. The derivatives are then tested and analysed through their quantitative structure-activity relationship (QSAR) to obtain candidate drugs with high affinity and specificity to their targets. Drug formulation development and manufacturing are also prepared in laboratory scale production. The preclinical studies are performed both *in vitro* on cells culture and or *in vivo* on animal models which are mainly aimed to characterize the mechanism of action, the toxicity, the dosage or route of administration, and the pharmacokinetic profile of the drug candidates before the clinical study can be conducted in humans. Drug preparation is also scaled up to make the large enough quantities for clinical trials (Scavone et al., 2019; Sun et al., 2022).

Based on the potential results of the preclinical study, some of the drug candidates can be investigated in human during the four main phases of the clinical study. First is phase I, the clinical trial aims to evaluate the safety and tolerability of the drug candidates on healthy volunteers with relatively simple study design. Second is phase II, the clinical trial aims to evaluate efficacy and safety profile on limited number of patients which is the drug candidates indicated without control. Third is phase III, the clinical trial aims to evaluate the efficacy and safety profile of one or two best drug candidates in a larger number of patients compared with the available drug of choice for the disease or placebo by using a randomized and controlled design (randomized controlled trials or RCTs). Once the new drug is authorized for marketing by the National Drug Regulatory Agencies (NDRAs) based on the data demonstrating the positive benefit/risk profile from the phase III of clinical trial, the real world effectiveness and safety of the new drug is conducted through phase IV of clinical trials (post marketing surveillance trials) involving pharmacovigilance. In this last phase, the new drug is observed a rigorous clinical program, in which it is compared with the best available drugs, if they exist (Scavone et al., 2019; Sun et al., 2022).

## **b. Innovation in Drug Discovery and Development**

The cash investment in research and development (R & D) has increased over the last decade, however, the productivity of the pharmaceutical industry has decreased. The investment to bring a new drug to the market has risen to approximately USD 2.6 billion over the last decade, up from USD 1.5 billion in the previous decade (Hinkson et al., 2020). On the other hand, the number of New Molecular Entities (NME) achieving in the market is not increasing. Over the 20 years, the number of Investigational New Drugs (INDs) approved by the NDRA did not increase as anticipated with enhanced quality control level, strict safety assessment and many molecular targets identified (Liu et al., 2014). The ratio of the number of new drugs approved for marketing to active molecules remains approximately 0.01% or one in ten-thousands molecules (Sun et al., 2022). Facing these situations, various innovations on drug discovery and development have applied to increase the R & D efficiency and productivity.

Biomedical science and technology are now rapidly expanding in the 21st century. Advances in biology/biotechnology, bioinformatics and nano technology can have significant impact on drug discovery and development, even revolutionary change. Innovations have been applied in all stages of drug discovery and development by using advances in biomedical science and technology. In the target validation, the disease targets have been confirmed using genetic, genomic, and proteomic studies in cell lines, tissues, preclinical models, and human disease models (Sun et al., 2022). In drug screening, HTS and artificial intelligence (AI) have been often used to select the best lead compounds. HTS using protein-based biochemical assays, cell-based assays, or organism-based assays can improve the efficiency and specificity of the hits. Furthermore, AI and machine learning computational tools optimize the lead compounds through QSAR analysis or molecular docking to obtain the best drug candidates (Sun et al., 2022; Paul et al., 2021).

In preclinical studies, many animal models have been established to mimic human disease conditions. To date, the transgenic animal is used increasingly to investigate molecular mechanisms of disease, evaluate new drug targets, and screen the activity and/or toxicity of new drugs (Lee, 2014). Whereas, AI can be used to predict *in vivo* activity and toxicity as well as for pharmaceutical product development (Paul et al., 2021). In clinical

studies, genetic and genomic biomarkers have been extensively used to select patients for clinical trials to improve drug development's success rate (Sun et al., 2022). Furthermore, AI can assist to select specific patients by using patient-specific genome-exposome profile analysis, which can help in the early prediction of clinical outcome in patients selected (Paul et al., 2021).

Innovations and disruptions on biomedical science and technology have grown steadily over the last decade and it will continue in the future to shorten and streamline the drug discovery and development process. Unfortunately, the real impact on increasing the efficiency and productivity have not been achieved. Several strategies such as a collaboration of academia, the pharmaceutical industry and the government that foster an acceleration the drug discovery and development process have not been helping to increase the efficiency and productivity. Therefore, it is important to identify the problems and challenges in the drug discovery and development steps that needs to be solved.

### **c. Drug Discovery During Pandemic Covid-19**

The Covid-19 pandemic has had a significant impact on almost all aspects of human life mainly economics and health care for over the past three years. Nevertheless, despite its devastating effects, it has also mobilized and united all elements of the drug discovery and development to seek vaccines or drugs to prevent or treat Covid-19. Due to the presence of a global will and need, in less than a year during the Covid-19 pandemic, 36 vaccines have entered in clinical studies and 89 are in preclinical studies (Thorlund et al., 2020). In addition, Accelerating Covid-19 Therapeutic Interventions and Vaccines (ACTIV) programme run by the US National Institute of Health (NIH), has evaluated data on most promising early drug candidates for clinical trials by efficient use of the NIH funds. More than 30 clinical studies of drugs chosen from a list of 800 drug candidates have been conducted during the Covid-19 pandemic (Ledford, 2022; Rani et al., 2021). To date, several vaccines and drugs have been approved under the emergency use of authorization by global regulatory agencies and are being used worldwide. The development process to obtain a new vaccine or drug that usually takes over 10–15 years can be accelerated in several years.

This Covid-19 pandemic gives us a valuable lesson in the acceleration of the discovery and development process of a new drug. The Covid-19



has accelerated the productive and effective collaboration between the researchers from universities/research institutions, the pharmaceutical industry, and the government, therefore the challenges in the drug discovery and development of a new drug can be overcome. The lesson learned from the Covid-19 pandemic can be applied to develop another unmet drug need such as non-communicable diseases, infectious diseases, cancer, and CNS diseases.

### **3.3 PROBLEMS AND PITFALLS IN DRUG DISCOVERY AND DEVELOPMENT**

Discovering and developing a new drug is a very long and complex process involving multidisciplinary experts from academia, the pharmaceutical industry, the government, non-governmental organizations (NGOs), and public-private sector (FIP, 2014; de Vruet and Crommelin, 2017). They should collaborate to produce an ideal drug that is more effective, safe and selective than the available drug of choice. This process is surely challenging because among thousands selected compounds, only one or two that will be successfully developed as a new drug. Many problems and pitfalls must be faced and solved by the researcher, the pharmaceutical industry and the government.

#### **a. Academic Perspectives**

Academia are mainly involved in the early drug discovery process initiated with the identification of the best target, screening of lead compounds and optimization. Furthermore, they are also involved in the preclinical studies to investigate the mechanism of action, the toxicity and the pharmacokinetic profile. This process requires collaboration from highly skilled multidisciplinary research teams. The research funding and time are two major challenges in the early drug discovery in university (Roy, 2019). The early drug discovery is funded primarily by the government. In Indonesia, the academic research funding is allocated by the Ministry Research, Technology and Higher Education. However, the annual research budget from the government is limited and does not allow support for all the drug discovery process, therefore the chances of obtaining grant funding is highly competitive. In 2022, the Indonesian Government through the National Research and Innovation launched Research and Innovation Funding Program including for drug discovery and development.

As a lecturer or professor, academia struggles to balance and prioritize time to fulfil its academic obligations including research, teaching students, guiding laboratory and administrative responsibilities. Therefore, they have limited time to devote to research activities and innovations on drug discovery and development. Their academic productivity is evaluated based on teaching and research productivities including number and quality of published books, research article, impact and research potential (Roy, 2019). Publications of research findings are critical for survival in academia. The publications increase the chances of obtaining highly competitive grant funding and academic career. Therefore, many academia more focus on publishing their research findings rather than discovering and developing of a new drug.

Drug discovery and development is a translational research bridging between basic scientific research into clinical research (from bench to bed) through multidisciplinary approach (Seyhan, 2019). The problem with reproducibility and translatability of the basic scientific research findings to the clinical applications is widely recognized in academic research. Drug discovery research in universities is not integrated and often fragmented in basic and clinical sciences. Investments in laboratory and research facilities to support translational research is far slower than the expected. Therefore, translational centers facilitating the interaction between basic scientists, clinicians and practices are limited.

Not a lot of research facilities in universities are internationally accredited or comply with international standards including good laboratory practice (GLP), good clinical laboratory practice (GCLP), or Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC). The research facilities are mainly devoted to multiple mission including education, research, service, and patient care. Therefore, the research findings from academia are often not fulfilling the regulation requirements.

## **b. Pharmaceutical Industry Perspectives**

Deferentially from academia who involved mainly in the early drug discovery process, pharmaceutical industry mainly involved in the drug development process. Once the promising drug candidates have been successfully performed in preclinical studies, the pharmaceutical industry synthesizes for large-scale production, develops its formulation and conducts

clinical studies (Dowden and Munro, 2019; Takebe et al., 2018; Scavone et al., 2019; Sun et al., 2022). Similar to academia, time and cost are also major challenges in drug development process by the pharmaceutical industry. The process is also challenging intellectually, organizationally, and emotionally (Rosenblatt, 2013).

Although the time, labor, and cash investment is solely focused on following the established drug discovery and development workflow in pharmaceutical industry. The total time required to invent a new drug from screening of lead compounds to full regulatory approval, is approximately need 10–15 years. This long process is a consequence of the collaborative complexity of the research teams of individuals from academia, the pharmaceutical industry, the regulator, the health care providers, and patients. Although advances in basic and clinical sciences, AI, robotics, and automation have been implemented and aiming to help to sped up drug discovery and development and make it more efficient. However, they could not significantly reduce timescales in the drug discovery and development, yet. Among 5,000 compounds that enter preclinical studies, only five, on average, will succeed to tested in clinical studies, and only one of these five receives approval for clinical use (Hinkson et al., 2020; Krajevic et al., 2002).

Developing a new drug is time-consuming, extraordinarily costly, and high risk, with very little chance of a successful outcome. It is estimated that the pharmaceutical industry spends about USD 1–2 billion to develop a new drug (Hinkson et al., 2020; Rosenblatt, 2013). Unlike academic research that not driven by any return on investment, the pharmaceutical industrial research, on the other hand, is a more profit driven focus on drugs affecting large population groups. Over the four decades, annual expenditure for R & D has increased annually, but the return on R & D investment has decreased. In 1980s, the capitalized R & D returned USD 3 per USD 1 invested, 30 years later only USD 0.83 per USD 1 invested (Rosenblatt, 2013). It is not surprising that today the research investment in the pharmaceutical industry tends to decrease due to a decrease in return on investment.

### **c. Government Perspectives**

Most government around the world have the National Drug Regulatory Agencies (NDRAs) that play important role in ensuring the safety and efficacy of the approved drugs. The regulatory affair of a new drug is

involved all stages of drug development and also after drug approval and marketing. The assessment of a new drugs is conducted based on documents submitted by the pharmaceutical industry that include all data from preclinical and clinical studies on safety and efficacy, proposed labelling, and manufacturing details. A team from the NDRA reviews the documents, communication with the pharmaceutical industry occurs throughout the process to address scientific, medical, and procedural issues. Moreover, this assessment is also involved in advisory committees of external scientific experts for advice and opinions to broaden its basis for decision making on a new drug or regulatory issue (Mitchel, 2000; Chiodin et al., 2019; Wileman and Mishra, 2010).

The assessment often prolongs the process for bringing the new drugs on the market. To shorten this lengthy assessment, working closely and cooperatively between academia, the pharmaceutical industry with the NDRA team during drug development is crucial to successful drug development process (Mitchel, 2000). Compliance with laws, regulations, and guidance is concern of NDRA which is not driven by the standards of merit that typically apply to the academia. On the other hand, academia sometimes communicates with NDRA as though they are the experts and believe less oversight is needed (Chiodin et al., 2019). Difference of opinion between academia, the pharmaceutical industry with NDRA is a common thing during working together. It can be a potential reason for delays in the approval process of the new drugs. Therefore, appropriate informal discussions through e-mail and telephone are encouraged.

### **3.4 RECOMMENDATIONS FOR THE G20 TO IMPROVE IN DRUG DISCOVERY AND DEVELOPMENT PROCESS**

The Indonesian G20 Presidency carries the spirit of recover together with the theme “Recover Together, Recover Stronger.” Three priority topics become the focus and will be achieved that is (1) strengthening of global health architecture; (2) digital transformation; and (3) energy transition. The increase of global health resilience is one priority to strengthen of global health architecture. Available of effective and safe drugs with easily access is still a challenge in strengthening of global health architecture. There are many unmet drugs need including the drugs for NCDs, microbial resistance, and new emerging diseases.

The Group of Twenty (G20) countries collectively occupy around 54% of the land mass worldwide and comprise 64% of the world's population, 86% of the world's economic output, and 92% of global R & D investment. The G20 has been already facing many issues associated with health including increased elderly people populations, increased prevalence of NCDs, and antimicrobial resistance (AMRs). Recently, 71% world's elderly population lives in the G20 countries and most of these countries have a high proportional mortality from NCDs of more than 70%. Moreover, AMR has become a health issue globally including in the G20 members (Akhasi et al., 2019). With these characteristics, the G20 has significant influence health issues globally including the problems on drug discovery and development process. The G20 countries can important role in developing the unmet drugs need. Among the world's top 50 pharmaceutical companies, 78% are located in G20 countries such as the USA, Japan, the UK, and Germany (Akhasi et al., 2019). This further reinforces the role of the G20 in the drug development more efficient and effective.

Several strategies to enhance the efficiency and productivity in drug discovery and development have been exploited, proposed and applied to varied extent both in academic and pharmaceutical R & D. Despite the increased cash investments in research facilities and application of advances in technology and science conducted, these efforts have not largely been fruitful. In the following sections, several recommendations to improve in drug discovery and development process are proposed to the G20 counties. They include improvement in drug R & D resources, strengthen of translational research, development of international collaborations and focussing in unmet drugs need and drugs for new emerging diseases.

#### **a. Improvement in Drug R & D Resources**

The productivity of any research depends on many factors including research talents and research facilities. Academic and pharmaceutical industrial researchers must possess not only a wide range expertise in basic medical and clinical sciences but also business and management skills in drug and development process. The lack of these skills is a major barrier in drug development for academic and pharmaceutical industrial scientists. A proper continuing education and training at interfaces among disciplines should be empowered. Furthermore, research facilities must be supported

by GLP or GCLP compliant, so the data generated in these research facilities are presentable to NDRA (Moridani and Harirforoosh, 2014). Universities and the pharmaceutical industry need to create funding making their R & D facilities GLP and GCP compliant.

#### **b. Strengthen of Translational Research**

Drug discovery and development is a complex process through a multidiscipline approach involving the basic to clinical scientists. The crisis involving translating basic scientific findings into clinical settings is widely recognized in academia and the pharmaceutical industry. Many researches in drug discovery in academia are most often fragmented that organized around principal investigators (Villoutreix, 2021). Strengthen of multidisciplinary collaboration between basic medical scientist, clinical scientists, practices and regulators through establishment of translational centers is recommended. It will synchronize efforts and actions in the context of the drug discovery and development will be performed. Therefore, the gap between basic medical sciences finding and their incorporation into clinical application can be solved.

#### **c. Development of International Collaborations**

A lesson learned from Covid-19 pandemic, drug approval can be accelerated in the presence of a global will and collaboration. By going through the productive and effective international collaboration between researchers from universities/research institutions, the pharmaceutical industry, the government, and the funding agencies, the challenges in drug discovery and development can be broken down to cost, risk and pace. Through data sharing, during 1–2 years of Covid-19 pandemic, several vaccines and drugs have been approved under emergency use authorization and have become widely available in around the world. The international collaboration models during Covid-19 pandemic can be adopted and developed toward a better system in drug discovery and development for the future.

#### **d. Focussing in Unmet Drugs Need and Drugs for New Emerging Diseases**

The need of medicine is as ancient as humanity. Although thousands prescription and OCT drugs have been available in clinics for the prevent

or treatment of various diseases. However, there are still diseases for which unmet therapeutic need persist such as DM, multidrug-resistant infectious diseases, cancer, Alzheimer's diseases, haemophilia, etc. (Rani et al., 2021; Scavone et al., 2019). The global burden of some these diseases tends to increase, therefore, the available of new drugs are needed. The new drugs are also needed for new emerging diseases such Covid-19. The Covid-19 is only the latest even of emerging pandemic diseases. Emerging pandemics already occurred and others will occur in the future. Focussing development of new drugs to respond to unmet therapeutic need and new emerging diseases should be prioritized.

Developing a new drug is time-consuming, extraordinarily costly, and high risk. Despite the increased cash investments and the advances in technology and science that have been applied, the overall success rate of drug discovery and development remains low. Several problems and challenges seem to be solved by academia, the pharmaceutical industry, and the government who involved in drug discovery and development help to shorten the process and increase the success rate. A lesson learned from the Covid-19 pandemic, drug development must be accelerated. Improvement of research facilities GLP and GCP compliant both in universities and pharmaceutical industry, strengthen translational research from the basic to clinical sciences, developing an international collaborations involving all stakeholders, and focussing in unmet drugs need and drugs for new emerging diseases are recommended to enhance success rate of drug discovery and development.

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## CHAPTER-4

# GLOBAL HEALTH FINANCING ARCHITECTURE AND SUSTAINABLE DEVELOPMENT GOALS

Siswanto Agus Wilopo

### 4.1 INTRODUCTION

At the Global Health Summit on May 21, 2021, in Rome, the Group of Twenty (G20) country leaders issued a joint declaration aimed at coordinating worldwide efforts against the Covid-19 pandemic. They met to share lessons learned from the Covid-19 pandemic and the path ahead for preparedness and resilience to incoming pandemics and health crises. They affirmed their support for efforts to boost and diversify global vaccine-manufacturing capacity, and strengthen supply chains for the materials needed to produce vaccines, including the vaccine technology transfer launched by the WHO (Leaders of G20 and other States, 2021). The declarations also include the statement:

“the importance of ensuring the continuity of health services beyond Covid-19 and strengthening national health systems and primary health care services, in light of the repercussions of the pandemic on mental health and well-being, due to isolation, unemployment, food insecurity, increased violence against women and girls and constrained access to education as well as health services, including sexual and reproductive health, paying special attention to women and girls and the needs of the most vulnerable”. ([https://global-health-summit.europa.eu/rome-declaration\\_en](https://global-health-summit.europa.eu/rome-declaration_en))

The Rome Declaration comprises 16 mutually supporting principles that reconfirm their commitment to global solidarity, equity, and multilateral cooperation and promote sustained financing for global health under a new global health architecture. These principles require a new approach to address questions about how ‘development assistance for health’ (DAH) can better prioritize equity, efficiency, and sustainability of the global health system and health care industry (Dieleman et al., 2019).

Indonesia as President of G20 this year leads a discussion on the problems in three areas: (1) to renew global health architecture, (2) energy transition, and (3) digital transformation (Antara, 2022). For the first area, Indonesia recommends that G20 countries build a global health system that can help future generations become more resilient to pandemics by transforming the health infrastructure globally and not only in G20 countries. This recommendation should focus on the financing of the global health system. These include investing in financing strategies to address the structural and social determinants of health, such as investing in healthier societies and incentivizing inter-sectoral action in the face of urgent crises (Downey et al., 2021).

The changing global problem after the Covid-19 pandemic requires new sets of global health architecture. Resolving the current global health challenges is essential to developing stronger health financing systems capable of reaching and sustaining crucial global health goals under SDG-3 (Malpass, 2020). Governing international trade and the intergovernmental rules have become policy concerns for most of the world’s countries after the Covid-29 pandemics, especially for addressing the availability of vaccines to all people. Discussing the involvement of multilateral organizations such as the World Trade Organization (WTO) and the World Health Organization (WHO) will be the forums where countries will agree on the removal of export bans, the removal of property rights, and ensuring the continuous flow of the supply chains for Covid-19 vaccines. These issues are important for building global health equity and resilience to future pandemics in producing vaccines cheaper (Brigante, 2022).

The next Bali G20 Summit, with its focus on global health architecture, is a unique forum to consider the changing DAH context and the most pressing DAH questions to rebuild the global health system and achieve the SDGs. From the perspective of financing to the global health system

and health care industry, the priority areas for discussion during the meeting should include: (1) how to focus DAH for building equitable health improvement, (2) how to deliver DAH to strengthen the global health systems to efficiently use limited resources, and (3) how to promote domestic financing for sustainable health gain as a main goal of rebuilding global health architecture. Previous summits have not fully agreed upon these three areas of financing (Dieleman et al., 2019).

The G20 consists of the 20 most powerful economies —covering 85% of global gross domestic product and around two-thirds of the world’s population. They can contribute to DAH to close the gap between developed and developing countries to build an equitable global health system (McBride et al., 2019).

The commitment of the G20 countries carries significant implications for the direction of economic and global health policies to address today’s most pressing challenges which are to recover faster and stronger from the impact of the Covid-19 pandemic. To prioritize the rebuilding of health architecture suggests resolving these questions.

1. What financing system is needed at global, regional, and national levels to ensure effective, multilateral, multi-sectoral cooperation to prevent, prepare for and respond to future pandemics and global health crises?
2. What financing is needed to secure sustainably, ‘countries’ public health capacities and health systems’ preparedness and resilience in the face of future global pandemics and health crises by strengthening the Universal Health Coverage (UHC)?
3. How can the necessary domestic and global resources be mobilized to address the challenges of sustainable health security preparedness and response at global, regional, and country levels?

These questions should provide the best direction on how to finance the global health system for (1) equitable health gains, (2) how to deliver DAH to strengthen health systems, and (3) how to support domestic resource mobilization and transformative partnerships for sustainable impact. These issues are considered in the context of the growing impacts of demographic and epidemiological transitions, globalization, and a global political shift towards increasing the prioritization of national interests (Dieleman et al., 2019).

The Covid-19 pandemic shows the imperative for governments to step up investments in core health systems functions that are fundamental to protecting and promoting health and wellbeing, including common goods for health, such as surveillance and risk communication, and the need to strengthen primary health care (PHC) as the cornerstone of people-centered integrated service delivery. All answers force revising of the global health financing system which is required by a new global health architecture, especially in the roles of multilateral and multi-sectoral institutions that need more coordination and collaboration.

The Group of 20 (G20) leading industrialized nations should plan to set up a financing mechanism to prepare for future pandemics. It aims to lay the foundations to ensure that the world is better equipped for any future pandemics. They can foster international collaboration to promote high-performance health financing in all countries by adopting and navigating a UHC financing resilience and sustainability agenda. This agenda is fully consistent with the G20 mission of protecting economies from shocks and promoting global economic stability and growth, and every country in the world stands to benefit, regardless of income level (Leaders of G20 and other States, 2021).

By enabling all countries to build greater resilience and sustainability in health financing, G20 member countries will grow the circle of effective partners to promote global health security, other global public goods, and inclusive economic growth. This will help reduce the impacts of pandemics, forced displacement, and other negative cross-border spillover effects. Meanwhile, strong, sustainable health financing will help drive both quality and efficiency gains in one of the largest global industries, freeing productive resources that can further contribute to global stability and growth (WHO and World Bank, 2021a).

Given the very broad scope of issues regarding financing for global health architecture and achieving SDGs, the following discussion will be focused on: (1) its effectiveness and efficiencies of financing from the multilateral organization and multi-sectoral cooperation; (2) financing of public health capacities and global health systems; and (3) financial protection for preparedness and response for future pandemics and crises.

## **4.2 ENSURE EFFECTIVE FINANCING FOR MULTILATERAL AND MULTI-SECTORAL COOPERATION**

The development toward the global goals of vaccinating at least 40 percent of the population in all countries by the end of 2021 and 70 percent by mid-2022, as recommended by the World Health Organization’s global vaccination strategy, G20 countries should take steps to help boost the supply of vaccines and essential medical products in developing countries and remove relevant supply and financing constraints. This can only be done by ensuring effective financing multilateral dan multi-sectoral cooperation.

### **a. Financing to Confront Pandemics**

The Lancet Covid-19 Commissioners: Task Force Chairs and Members and Commission Secretariat (2021) calls for three urgent actions in the Covid-19 response. First, all regions with high rates of new Covid-19 cases should intensify measures for rapid deployment of Covid-19 vaccines and minimize community transmission. Second, governments, especially the G20 countries should urgently and fully fund WHO and the Access to Covid-19 Tools (ACT) Accelerator, including activities related to COVAX. Third, the G20 countries should empower multilateral development banks and the International Monetary Fund (IMF) to increase the scale of debt relief and finance the recovery of the health system. Those three recommendations require strong multilateral cooperation.

This Lancet Commission also recommends:

“The full ‘firepower’ of the multilateral system—including the World Health Organization (WHO), United Nations Environment Program (UNEP), the United Nations Framework Convention on Climate Change (UNFCCC), and the other agencies of the United Nations (UN) system; the IMF, the World Bank, and other multilateral development banks; and other regional bodies—should be directed towards the multiple COVID-related crises”.

These organizations should receive the financial resources and political support from their member states for this call.

## **b. Roles International Financial Institutions and Development Partners**

In a very short time, the IMF should be given authority by its shareholders to provide substantial additional financial support to countries members as they tackle the health emergency and seek to recover their economies stronger and faster. Using the existing regulation, IMF shareholders might consider general Special Drawing Rights (SDR) allocation funds. Up to now, the IMF has provided financial assistance and debt service relief to member countries facing the economic impact of the Covid-19 pandemic. Assistance approved by the IMF's Executive Board in late March 2020 (under its various lending facilities and debt service relief financed by the Catastrophe Containment and Relief Trust or CCRT) is already about \$250 billion.

International financial institutions and multilateral development banks should be empowered to expand their development financing, with the loan to meet the urgent needs of their members for recovering their health system. While safe vaccines are being rolled out, the global response must be collaborative to ensure low-and middle-income countries aren't left behind. As global cooperation is essential to ensure global vaccination and other efforts, the G20 countries should be more active in participating in COVAX. It is vital in the fight to ensure everyone around the world can access lifesaving Covid-19 vaccines. It believes that success on all three priorities (containment of transmission, rapid vaccination, and emergency finance) will require improved global multilateral cooperation. To date, there have been important positive signs of multilateral collaborations, for example, the initiation of the COVAX facility, the IMF's emergency financing, and commitment from the Leaders' Declaration of the G20 previous summit. However, financial commitments are still lower in comparison with needs.

## **c. Policy and Financial Support to UN system**

G20 leaders should call on all countries and national political leaders to offer their strong policy and financial support to the effective work of the UN system in dealing with the Covid-19 pandemics. So far, the UN System, especially the WHO has demonstrated the indispensable framework for global cooperation and vital support for countries and populations in need throughout the pandemic. The UN system has helped with economic and social fallout due to pandemics and provides the means to deal with



the crisis in a coherent, cross-border, and cross-sectoral way. Only a strong and properly resourced UN system can convene governments, experts, civil society, and the private sector for a “whole of society” approach to containing Covid-19.

**d. Bilateral Assistance from the High-Income Countries to Reduce Cost of Vaccines**

Direct bilateral assistance from the high-income countries (HICs) has been limited, and some donor countries are cutting back on their official development assistance (ODA) amid the crisis due to the pandemic. It is expected that with more financial assistance in hand, COVAX could incentivize expanded production and delivery of vaccine doses for the developing countries and assure COVAX’s availability anywhere. Financing COVAX’s assistance would benefit not only the developing countries but all global economies.

To increase availability, vaccine manufacturers should be promoted to produce low-cost vaccines at a scale by promoting bilateral collaboration. For example, makes use of needed waivers on intellectual property as permitted for public health emergencies among two countries or more under WTO supervision and rules. Another strategy to reduce the cost of vaccine production is manufacturing vaccines in developing countries as part of the multilateral collaboration. Considering relatively lower production costs of vaccines in the developing countries, due to a lower salary for the human resources and waivers on intellectual property the price of vaccines can be reduced significantly. This initiative needs support from the G20 leaders.

**e. Financing Multi-Sectoral Activities**

Within the country, the financing of a multi-sectoral approach (MSA) to combat pandemics should be given priority since the health sector will not be able to work alone (Corpuz, 2021). MSA refers to the ‘deliberate collaboration among various stakeholder groups (e.g., government, academia, civil society, and private sector) and sectors (e.g., health, social, environment, and economy) to jointly achieve a policy outcome’ (Salunke and Lal, 2017). By financing multiple sectors, governments can leverage knowledge, expertise, reach and resources, benefiting from their combined and varied strengths as they work toward the shared goal of building public trust in vaccines.

MSA helps in formulating the common objectives, pooling the resources, and addressing identified health issues in a focused way. Furthermore, since it involves multiple sectors, it creates participatory and inclusiveness approaches. The common objectives and coordination among all the sectors help in strengthening holistic program planning and implementation. As Salunke and Lal (2017) stated the advantages of MSA are: “the optimization of usage of resources by avoiding duplication of inputs and activities which tremendously improves program effectiveness and efficiency”. As result, these lead to avoidance of wastages of resources and improvement in the quality of services, and ultimately will the optimization of outputs of MSA.

### **4.3 FINANCING PUBLIC HEALTH CAPACITIES AND GLOBAL HEALTH SYSTEMS**

One of the cores of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals is “leaving no one behind” (United Nations, 2015). However, despite scientific progress and great medical advances over the past century, one billion people globally still lack access to basic health care services. We need a new model to improve access to basic health services that can bridge the health care delivery gap, address the global health equity, and create social resilience for future pandemics and health crises (Myint et al., 2019). One strategy to respond to this problem is increasing the financing of public health institutions under a better global health system.

The Covid-19 pandemic underscores the crucial importance of UHC as SDG target 3.8 and the need for strong primary health care and community participation for high-quality health services. Resilient health systems that are linked with social care systems offer substantial economic and social benefits by promoting healthier and more productive populations (WHO and World Bank, 2021b). The G20 Summit should highlight key questions for G20 leaders to address the future of DAH for global health recovery faster and stronger to meet the target of UHC as SDG target 3.8 (Dieleman et al., 2019).

#### **a. Coping with Increased the Demand for Health Care Services**

Covid-19 has greatly increased the demand for health care services, both for those suffering from Covid-19 as well as for other conditions

(World Bank, 2022). Within all countries, there are large numbers of people struggling with the aftermath of infections and deaths in the family. For example, the pandemic has impacted several facets of mental health and psychological well-being (Javed et al., 2020). Data from Southeast Asia indicate that levels of depression, anxiety, self-harming behavior, and suicidal ideation appear to have increased since before the Covid-19 pandemic (Pappa et al., 2022). We note the urgent need to scale up access to health services, including mental health under PHC, which have long been under-resourced and difficult to access.

Facing more complex challenges after pandemics, the country needs to increase the financing of health services in all aspects. However, policymakers need to be realistic in the layout of programs and strategies which prioritize creating a resilient health system. The priority should be focused on the problems related to PHC and implemented using a basic UHC policy. This should impact to reduce the catastrophic budget which is already dominating the budget for UHC at this time. At the same time, personal out-of-pocket spending should be minimized. PHC focuses on promotion and prevention that will reduce catastrophic conditions (World Bank Group, 2019). Finance to improve public health capacities and global health systems required new additional funds from the country and global community, especially to strengthen the health care financing for UHC (World Bank Group, 2019).

Research and development efforts on developing medical technologies, medicines, vaccines, and diagnostics have not reached many populations, in particular those living in developing countries who are most marginalized and in greatest need of health services. These conditions call for innovative approaches to research and development to provide quality, accessible and affordable health care for all people. The innovation in public health models should aim to provide solutions to implementing health care programs to bridge the health care delivery gap, address equity and create social value for health (Halpaap et al., 2019).

The required financing for the investments and implementation of PHC ideally comes from the government and domestic public resources. The degree to which those resources result in an effective PHC-oriented health system depends on the design of public policy and its implementation. DAH flows, including global health initiatives, will continue to contribute to the

advancement of UHC with PHC oriented. However, the contribution needs to be evaluated to improve its effectiveness and efficiencies. This requires a renewed commitment to coordinated responses aligned with the national health policies, strategies, and plans in the country on the UHC (WHO and World Bank, 2021b).

The majority of the developing countries will fail to achieve their targets for UHC unless they take urgent steps to strengthen their health financing (WHO and World Bank, 2021b). From the global health policy perspective, they should examine trends in DAH and its evolution over time, with a particular focus on the member of G20 countries. The financial challenges require a new approach to address how DAH can better prioritize equity, efficiency, and sustainability, particularly through domestic resource use and mobilization, and strategic partnerships to implement UHC (WHO and World Bank, 2021a).

#### **b. Human Resource for Health as Backbone of Quality of PHC Services**

Progression towards the implementation of UHC has been highly variable, both across and within countries (Watahiki and Matsushige, 2020). There has been growing recognition that human resources for health (HRH) are central to improving and promoting health through UHC. HRH-related issues are complex, and components arguably include the competent health workforce equipped to provide quality health services, health education, maldistribution of health workers, and clinical and management competencies. Many different pathways toward the development of a healthy workforce have been created such as short-term training on UHC.

WHO (2020) recommends the global strategy on human resources for health on how to: (1) optimize the health workforce to accelerate progress towards UHC and the SDG; (2) understand and prepare for future needs of health systems, harnessing the rising demand in health labor markets to maximize job creation and economic growth; (3) build the institutional capacity to implement this agenda, and (4) strengthen data on HRH for monitoring and ensuring accountability of implementation of both national strategies and the Global Strategy itself. The strategy recognizes that diversity in the health workforce. It is an opportunity to strengthen collaborative approaches to interprofessional education and practice, social accountability, and closer integration of the health and social services workforces.

These persistent HRH challenges, combined with broader macro-economic trends, require the G20 countries to reappraise the effectiveness of past strategies on DAH for developing HRH in the developing country. They should adopt a paradigm shift in how to plan, educate, deploy, and manage the HRH of the recipient country with the full agreement between them. More effective use of existing DAH for the development of HRH is needed through the adoption of inclusive models of health care systems that encompass promotive, preventive, curative, rehabilitative, and palliative services. Other efforts are by reorienting health systems towards a collaborative primary care approach built on team-based care and by introducing the potential of technological innovation such as e-Health. This is primarily through education and training relevant to the developing country.

#### **4.4 FINANCIAL PROTECTION FOR PREPAREDNESS AND RESPONSE**

A resilient global health system plays a crucial role in pandemic readiness and response. Although WHO has required all state parties to strengthen core capacities to respond to public health emergencies under the International Health Regulations (2005), the actions of most countries to combating coronavirus disease 2019 (Covid-19) have shown that they are not well-prepared (Jee, 2020; WHO, 2021). Wang et al. (2020) have revealed the fact that most countries still do not build resilient health systems in response to public health emergencies.

The strengthening of health system and health security efforts should be pursued in tandem, as part of the same mutually reinforcing approach to developing resilient health systems. A resilient health system should respond effectively to the health needs of the population and ensure the adequacy of government health expenditure and financial protection that most developing countries have not had adequate funds for. For these reasons, financing preparedness and response to pandemics need global collaboration and attention to the design of responses.

##### **a. Different Approaches to Financing PHC and UHC**

Under the concept of “resilience”, health financing must be able to flexibly absorb and rapidly respond to external shocks. Covid-19 pandemics

are a prime example of such shocks, which can strike any country at any time. Pandemics' response requires different approaches to financing because the required funding is so much greater within a short time. The first option to respond is to use the availability of a normal budget and allocations. These are commonly not sufficient in the country. A second option is to create a special fund for emergencies that could be triggered by health emergencies as well as other types of disasters. Some countries have created contingency funds through their constitutional or legal structures, such as Indonesia. A third option is borrowing to respond to pandemics, which is under the mandate of the ministry of finance. Forth option, countries can create insurance for pandemics where they contribute a small amount of money every year in return for access to larger amounts of funding to respond to any future pandemics. Some developing countries, however, are unlikely to be able to raise the funding they need for either preparedness or response purely from domestic funding. Therefore, these options depend on the global community to contribute to building health system resilience for the developing country.

#### **b. G20 Contribution to Financing UHC**

Financial protection is an intrinsic part of universal UHC, and it is one of the health systems' goals. This financial protection for UHC should address sustainable health security preparedness and response for future pandemics and crises. Financial protection can be achieved when: (1) there are no financial barriers to access, and (2) direct payments required to obtain health services are not a source of financial hardship (WHO and World Bank, 2021b). This can be achieved with UHC health-financing principles and adequate financial support that address these two issues. G20 countries can make substantial progress toward global UHC by adapting to their own settings policies derived from widely recognized health-financing principles.

During G20 summit can present a valuable opportunity to reflect on the provision and receipt of development assistance for health (DAH) and demonstrate the role of the G20 in shaping the future of global health financing through UHC (Dieleman et al., 2019). It offers a unique forum to consider the changing DAH context and its pressing questions for global health recovery together and stronger. In this context, G20 countries should

focus on financing the global health system and achieving the SDGs, especially on the UHC.

What actions can countries prioritize as they work to develop high-performance health financing for UHC that captures more of the benefits? G20 countries can propose three approaches, these are: (1) adapt and implement proven principles and policies to address core health financing challenges, (2) broaden the vision of health financing to address both resilience and sustainability through a whole-of-government approach, and by making health financing future-fit, and (3) strengthen health-financing leadership, governance, and organizational capacity (World Bank Group, 2019).

## **4.5 RECOMMENDATION**

G20 on the global health financing architecture can be focused on two actions: global and national actions. These two actions need simultaneously implemented to prepare for future pandemics and health crises as well as to achieve SDGs.

### **4.5.1 Action at Global Level**

At the global level, resource mobilization, financial protection, and effectiveness and efficiencies of DAH are the core issues that need better attention. The G20 can have more contribution in doing these issues than other international organizations.

#### **a. Global Resource Mobilization**

To leverage resource mobilization and financing sustainably, there is a need for a reform of the global financial architecture on resource mobilization. These can include:

1. G20 leaders must deliver the deployment costs of vaccines and other COVID tools. Filling the funding gap for ACT-A should be seen as an important outcome of the pandemic response for the Summit of Global Health in Rome in May 2021.
2. For building global health equity and resilience to future pandemics by producing vaccines cheaper, G20 leaders should agree on the removal of export bans, the removal of property rights, and ensuring the continuous flow of the supply chains for Covid-19 vaccines in coordination with UN system and WTO.

3. DAH allocation should be coordinated among international and multilateral funding agencies (i.e., World Bank and IMF) with bilateral assistance and it can better prioritize equity, efficiency, and sustainability, particularly through domestic resource use and mobilization, and strategic partnerships to implement UHC.
4. DAH should be allocated to strengthen developing countries for research and development efforts on developing medical technologies, medicines, vaccines, and diagnostics as well as manufacturing these products.
5. G20 mobilize resources to support and collaborate with developing countries to diversify global vaccine-manufacturing capacity and other health products (i.e., drugs, diagnostic test, and health technology). For these recommendations, G20 leaders should encourage sharing of knowledge and skills among developed and developing countries' experts for these collaborations.

**b. Financial Protection**

1. Current political attention should be leveraged for long-term funding such as 'a Pandemic Preparedness Fund', which could be implemented by pre-existing organizations with the comparative advantage and existing implementation structures.
2. The IMF, World Bank, and other international financial institutions and multilateral development banks should make a strong consideration of debt relief and/or cancellation for the developing countries, including concessional loans offered to help with vaccine rollout.
3. International financial institutions and multilateral development banks should pay more financial protection to the developing countries by fully funding WHO and ACT Accelerator, including activities related to COVAX.

**c. Effectiveness and Efficiencies of DAH from G20**

1. G20 countries should build a new approach to address how DAH can better prioritize equity, efficiency, and sustainability, particularly through integration with domestic resource use and mobilization, and strategic partnerships to implement a program using DAH.
2. DAH allocation and use should be carefully planned by involving the recipient country to guarantee its' effectiveness and efficiencies for the beneficiary and not only the interest of funders.



3. On the allocation of DAH from the G20 countries should be linked with corruption prevention, the introduction of effective corporate taxes to prevent illicit financial flows, and avoiding global tax evasion.
4. Transparent monitoring and evaluation of DAH should be conducted routinely to guarantee its' effectiveness and efficiencies for the beneficiary. When there is evidence that DAH has no impact on countries' recipients, they have the right to discontinue the DAH.

#### **4.5.2 Action at Country Level**

All countries should promote tax reforms to increase domestic resource mobilization for health, with an explicit commitment to limit “out of pocket” spending. The following actions at the country level are needed to build financial protection for preparedness and response to future pandemics: (1) improve financial protection by country allocation, (2) increase resources mobilization from domestic resources and external funding, and (3) increase effectiveness, efficiency, and equity of the use of health resources.

##### **a. Improve Financial Protection by Country Allocation**

To improve financial protection for future pandemics and health crises, the country can take actions to include:

1. To draw on funds from prepaid and pooled sources, to ensure that financial protection for a set of guaranteed services is universally available with subsidies for poor people who cannot afford to contribute to health spending.
2. Aiming toward zero or nominal out-of-pocket payments along with strong protection mechanisms for those who can least afford to pay.
3. To guarantee packages are large and diverse enough to be able to cover high health expenditures by some beneficiaries.

##### **b. Increase Resource Mobilization from Domestic Sources and External Funding**

Over time, sustainable funding for health will need to come largely from domestic sources. The focus on domestic sources is underscored by the principle of national ownership to attain sustainable financing for UHC. Countries can increase domestic resource mobilization and external funding for health in several ways:

1. Increase overall government revenue and the increasing share of GDP that flows to health financing reforms to increase domestic resource mobilization up to 5% GDP for health.
2. Develop a mix of resource-generation instruments that assures stability in funding flows and allows funding to cover a set of health services guarantees. Resources can come from general government revenues and external funding supplemented by obligatory health insurance contributions and reducing the reliance on out-of-pocket payments.
3. Removing ineffective subsidies (e.g., on fossil fuel) that disproportionately benefit the non-poor also allows spending on health or poverty alleviation to increase.
4. Multi-sectoral to strengthen the share allocated to health budgets, and to activities that improve health, within overall government health spending.
5. Measures to improve health by raising taxes on health-damaging products, including but not limited to tobacco and alcohol.
6. Reduce reliance on wage-based deductions for health spending or voluntary forms of insurance to strengthen prepaid and pooled funding, including the mandatory policy to become a member of health insurance.

**c. Improve Efficiency and Equity in the Use of Health Resources**

This ensures that more rapid progress toward UHC can be facilitated with the available resources and can help to generate higher priority for health in government spending decisions. Areas for countries to focus on include:

1. Prioritize investments in primary care health services, frontline health workers with appropriate referral systems, other public or private sector services or institutions that serve as front line service in the health system, and health promotion and disease prevention.
2. Gives adequate funds to health promotion and disease prevention, as well as core public-health and health-security functions, including disease surveillance, outbreak response, monitoring and evaluation, and governance.
3. Strengthen public financial management (PFM) that enables revenues to be directed more efficiently and equitably toward UHC goals through

greater stability and reliability of health funding, more transparent and accountable government, and greater financial discipline.

All countries are required to increase the financing of health services in all aspects. International and domestic financing strategies need to be focused on the development of PHC and UHC so that countries have better equity in their health services. Policymakers need to be realistic in the planning of programs and strategies which prioritize creating a resilient health system.

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**PART-2**  
**DIGITAL TRANSFORMATION**





## CHAPTER-5

# DIGITAL ECONOMIC TRANSFORMATION FOR ACCELERATING INCLUSIVE DEVELOPMENT IN DEVELOPING COUNTRIES: THE INDONESIAN CASE

Sri Adiningsih

### 5.1 INTRODUCTION

In 2022, carrying the baton of charge G20 presidency, Indonesia has designated digital transformation as one of the priorities, which mirrors developments in current G20 discussions that underscore the importance of the digital economy (G20.org, 2022). Besides, one of the crucial topics in some of the communiqués issued emphasizes digital economic transformation. In any case, G20 is committed to the notion of recover together and recover stronger from the impact of the pandemic, which makes the economic digitization crucial.

It is undoubtable that the process of economic recovery and the ability of G20 members to make use of digitalization to recover from various sources of adversity varies. In other words, there is a wide digital divide and digital competitiveness advancement among members, which therefore is a challenge for all if they are to achieve recover together and be stronger in the G20.

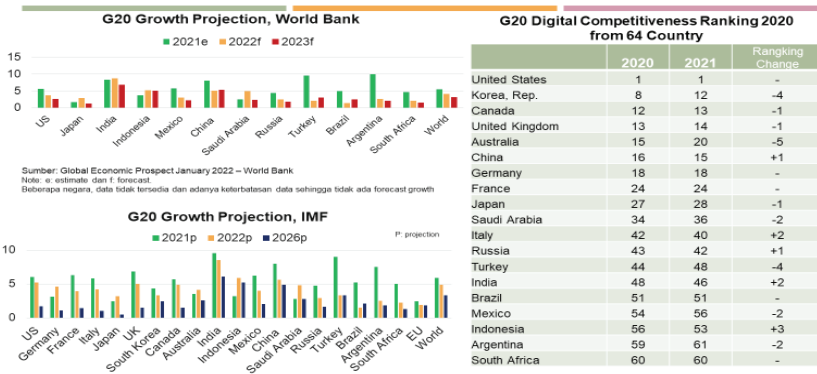


Figure 5.1 Economic Growth Projection and Digital Competitiveness in G20  
 Source: World Economic Outlook IMF, 2021; Global Economic Prospect WB and IMD, 2021

Indonesia as the host of the G20 in 2022 is also encountering some hurdles to recover from the impact of the Covid-19 pandemic. The economy, which posted 2.07% contraction in 2020, was able to register 5.01% growth in the first quarter of 2022 (BPS). Some of the social indicators that deteriorated during the pandemic are already showing improvement, albeit not all have been back. Various policies implemented by the government have been successful in mitigating and controlling the pandemic and its effects so far, which has enabled Indonesia to achieve success in overcoming its deepest economic downturn attributable to the impact of the Covid-19 pandemic.

Indonesia's economic recovery has to large extent been underpinned by the digital economy, which has registered rapid growth in the last decade. During the pandemic, the use of digitalization has become more evenly distributed and widespread. Nonetheless, the digital divide remains a big problem which coupled with high inequality across regions and between urban and rural areas. Moreover, while there are still exist of Society 1.0 in the remote areas, big cities are witnesses to the Super Smart Society 5.0. In fact, today digitalization has opened getaways to the virtual world with the development of the metaverse, cryptocurrency or non-fungible tokens (NFTs). Therefore, to avert becoming a laggard in development, Indonesia should accelerate and strengthen economic recovery by creating enabling conditions that support digitalization development and equitable distribution of progress and prosperity (Adiningsih, 2022).

## 5.2 DIGITAL ECONOMIC TRANSFORMATION

The digital economy disrupts all aspects of life and the economy, including business, investment, production, and trade. According to the G20 (2016), “The digital economy refers to a broad range of economic activities that include using digitized information and knowledge as the key factor of production, modern information networks as an important activity space, and the effective use of information and communication technology (ICT) as an important driver of productivity growth and economic structural optimization.” Thus, the scope of a digital economy is very broad. Bukht and Heeks (2017) groups it into 3 categories (Figure 5.2), inter alia, digital industry (Information Technology/Information & Communication Technology), as the core that encompasses the telecommunications industry, software & IT consulting. While in a narrow sense, the digital economy includes the digital services industry and platform economy, broadly, the scope of a digital economy also includes e-Commerce and Industry 4.0. The following discussion uses the broad definition of the digital economy.

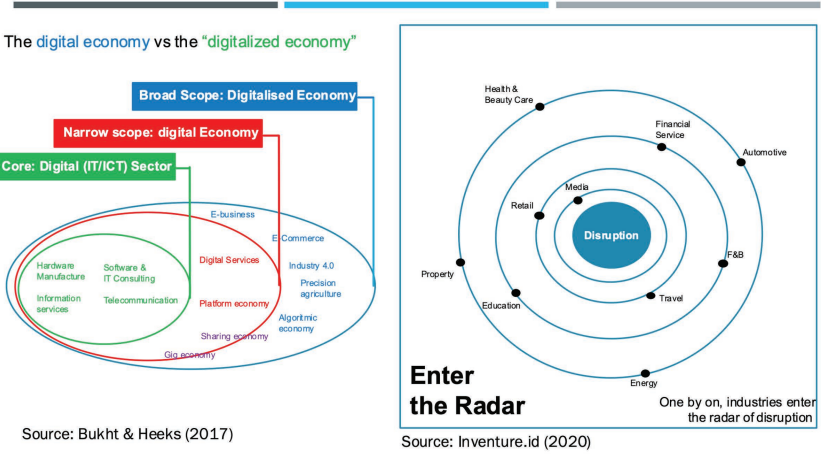


Figure 5.2 Disruption and Digital Economy Scope  
 Source: Bukht and Heeks, 2017 (left); Inventure.id, 2020 (right)

The digital economy is disrupting the economy in phases. At the beginning of its development, the digital economy disrupted media, radio, and television, which fostered easier access to information from various

media, anywhere and anytime for consumers. The second phases of disruption was in retail and travel, including logistics, followed by F&B, finance, and education. Slowly all economic sectors would be disrupted, including automotive, property, and health services.

Based on the 2021 World Economic Forum Survey, all sectors and industries will gradually become digitalized because of the immense benefits. Digitalization has the potential to enhance progress and prosperity that is more equitable. This is in part attributable to the flexibility in term of space and time, as long as access, literacy and/or digital talent are assured, especially for developing countries with large population such as Indonesia. However, digitalization also has the potential to increase inequality unless proper anticipation are put in place. To that end, cooperation among G20 members plays an important role in creating enabling conditions that should make digital transformation foster recover together and stronger from the pandemic, both at the international and domestic level. This especially so considering the fact that some members of the G20 are digital pioneers.



Respondent: 85,908. The survey was held in July and August 2021

Figure 5.3 Digitalization Benefits  
Source: World Economic Forum, 2021

**Digital Economic Development in Indonesia**

The digitalization of the economy got underway in the last two decades and has disrupted business and livelihoods. Developed countries that are equipped with better human resources and infrastructure were able to achieve earlier development, leading to a more advanced digital economy. While Indonesia has been somewhat sluggish in entering the digital economy, it

is today experiencing rapid growth. Based on the digital evolution index, in 2020, Indonesia was categorized as falling into the “break out” zone. That means that although the country has a low digital score, the digital economy is showing rapid growth and has great potential (The Fletcher School and Mastercard, 2020). Today, of the total Indonesian population, 133.3% has mobile connections, 73.7% and 68.9% are internet users and social media users, respectively (We are Social, 2022). Such statistics underscore the rapid increase in digitalization growth today compared to the pre-pandemic period.

Regarding the development of the digital economy in Indonesia, it has occurred in phases. Digital economy growth started with the media in the 1990s, which was characterised by the emergence of various online media, followed by the establishment of Bukalapak and Tokopedia retail businesses in 2010. Subsequently, digital disruption affected travel, followed by financial services, which was marked by the development of payment gateways, peer-to-peer lending and crowdfunding. Due to the various benefits it provides, the number of businesses that are adopting digital transactions is increasing by the day (Adiningsih et al., 2019).

Although Indonesia’s digital transformation still behind the progress achieved in advanced economies, just like other developing countries, its digital economy shows rapid growth. There is no better indicator of the rapid development of the digital economy than the Gross Merchandise Value (GMV) of Indonesia’s internet economy, which registered an average growth of 49% per year from 2015 to 2019, making it the fastest in ASEAN (Google, Temasek and Bain & Company, 2019). This implies that Indonesia’s digital economy was growing rapidly prior to the pandemic. Moreover, based on projections, the digital economy will be deeper, broader, and more evenly distributed in the G20. Indonesia, the Philippines, Vietnam and Thailand are among those projected to achieve a big leap in their digital economy. Indonesia’s internet economy has the potential to register fivefold growth from 2021 to 2030, while that of Vietnam has the potential to grow by eleven (11) times (Google, Temasek and Bain & Company, 2021).

Thus, the rapid development of the digital economy has huge potential to improve people’s welfare if the deployment and use of digitalization is more evenly distributed. One of the better ways to achieve a fair distribution of benefits emanating from the digital economy is by taking into consideration that impact that digitalization is having on micro, small

and medium enterprises (MSMEs), which are the backbone of people’s livelihoods. MSMEs are deriving benefits from using internet-based online transactions, which include an increase in labor productivity and exports as a study on MSMEs in Yogyakarta showed (Falentina et al., 2020).

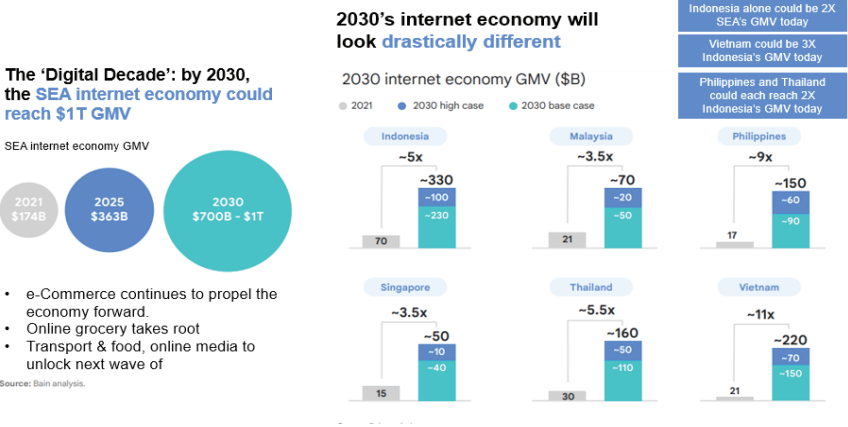


Figure 5.4 South East ASIA Internet Economy GMV (US \$\_B)  
Source: Google, Temasek and Bain & Co, e-Economy SEA, 2021

At the onset of the pandemic in Indonesia, digitization experienced a drastic increase of more than a third (37%) attested by new consumers, mainly from small cities and rural areas, making use of online transactions. Consequently, the internet economy was able to post growth of 11% from 2019 to 2020 (Google, Temasek and Bain & Company, 2020). On the same note, an ADB report (2021) found that the majority of large companies in Indonesia have been able to undertake digital transformation, although only 13% of MSMEs are utilizing digital tools in their operations (SEADS ADB, 2021), which is an indication of entrepreneurial agility. Besides, data shows that 20% of SMME are already digitally literate, meaning that they have the ability to use e-Commerce (BCG, 2021).

In a statement released by the Minister of Cooperatives and SMEs showed that 18.5 million MSME players were already digitally connected and onboarded (IDX Channel, 2022). It is estimated the number of MSME actors and the informal sector players who are connected to e-Commerce or socio commerce, online motorcycle taxis and partners they acquire through online services could reach 20 million people. It is thus apparent

that digital economy has mitigated both MSMEs and informal workers from the impact of the pandemic. This is supported by a survey that showed 70% of business actors at Tokopedia registered a median increase of 133% in sales, the majority of which are located in outside Java areas (LPEM FEB UI, 2020). This shows that digital economy has become important driver of the grass roots economy.

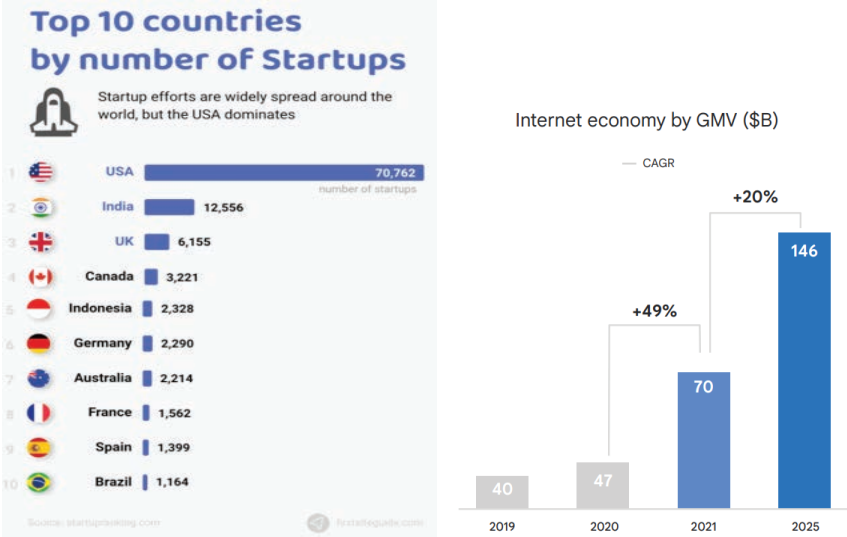


Figure 5.5 Countries by Number of Start-ups and Value of Indonesia Internet Economy  
 Source: First Site Guide, 2022; Google, Temasek & Bain & Co, 2021

Indonesia’s internet economy has registered rapid growth, a fact that is reflected by the number of start-ups that are emerging in Indonesia. Indonesia, with 2,328 start-ups, has become one of the leading developing countries in start-ups growth. Based on First Site Guide, Indonesia is ranked 5th in the world, a position that is only behind the United States, India, Britain, and Canada. Moreover, several start-ups have become Unicorns, four (4) by 2016 (Adiningsih et al., 2019). Today, Indonesia already has one Decacorn and 6 of Unicorns, and some have already been listed on capital markets (go public).

In general, although some areas still lack quality access, developments in the digital economy in Indonesia have been underpinned by improvement in infrastructure that support digitization, such as electricity and the internet.

For example, the electrification rate in 2020 was 99.2%, which represented an increase from 88.3% in 2015 (ESDM, 2021), 4G signal coverage is 97.06% at the provincial level, and 82.35% in urban areas throughout Indonesia (Wantiknas, 2020). It is also worth noting, the digital economy transformation has been supported by various supportive policies and regulations from all relevant authorities. This is in line with fact that in its early phases, the development of the digital economy was treated as an infant industry, which measures created an enabling environment for rapid growth.

### **5.3 THE FUTURE OF DIGITAL ECONOMY**

There is strong belief that even if the pandemic were to become an endemic, the use of online in daily life and economic transactions will continue. This is discernible from various surveys, including ISED (2021) which shows that the majority of respondents (74%) opted for flexible work options, which translate into both Working From Office (WFO) and Working From Home (WFH). The findings were corroborated by a Redseer (2020), which showed that 77% of people will continue to use online after the pandemic. Findings of a survey in the US are very much in line with those in Indonesia. The majority of respondents in US showed preference of not working in the office after the pandemic (Statista, YouGov, 2021). Nonetheless, adjustments will have to be made. This is because although businesses such as e-Commerce and automation, restaurant delivery, online grocery shopping and online education will continue to grow, the rate of growth after the pandemic will be slower than was the case prior to and during the pandemic (Mckinsey Global Institute, 2021). Also worth noting is that some businesses that support the digital economy develop, such as logistics, health and online-based sanitation, will also register strong growth.

That said, the inconvertible truth is that lifestyle in future will change. Results of the Pew Research Center (2021) showed that the new normal economy in 2025 will be driven more by technologies such as artificial intelligence, augmented reality, chatbots, big data, and blockchain. Meanwhile, according to The Pourquoi (2020), there are twenty (20) technologies that will change the world in the 2050s, including DNA computing, 4D printing, nanoscale 3D printing, digital twins, Brain-Computer Interface (BCI), flying autonomous vehicles, smart robots/autonomous mobile robots, secure quantum internet, biotech/cultured/



artificial tissues/bioprinting and miniature AI, some of which we can barely imagine today. Undoubtedly, all such developments will change our lifestyles, livelihoods and economy of the future.

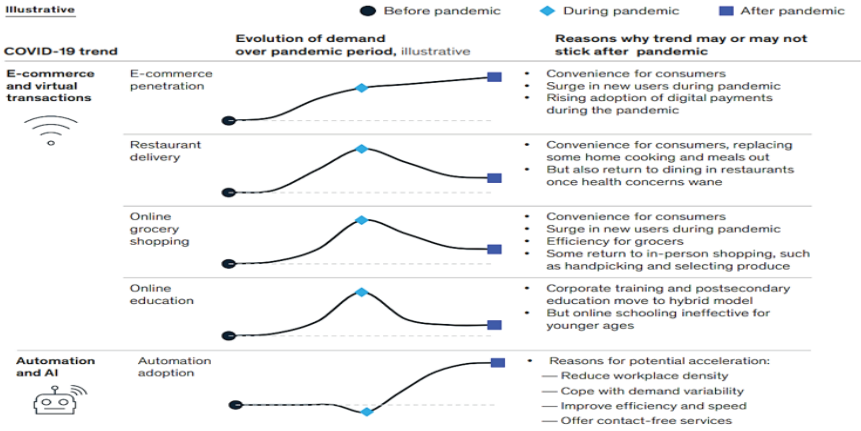


Figure 5.6 Consumer Behavior Transformation Before, During, and After Pandemic  
Source: Mckinsey, 2021

The world is expected to experience rapid, unprecedented progress, which will fundamentally change our lives. Innovation in the next 5 years is projected to exceed achievements made 30 years ago (eBusiness Institute, 2020). The use of information technology in both livelihood and the economy will grow at an even greater pace, a reality that was clearly stressed by Mazzucato from College University, London who noted that “Digitalization is no longer an option. It is a necessity” (IMD, 2020). The utilization of information technology will be widespread in all economic sectors, creating a situation whereby everything will be just the same, “just the economy” (Bukht and Heeks, 2017). Moreover, the development of digitalization will enter a new phase with the development of the virtual economy. More than 60 countries, especially developing countries with low financial inclusion (PWC, 2021), have embarked on study/trials of Central Bank Digital Currency (CBDC).

Several countries have started to gradually implement CBDC, Jamaica being one of such after adopting the currency nationally in 2022 (Sankaran, 2022). The virtual economy shows signs of rapid growth as reflected by the emergence of “land” asset offerings in the metaverse (virtual reality space),

which in future has the potential to become widely used at both work and lifestyles in the next few years (Gates, 2021). Needless to say, Indonesia has also joined the fray of the metaverse wave, with some metaverse asset offerings already issued.

Innovation	Description
E-commerce	Some of the technologies used: <b>Augmented Reality (AR):</b> Product display in 3D images; <b>Artificial Intelligence (AI)</b> can integrate data such as sales, customer records and social media attendance; <b>Chatbots:</b> Helps answer questions from customers with 24/7 service (Adiningsih et al., 2019); <b>Voice commerce</b> purchases goods by voice – using voice assistant technologies such as Apple’s Siri, Google Assistant, Amazon Alexa, and Microsoft Cortana. Amazon has used a <b>robotics Warehouse</b> to help organize and deliver goods (Sellbrite and Vox)
Financial Technology (FinTech)	Some of the technologies used: <b>Artificial Intelligence (AI)</b> through <b>Robo-advisors</b> (advisory robots) improves the investment landscape; <b>Blockchains</b> can make the financial services industry infrastructure much cheaper; <b>Big Data</b> can help create a risk profile on each individual; <b>Biometrics</b> help keep data privacy secure (Adiningsih et al., 2019)
Logistic	Some of the technologies used: According to WEF (2016), logistic control tower transformation with <b>AI system, same-day delivery, circular economy and sharing economy (sharing transport capacity and sharing warehouse)</b> <b>Autonomous Vehicle and Drone</b> can be a transformation for logistic providers by reducing operational costs while improving delivery efficiency; the <b>Internet of Things</b> enables logistic providers and customers to analyze supply chain data in real-time
Processing Industry	Especially the automotive industry that develops such as <b>driverless cars</b> . In addition to electric mobility, automated factories, and ridesharing (McKinsey, 2020) <b>Connected cars:</b> Algorithm-based insurance based on data from connected cars (Forbes, 2021)
Health	Some of the technological innovations such as online and mobile health applications (Apps), 3D and Bio-printing, AI, Electronic health (e-health) and mobile health (M-health) involving mobile phones; <b>Healthcare trackers, wearables and sensors:</b> Taking care of one’s health through technology; <b>Nanotechnology:</b> device inside the body; <b>Whole Genome Sequencing Application:</b> Useful such as finding the cause of a rare hereditary disease (inherited disorder disease), providing genetic info of complex diseases, and finding the cause of mutase in cancer types or inherited cancer. (OECD Paris, 2017).
Education	With the development of a digital-based economy, universities, tutors, and other online education service providers can provide distance courses without face-to-face interaction through technologies such as video conferencing and streaming (OECD, 2014). <b>Artificial Intelligence (AI)</b> can help to personalise learning based on students’ individual needs and strengths, Assess new skills, supporting students with particular needs (OECD, 2020)

Figure 5.7 Digital Economic Future Development  
Source: Adapted from Various Sources

The development of the digital economy will have disruptive effects on the labor market triggered by an increase in the widespread implementation of high-speed mobile internet, artificial intelligence, big data analytics, internet of things, cloud, and stationary robots. Many jobs, especially those that are simple and repetitive, such as data entry, bookkeeping staff, administrative staff, factory employees, and customer service will be replaced by machines in the coming years. This is despite the fact that the number of jobs that require digital skills is increasing, in such positions as data analysts, data scientists, AI and Machine Learning expertise, big data specialists (WEF, 2018). Thus, most of the jobs (56%) in Indonesia that are repetitive and simple are at risk of being replaced by machines in the next few decades (ILO, 2016). However, McKinsey (2017) study is more optimistic that automation will spur the creation of more new jobs than those replaced during the period of 2013 to 2030. To that end, reskilling one billion workforces by 2030 is a pre-requisite needed to prevent the loss of jobs in the world (Zahidi, 2020). Unboundedly, this is a big challenge for G20 members, especially developing countries such as Indonesia.

So far, digital transformation in Indonesia has not been create some opposition. Results of survey show that the majority of Indonesians have positive perception about the onset of the Industrial Revolution 4.0 or digitalization (ISED, 2020), especially the Millennial and Gen X groups (Deloitte, 2018). The development of gig or the labor market with short-term working relationships or freelancers will continue to grow. Thus, to prevent the loss of job opportunities, it is necessary that preparations tailored toward labor market transformation are made through equipping the workforce with critical, innovative, creative, originality and initiative, skillsets as well as developing supporting institutions that enhance easy and flexible labor force adjustment.

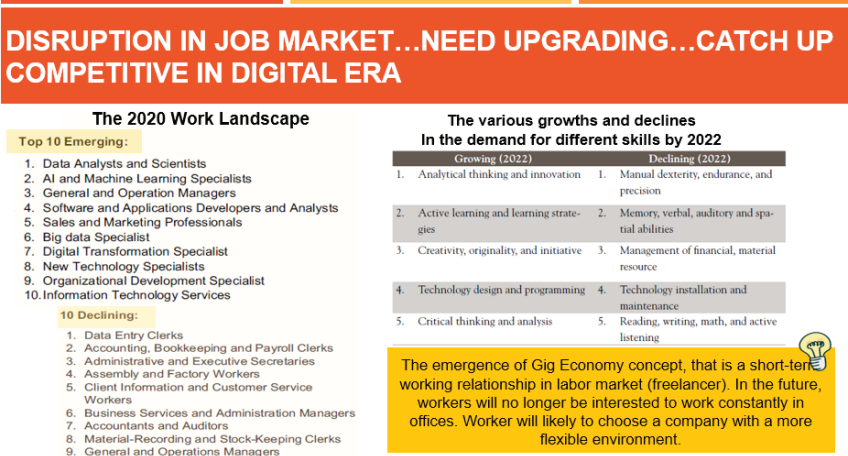


Figure 5.8 Trend Work Landscape  
Source: Future of Jobs and Gallup, 2018

The digitalization of the economy has entered a new phase with the development of the virtual economy (VE) or metaverse economy as well as cryptocurrencies and non-fungible-tokens (NFTs). VE is defined as the “process of exchanging virtual items and services with virtual currency within a virtual world” (Nazir and Lui, 2016). The development of VE is supported by metaverses, which Oxford Languages defines as “a virtual-reality space in which users can interact with a computer-generated environment and other users”.

The development of the metaverse economy from the idea of “extended reality—the combination of augmented, virtual and mixed reality will become a key medium for social and business engagement” (Hall and Li, 2021). In the virtual economy as well as the metaverse economy, NFTs are important as digital ownership records stored on the blockchain (Financial Times, 2022). Indications are pointing towards signs that the digital or virtual economy will continue to grow, triggering disruption of life, economy and businesses.

## **5.4 CHALLENGES AND PROSPECTS**

### **a. Challenges**

Doubtless, the digital or virtual economy is the future of the G20, including Indonesia; it is expected to deepen, widen and become more evenly spread, hence has the potential to promote progress and equitable distribution of people’s welfare if adequately managed. Nonetheless, the development of the digital economy in Indonesia faces some problems and challenges, including low quality of human resources (BPS data shows that 55.45% of workers have educational attainment of junior high school and below) and the digital divide.

This is compounded by low internet speed (according to the Speedtest Index in 2021, internet speed in Indonesia in 2021 was less than half of the world’s average internet speed); moderate digital literacy (according to Kominformo digital literacy in Indonesia is only slightly above moderate); low utilization rate; start-ups players are dominated by people with middle to upper socioeconomic status background (Indef, 2021); investors who enter digital business are predominantly foreigners (in the beginning); low digital competitiveness; data security and online transactions remain questionable and the quality of various supporting institutions is consider not sufficient (Adiningsih, 2022). Moreover, based on BPS statistics, Indonesia has internet access of only 53.06%, with urban areas having higher access (62.51%) than rural areas (40.55%).

Data also shows internet use by households is higher for those with higher education and/or wealthier. Thus, from various vantage points, Indonesia faces a serious digital divide, which is a challenge that is likely to influence the direction and effectiveness of its future development. Therefore, Indonesia has a lot of homework to do if it wants to compete in the digital era.

## Indonesia's Digital Literacy "Moderate" Level...digital divide ...also in access

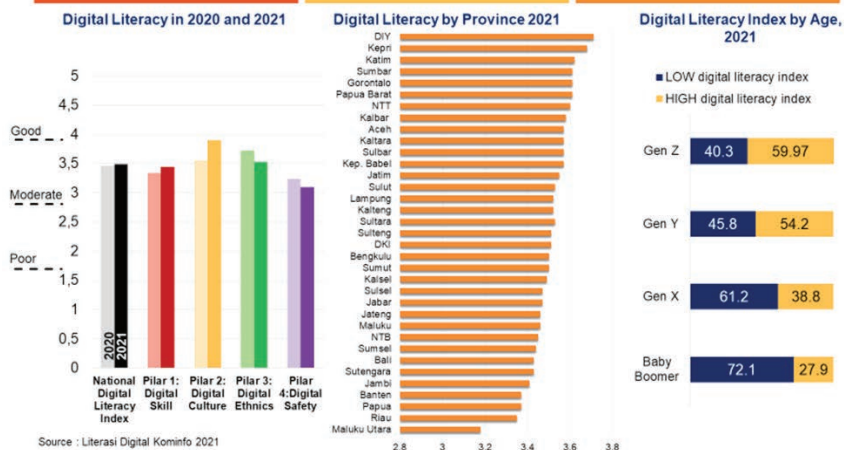


Figure 5.9 Digital Literacy Indonesia  
Source: Literasi Digital Kominfo, 2021

In any case, Indonesia also continues to face challenges related to its institutions and digital security. Digital transformation poses many fundamental and complex legal challenges, including the need for legal adaptation or rapid formulation and enacting of appropriate regulatory framework on e-gov, e-court, the legality of electronic transactions and commerce, e-waste, cyber bullying, and security, data, big data ownership and others (Harkrisnowo, 2021).

Protection of personal data is covered by existing laws, which is serious cause for public concern because consider it is not sufficient. This was succinctly reflected in an ISED survey (2021) that showed that 39% of respondents perceived that their data had been misused. The findings are in line with those of Deloitte (2019), which showed that 36% of organizations had experienced data security issues. Other problems that relate to the increase in public online activities that showing a worrying trend include fraudulent activities that are exploiting legal loopholes on peer-to-peer lending, crowdfunding, and online investment.

### b. Strength and Prospect

As a large country with a large population, Indonesia has immense capital and yet unexploited potential to develop the digital economy. Some

of the factors favouring the development of a strong digital economy include the population that has shown positive perception about digital economy, a large domestic market, and Indonesia being at the peak of the demographic bonus with 70.72% of the population in the productive age group (BPS, 2021). Besides, most Indonesian people are young and digital savvy and have enthusiastically welcomed digitization. Moreover, local and central government authorities (in general) are receptive to the development of digitalization. Furthermore, Indonesian consumers are generally quick to adapt to new technologies, which is reflected in the large number of consumers who have shifted their purchases from in-person to online channels during the pandemic (Google, Temasek, Bain & Company, 2021). It is also worth noting that Indonesians are digital life leaders compared to other ASEAN countries (Deloitte, 2020), which underscores the fact that the population is very enthusiastic to take advantage of the benefits that are associated with digitalization. To that end, digitalization has the potential to spur economic development and evenly distributed progress and prosperity (Adiningsih, 2022).

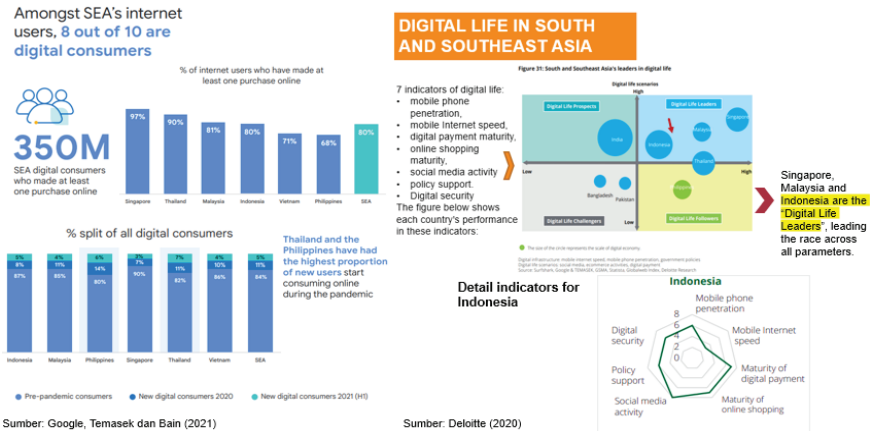


Figure 5.10 New Internet Users, *Digital Life* in ASEAN, Digitalization during Pandemic  
 Source: Google, Temasek and Bain, 2021; Deloitte, 2020; World Bank Indonesia, 2021

Indonesians are utilizing digitalization for various purposes and will continue to do so in the aftermath of the pandemic. In fact, many people have taken measures that are aimed at enhancing the benefits of online activities by taking such intensive courses as applications for meetings, e-Commerce, internet banking, and social media. In addition, the survey results showed that 83% of respondents acknowledged being inspired to find out more about digital technology (ISED, 2021). This attests to the reality that most Indonesians recognize of digitalization but are also enthusiastic to find out and learn more about all uses and issues that relate to digitalization.

**However, at a faster pace of digital skilling, this value could rise even further to reach Rp4,434 trillion – or 16% of GDP in 2030 (from 7%)**

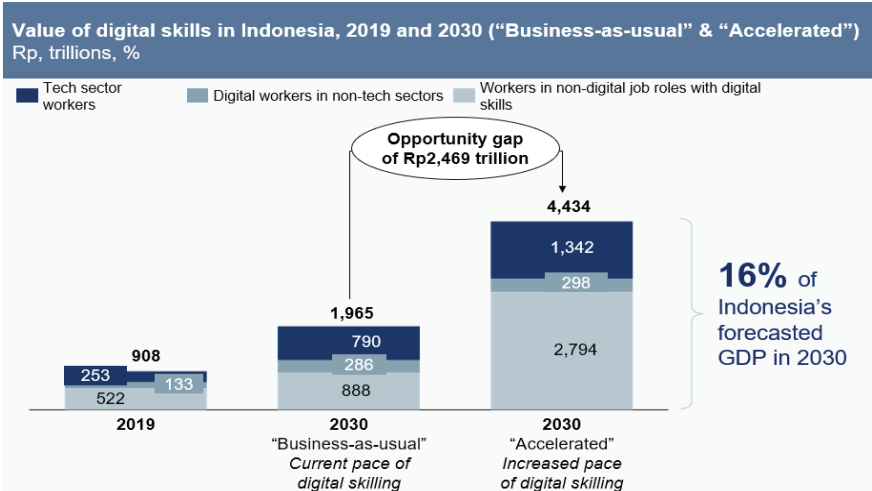


Figure 5.11 Indonesia Digital Skill Value  
Source: Alphabeta, 2021

It is an established fact that the digital economy has the potential to uplift and elevate public welfare. In 2019, projections put the value of Indonesia’s digital skills was estimated to be Rp908 trillion and forecast to reach 7% of GDP in 2030. However, if digital skills were accelerated, they would potentially increase to Rp4,434 trillion (16% of GDP) in 2030. Achieving such a milestone is only possible through training and putting in place supporting policies and facilities. Thus, Indonesia’s digital potential will be enormous if efforts are made to accelerate workforce skills, including digital talent training, remote training, MSME and women training using online,

equipping the workforce with digital skills, preparing future generations with digital capabilities, and expanding digital access to everyone, both in urban and rural areas (Alphabeta, 2021).

**ASIA PASIFIC AND JAPAN DIGITAL SKILLS STUDY SHOWS...DIGITAL TRAINING GAP INDONESIA 63%**

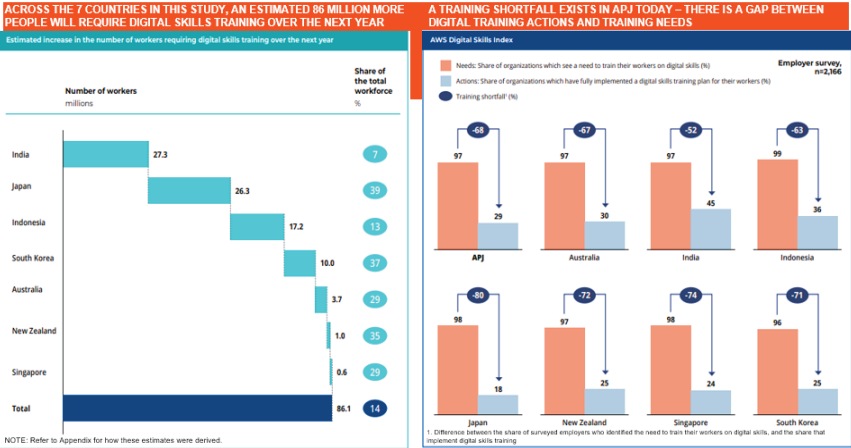


Figure 5.12 Digital Training Gap in Asia Pacific  
Source: AWS, 2022

Nonetheless, accelerating digital skills will not be easy to accomplish. This is attested by findings of a AWS (2022) study which showed that in many countries a training gap exists between digital training action and training needs. In Indonesia’s case, the training gaps is estimated to be 63%, which is high compared to other countries. Meanwhile, 98% of workers feel, since the pandemic they need more digital skills in their jobs (Alphabeta, 2021). Therefore, since the onset of the pandemic most of workers consider it necessary to acquire digital skills training to support them in doing their jobs. Thus, Indonesia should map the skill needs for its workforce if it is to achieve the maximum potential that digitalization and the benefitted digital economy have to offer.

**5.5 CONCLUSION**

Currently, the world economy, especially G20 members, is undergoing major disruption, that manifested in the development of economic digitalization, and a raging pandemic that has brought to the fore a new normal that is inevitable for us to live. There aren’t many options but to



adapt despite multifaceted challenges facing a developing country such as Indonesia with a large population, large surface area, high poverty and inequality. Meanwhile, digital economic transformation will continue, affecting all economic sectors, deepening and becoming more evenly distributed, and is even entering a new chapter with the development of the virtual or metaverse economy, cryptocurrencies and Non-Fungible Tokens, to which not all G20 members will have access to participate and derive benefits with much ease.

Indonesia's digital economy still faces many problems and challenges including low quality human resources, digital divide, low internet speed, lack of digital literacy and low utilization rate, the majority of start-ups and online business players hailing from middle and high social economic status, the digital business space being dominated by foreign investors, low digital competitiveness, inadequate data security and online transactions security and various unreadiness of many supporting institutions. Nonetheless, Indonesia's digital economy, which registered rapid growth during the pandemic, will continue. One of the challenges Indonesia faces to achieve and sustain (inclusive) digital economic development in future is to take proper and necessary policies to mitigate digital divide between rural and urban areas, low educated and high educated, and low income and middle to high-income sections of its population.

Despite many challenges, there are many positive factors that point to a robust development of Indonesian digital economy. Such factors include but are not limited to the overwhelming support and acceptance of Indonesians of the digital economy; the country's large population is at the peak of the demographic bonus; the digital savviness of the majority of the population, especially the young generation that is enthusiastic about digitalization; and support provided by government authorities to the development of digitalization. Besides, Indonesian consumers are quick to adopt new technologies and the fact that Indonesian are in digital life leaders compared to citizens of other ASEAN members. Such factors underscore the existence of strong factors to support digitalization which will pave way for deriving all benefits it has to offer to society and economy.

The digital economy transformation in the G20 region, especially Indonesia will continue with an increasingly competition. Thus, anticipation and proper preparation are necessary to overcome digital economy

development problems and challenges. Achieving the immense of potential of a competitive digital economy will only be possible if requisite condition is prepared. For that reason, preparing and formulating a well thought out, planned and coordinated roadmap of the digital economy development that involved various stakeholders to guide the direction, progress and advancement of the process is imperative. Moreover, improving the quality of human resources to ensure that workforce has the necessary literacy, expertise and skills/talents in the digital or virtual is paramount importance. Equally important is the availability of equitable and quality electricity power supply and internet services.

Consequently, to support universal internet, efforts should be made to extend subsidies to members of society from low and middle income social to enable them to acquire and improve their skills by attending online courses. Doing so will create opportunities for advancement by engaging in online work or business, especially in MSMEs, farmers, and the informal sector. Internet access by increasing time and special flexibility of activities fosters progress and equity because its removes obstacles that are associated with time and geographical limitations. This is in line with the recommendations of the World Bank Indonesia (2021) that argues that to support an inclusive digital transformation that makes the digital economy work all, and there is also a need to increase facilitation of interaction between the public and central and local government authorities. Increasing competitiveness of online business activities by strengthening the security of data and online or virtual transactions, strengthening relevant institutional frameworks (such as the regulatory framework) and scaling up investment in digital connectivity.

To this day, the government has done a lot in developing digitalization in the country, including enhancing equitable access to electricity and the internet, implementing digital literacy and digital talent improvement programs; and supporting MSMEs in entering online space, among other endeavours, even still limited.

Nonetheless, the competitiveness of Indonesian digital economy remains low, while the digital divide is still a big challenge that must be resolved. Moreover, while authorities at both the central and local government levels showed commitment to facilitate and support the development of the digital economy, though this remains limited, many local governments are still lagging in such efforts (Adiningsih et al., 2019). Another challenge

is unavailability of quality and affordable electricity and internet services (especially in backwarded 3T areas) in all regions. To that end, laying the foundation for strong and resilient digital economy transformation that will enhance progress and foster equitable prosperity will require an increase in the commitment of the central and local governments and the participation and cooperation of all stakeholders. Thus, Indonesia continues on its development journey like other nations in the developed and developing world. Doubtless, considering the growing importance of the digitalization and digital economy development in current development efforts, the role of G20 in coordinating and cooperation in digital transformation efforts will shape and inform the extent to which the digital economy will contribute to the realization of the recover together and recover stronger.

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## CHAPTER-6

# DIGITAL TRANSFORMATION FOR MICRO-SMALL-MEDIUM ENTERPRISES (MSMEs): INDONESIA READINESS AMONG ASEAN AND G20 COUNTRIES

Syaiful Ali

### 6.1 INTRODUCTION

**M**icro-small-medium enterprises (MSMEs)<sup>1</sup> are the largest players in every country's economy worldwide (Mandviwalla and Flanagan, 2021). MSMEs absorb the most labor, significantly reduce poverty and contribute greatly to the economy. Although MSMEs represent a large part of economic actors in each country and at the global level, MSMEs' contribution to country's economy is different for each country and between regions (Bouri et al., 2011). Research conducted by the International Trade Center (ITC) shows that MSMEs tend to make a lower contribution due to low productivity levels compared to larger companies. This difference is more remarkable in developing countries than in developed countries, creating income and social inequality even greater (Yasiukovic et al., 2020). Suppose a government wants to achieve inclusive and sustainable economic growth, then special attention must be paid to MSMEs to reduce the productivity gap between MSMEs and large companies, between middle-lower income groups and high-income groups countries.

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1 MSMEs in Indonesia are defined according to UU No. 20/2008 about Micro, Small, and Medium Enterprises.

The Covid-19 pandemic since the beginning of 2020 has made tremendous changes in the business environment. The pandemic is changing how people work, shop, study, and do other daily activities. The pandemic has forced people to physically limit gatherings (physical distancing, transport, and border restrictions), avoid large crowds (social distancing, lockdown), and maintain continuous hygiene (Mandviwalla and Flanagan, 2021). The pandemic disrupts supply chain flow, reduces consumer demand, and lowers cash flow so that overall economic activity declines and makes economic growth rates negative (contraction).<sup>2</sup> The pandemic has led to a double disruption, namely a decline in economic activity and an increase in the use of technology for business services. The increase in the use of technology that has changed drastically as a result of the changing environment has encouraged digital transformation in all company business processes.<sup>3</sup>

The Covid-19 pandemic has had a negative impact on MSMEs around the world. For example, 54% of SMEs in the US are affected by the pandemic (risk and near-term risk category). In the Indonesian context, 87.5% of MSMEs were negatively affected by the pandemic.<sup>4</sup> The pandemic has pushed MSMEs to survive and adapt to a drastically changing business environment. MSMEs must utilize technology to increase their low productivity in the pre-pandemic era, survive the pandemic era and thrive during and after the pandemic. Digital transformation is a must to do by MSMEs if they want to survive and thrive in an environment that has drastically changed due to the Pandemic (Mandviwalla and Flanagan, 2021).

The development of the digital economy, before the pandemic, had shown a high growth rate in the last two decades.<sup>5</sup> Gartner predicts that world spending on information technology will reach \$4.4 trillion in 2022. This figure is an increase of 4% from 2021. Based on IDC Indonesia's forecast ([www.idc.com](http://www.idc.com)), the digital economy's contribution will reach 40% of GDP in 2020 and 2021. Indonesia is predicted to be the country with the largest digital economy in the South-East Asian region, with a contribution value

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2 [https://development.asia/policy-brief/how-smes-can-bounce-back-Covid-19-crisis?utm\\_source=daily&utm\\_medium=email&utm\\_campaign=alerts](https://development.asia/policy-brief/how-smes-can-bounce-back-Covid-19-crisis?utm_source=daily&utm_medium=email&utm_campaign=alerts)

3 <https://www.weforum.org/press/2020/10/recession-and-automation-changes-our-future-of-work-but-there-are-jobs-coming-report-says-52c5162fce/>

4 <https://www.thejakartapost.com/academia/2021/10/17/digitalization-shows-indonesian-msmes-the-way-to-recovery.html>

5 <https://www.statista.com/statistics/203935/overall-it-spending-worldwide/>



of US\$130 billion (IDC, 2018). ICT expenditure in 2020 is estimated to reach IDR 48.6 billion 394 trillion. In addition, most IT investment will be spent on the technology included in the industrial revolution 4.0 category, such as cloud computing, data analytics, and data center management (IDC, 2018). The Indonesian Government itself has budgeted IDR 29.6 trillion for the development of the information and communication technology sector in 2021; this is an increase of 10% due to the pandemic.<sup>6</sup>

Digital transformation is a process that requires a lot of preparation. A study by Vilnius (2019) shows that digital transformation involves many factors such as technology, supporting processes, suitable business models, employee and top management support. What about MSMEs in Indonesia? Are these MSMEs ready for digital transformation? What about the country's readiness to face digital transformation, especially in Indonesia and other countries (ASEAN and G20)? What challenges lie ahead? How can the government, private companies, universities, and the public play an active role in helping SMEs carry out this digital transformation? How can ASEAN and the G20 be able to play an active role in increasing the readiness for the digital transformation of MSMEs in each ASEAN and G20 member country? This article will discuss this. It is hoped that this paper can provide an overview of how significant digital transformation is for MSMEs, especially digital transformation for MSMEs in Indonesia. How MSMEs in Indonesia can carry out digital transformation well, support increasing the productivity of SMEs, and in turn, increase the contribution of SMEs to the national economy even higher.

## **6.2 MSMEs AND CHALLENGES DURING THE COVID-19 PANDEMIC**

MSMEs in each country represent the largest number of economic players. In general, MSMEs represent more than 90% of all business types, absorb 60–70% of the workforce and contribute more than 55% of the world's GDP (Mandviwalla and Flanagan, 2021; Arnold, 2019). The number of SMEs in Indonesia reached 59.3 million, contributed 58.9% to GDP, and absorbed 97% of the total workforce (Anonymous, 2016; Anonymous, 2018). Compared to large-scale companies, MSMEs have several characteristics that are both advantages and disadvantages

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<sup>6</sup> <https://www.idnfinancials.com/news/37164/government-budgets-ict-development>

(Mandviwalla and Flanagan, 2021). MSMEs can provide products/services that are unique/personal and offer products/services that are physically and culturally closer to their target customers. On the other hand, MSME has challenges, namely, lack of economies of scale, high business risk, and family ownership (Mandviwalla and Flanagan, 2021). MSMEs in Indonesia, as in other developing countries, also have many challenges, such as lack of access to capital in formal financial institutions, low levels of knowledge of company management and marketing skills, and lack of digital technology skills and knowledge.<sup>7</sup>

The Covid-19 pandemic poses a massive challenge to MSMEs. The study by Parilla et al. (2020) showed that approximately 54% of SMEs in the United States experienced business disruption due to the pandemic. The Covid pandemic has made the government prohibit its citizens from leaving their homes (stay-at-home orders), limiting business operating hours, limiting the number of employees entering the office and even total lockdown of an area. This government regulation dramatically affects SMEs that rely on physical access to sell their products and services (Mandviwalla and Flanagan, 2021).

A survey conducted by the Asia-Pacific MSME Trade Coalition in 2020 showed that MSMEs directly felt the impact of the pandemic. According to the study, there are five main challenges faced by SMEs due to the pandemic, namely the depletion of the company's operational cash flow, low customer demand, business closures due to the government's lockdown policy, reduced opportunities to meet new clients, and lastly related to changes in business models and strategies in the provision of new products or services (Asia-Pacific MSME Trade Coalition, 2020). According to a study conducted by the Katadata Insight Center, 62.9% of MSMEs experienced a 30% decline in sales. Furthermore, in its survey, Bank Indonesia showed that 87.5% of Indonesian MSMEs were affected by the pandemic, of which 93.2% of MSMEs were negatively affected by their sales.<sup>8</sup>

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7 <https://ekonomi.bisnis.com/read/20210420/9/1383593/sri-mulyani-ungkap-5-tantangan-umkm-sulit-berdaya-saing-di-tingkat-global>

8 <https://www.thejakartapost.com/academia/2021/10/17/digitalization-shows-indonesian-msmes-the-way-to-recovery.html>

### **6.3 DIGITAL TRANSFORMATION OF MSMEs DURING A PANDEMIC**

During the pandemic, MSMEs are forced to carry out digital transformation, regardless of whether they are ready. A study by Mandviwalla and Flanagan (2021) on 42 MSMEs during the pandemic in the United States showed that MSMEs outsourced some of their operational activities (such as accounting and payment). The study found that the MSMEs in the study had limited knowledge of digital knowledge and did not have ongoing relationships with IT vendors. In digital transformation, these MSMEs tend to focus more on optimizing digital channels, namely engaging with customers (marketing, advertising, and relationship management), selling (sales transactions), and delivering products/services.

What about MSMEs in Indonesia? A study by Muditomo and Wahyudi (2021) showed that only 8 million MSMEs out of a total of 64 million MSMEs in Indonesia were connected to the digital world (Andriani, 2020). This number represents 13 percent of the total population of Indonesian MSMEs. Furthermore, a survey conducted by Bank Indonesia in 2021 showed that only 20% of Indonesian MSMEs had effectively overcome the negative impacts of the pandemic through business digitization and online marketing media.<sup>9</sup> For large companies, the Forrester research institute, in its latest survey involving 163 companies in Indonesia, found that 49% of these companies are trying to accelerate their digital transformation process.<sup>10</sup>

### **6.4 DIGITAL TRANSFORMATION**

Digital transformation refers to the use of digital technology to improve organizational performance by changing work processes in organizations supported by digital technology (Hess et al., 2016). Digital transformation is considered necessary for every organization to survive in today's market conditions, namely adapting to the new digital environment (Chernbumroong et al., 2021). The trend of digital transformation has become an important phenomenon, both in the realm of strategic information systems research (Bharadwaj et al., 2013; Piccinini et al., 2015) and in the sphere of industrial practice (Fitzgerald, 2014; Westerman et al., 2011; Majchrzak et al., 2016).

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9 [https://www.bi.go.id/en/publikasi/ruang-media/news-release/Pages/sp\\_243422.aspx](https://www.bi.go.id/en/publikasi/ruang-media/news-release/Pages/sp_243422.aspx)

10 <https://www.forrester.com/blogs/indonesian-firms-expanded-their-digital-transformation-efforts-in-2021-but-fell-short-of-their-objectives/>

The term “Digital Transformation” is predicted to continue to be a global trend in 2030 when digital technology has transformed all aspects of people’s lives (Vilnius, 2019).

What is digital transformation? There are various definitions of digital transformation in the literature. Vial (2019) examined 248 scientific publications related to digital transformation and found so many definitions of digital transformation. For example, Westerman et al. (2011) define digital transformation as: “The use of technology to radically improve performance or reach of enterprises.”, Fitzgerald (2014) define digital transformation as: “The use of new digital technologies (social media, mobile, analytics or embedded devices) to enable major business improvements (such as enhancing customer experience, streamlining operations or creating new business models)”, while Matt et al. (2015) define digital transformation as “a blueprint that supports companies in governing the transformations that arise owed to the integration of digital technologies, as well as in their operations after a transformation.” (Vial, 2019).

These existing definitions have several shortcomings, such as the lack of clarity in the term digital technology, the ambiguity between concept and impact, and the lack of parsimony. From the literature study, Vial (2019) defines digital transformation as follows: “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies”. The definition of digital transformation by Vial indicates that digital transformation is a process that can occur not only in organizations but also in individuals and society. In that definition, too, digital transformation will improve organizational performance by triggering significant organizational changes but does not guarantee the realization of the digital transformation. This indicates that digital transformation requires supporting factors for the implementation of the transformation to run effectively. Finally, according to Vial, the definition of digital transformation uses a broad definition of digital technology taken from Bharadwaj et al. (2013).

From the definition of Vial’s transformation (2019) above, it can be interpreted that digital transformation is a process of transformative change in an organization that occurs continuously. The change process is driven by the use of digital technology, which includes the latest technological developments used in the industrial revolution 4.0, such as cloud computing,

mobile commerce, social media, Internet of Things (IoT), big data, blockchain, and Artificial Intelligence. The use of digital technology does not guarantee a significant positive impact on the organization without adjustments in business strategy, organizational structural changes, and resolving organizational barriers. A survey conducted on top management companies in 2019 found that 70% of the digital transformation implementation failed, meaning that of the US\$1.3 trillion spent, US\$900 billion was wasted (Tabrizi et al., 2019).

Digital transformation occurs because of the latest digital technologies such as social media, mobile devices, developments in analytics, the IoT, platforms, and ecosystems. The use of digital technology disrupts consumer behavior and expectations, affecting the business competition map. For example, using social media in marketing and sales is more effective than conventional methods. Consumers use mobile devices more often, so they use mobile applications more to do things such as shopping, banking, collaboration, and others. This existing disruption must be responded to adequately by the company in the form of a digital business strategy and a digital transformation strategy. Vial (2019), in his literature study, proposes building blocks of digital transformation (see Figure 6.1).

According to Vial (2019), the digital business strategy relies on digital technology in formulating and executing organizational strategies to offer new value. A digital transformation strategy is a strategy that focuses on transforming products, processes, and organizational aspects using new technologies. The two strategies ultimately refer to the digital technology consumers or their competitors use. The digital transformation carried out will impact the value creation path within the company, for example, value proposition, value networks, digital channels, and agility and ambidexterity. Of course, implementing an effective digital transformation is not only determined by the digital technology factor. However, it is also determined by the readiness for organizational change, such as changes in organizational structure, organizational culture, leadership, and the skills and roles of employees. In addition, companies also need to consider organizational barriers such as inertia and resistance. Ultimately, digital transformation aims to obtain positive impacts such as increasing operational efficiency, organizational performance, and industry and social improvement.

Companies must ensure that digital transformation has no negative impacts, namely security and privacy issues.

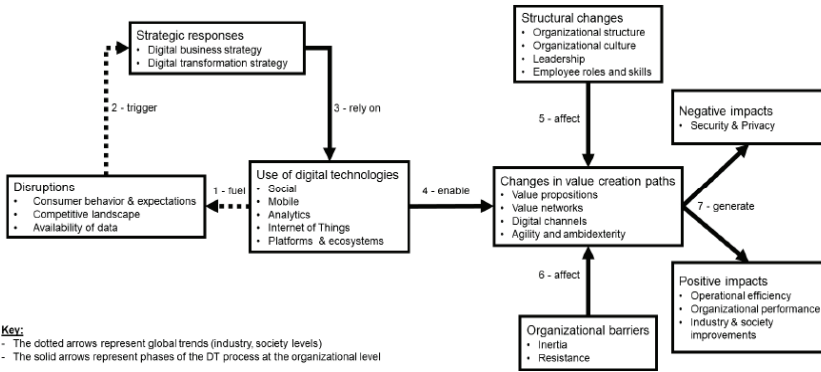


Figure 6.1 Building Blocks of the Digital Transformation  
 Source: Vial, 2019

The digital transformation building blocks proposed by Vial (2019) show that many factors in its implementation need to support digital transformation. Vilnius (2019), in his survey, also found similar factors closely related to the concept of digital transformation, such as technology, processes, data, and business models. Other factors involve human factors such as customers, employees, and top management. The latest digital technologies that MSMEs in implementing digital transformation can use include cloud computing, social media, big data analytics, platforms, and ecosystems.

Cloud computing provides an alternative for companies to obtain IT services at a low cost through the internet network. The National Institute of Standards and Technology defines Cloud Computing as “a model for enabling anywhere-at-home, easy-to-use, self-service, on-demand network access to a shared pool of configurable computing resources (examples: networks, servers, storage, applications, and services), which can be readily available with minimal management effort” (Jansen and Grance, 2011). Cloud computing offers various types of IT services that are tailored to the needs of service users (on-demand services). There are at least four types of cloud computing services: software-as-a-service (saas), infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), and data-as-a-service (DaaS). Through cloud computing, MSMEs can perform digital transformation quickly and efficiently without the need for high upfront investment costs.

Many cloud computing software-as-a-service services can be used by MSMEs, such as point of sales, marketing, social media applications, and even enterprise resource planning (ERP) applications (Yasiukovic et al., 2020).

## **6.5 DEVELOPMENT OF DIGITAL TECHNOLOGY IN INDONESIA**

The use of IT in Indonesia is growing rapidly in organizations. At the country level, Indonesia targets to become the largest digital economy in Southeast Asia, with a market value of US\$130 billion by 2020. International Data Corporation (IDC) Indonesia reports that Information and Communication Technology (ICT) spending in Indonesia is expected to increase by 16 percent from Rp339 trillion (US\$25.4 billion) in 2017 to Rp394 trillion (US\$29.5 billion) in 2020. If we separate IT spending alone, the increase in spending is estimated at 24.2%, from Rp128 trillion (US\$9.6 billion) in 2017 to IDR 159 trillion (US\$11.9 billion) in 2020. The IDC report also shows the trend of increasing IT investment in the latest technologies such as cloud, data analytics, and data center management (Baziad, 2017).

Furthermore, IDC announced the prediction of the top 10 information technology that will impact the digital transformation of local companies in Indonesia for 2018 and above. The ten technology trends in Indonesia predicted by IDC include: the digital economy (will contribute 40% of Indonesia's GDP in 2021); digital transformation (will occur in 20% of all companies in 2021), cloud-computing (will increase investment, artificial intelligence will be used in 20% of commercial firms in 2021), blockchain (will be used by 10% of companies in 2021 and 2021), Indonesian companies will experience an increase 20% of digital service interactions through an open API ecosystem, this is an increase of 5% from 2017. This prediction focuses on four technology pillars: Cloud, Mobility, Social, and Big Data-Data Analytics. Most of these ten technology trends fall into the industrial revolution 4.0 information technology category, which is predicted to happen significantly in 2021. Industrial growth in Indonesia will be increasingly driven by digital business processes, which are expected to contribute 40% of Indonesia's GDP in 2021. Digital technology involves many industry 4.0 technologies such as cloud computing, artificial intelligence, data analytics, and blockchain.

Concerning the industrial revolution 4.0, the Ministry of Industry of the Republic of Indonesia (Kemenperin) compiled a road map “Making Indonesia 4.0,” where industrial technology 4.0, such as advanced robotics, 3D printing, wearable devices, Internet of Things, and artificial intelligence is expected to increase the competitiveness of Indonesia’s industry and make Indonesia as the top 10 world economic powers based on GDP in 2030. Making Indonesia 4.0 also targets the Indonesian industry to double the productivity-to-cost ratio and push net exports to 10 percent of GDP in 2030. To achieve this goal, Indonesia is committed to budgeting two percent of GDP for research and development of industrial technology 4.0 (Kemenperin, 2018).

Furthermore, the Ministry of Industry has produced several strategic policies to implement the roadmap, including fiscal incentives in the form of super deductible taxes for companies conducting research and development activities for innovation and education/training, producing e-Smart IKM programs, appointing the Lighthouse of Industry 4.0 to select examples of companies implementing IT 4.0, carry out training to produce managers and experts for industrial transformation 4.0, and in the process of formulating Indi 4.0, which is an index to measure the level of readiness of Indonesian industry to transform towards industry 4.0 (Maskur, 2019).

## **6.6 READINESS OF THE INDONESIA IN SUPPORTING THE DIGITAL TRANSFORMATION OF MSMEs**

The Indonesian Government is currently entering the era of digital transformation. The increasing high adoption of digital technology has been happening in the government, private organizations, and society. At the same time, the government and the business world are experiencing economic challenges, namely the decline in economic growth due to the Covid-19 pandemic. Adopting technology that occurs primarily in the business world/private organizations and the community requires adjustments to business processes in government in Indonesia, both at the central and regional levels. Since the beginning of the Covid-19 pandemic, there has been a speedy adoption of the latest technology, for example, the massive use of (mobile) e-Commerce platforms, automation/digitalization of organizational business processes, and social media.<sup>11</sup>

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11 <https://www.idc.com/misc/Covid-19>



At the same time, the increasing level of technology adoption in government business processes coupled with the Covid-19 pandemic condition that limits the physical mobility of the community makes it increasingly crucial for the government to review the existing digital transformation strategy.<sup>12</sup> The government must quickly reorganize the digital strategy to ensure that existing policies and programs follow technological developments so that government goals, both central and regional governments, can be achieved effectively and efficiently.

The use of digital technology (that disrupts the community's behavior and the business world) needs to be anticipated with a strategic response by the government so that the government's role as a regulator of the state's life and society runs optimally. However, the government must face many challenges, such as structural challenges (e.g., organizational structure, organizational culture, leadership, and employee roles and skills) and organizational barriers (e.g., inertia and resistance) (Vial, 2019). Therefore, it is crucial to ensure that digital transformation in Indonesia can be achieved optimally so that the government can achieve the state's goals.

## **6.7 INDONESIA, ASEAN, AND G20**

Digital transformation in MSMEs in Indonesia needs to be supported by digital technology such as network infrastructure, reliable internet connections, and adequate digital literacy in every country in the world. The Portulans Institute annually publishes a network readiness index (NRI) which measures the readiness of every country in the world in its technology infrastructure. NRI in the last 20 years by the World Economic Forum in 2002 as part of the Global Information Technology Report. The Network Readiness Index (NRI) can be used to assess the readiness of a country's existing information technology infrastructure.

There are four factors (pillars) used in the NRI, namely the pillars of technology, people, governance, and impact. Pillar technology consists of three sub-pillars: access, content, and future technologies. The technology pillar refers to the core of the digital economy. This pillar is used to assess a country's technological level and its participation in the global economy. Pillar people consists of three sub-pillars: individuals, businesses, and

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<sup>12</sup> <https://www.mckinsey.com/featured-insights/asia-pacific/with-effort-indonesia-can-emerge-from-the-Covid-19-crisis-stronger>

governments. Pillar people shows the extent to which the population and organizations of a country have access, resources, and skills in using digital technology. The governance pillar also consists of three sub-pillars: trust, regulation, and inclusions. Pillar governance indicates the extent to which individuals and companies are protected in the digital economy, digital regulation, and inclusion context. Finally, the impact pillar includes three sub-pillars: economy, quality of life, and SDG contribution. This pillar measures the impact of the digital economy, namely increasing economic growth and the welfare of its people.<sup>13</sup>

The following is a comparison of Indonesia’s NRI index for the last three years, 2019 to 2021, compared to countries in ASEAN and countries in the G20. NRI calculations since 2019 have included essential elements such as trust, governance, inclusivity, and impact on SDG goals.

**INDONESIA vs ASEAN**

Indonesia’s ranking compared to ASEAN member countries in terms of network readiness index for 2019–2021 can be seen in Table 6.1 below.

Table 6.1 Network Readiness Index Rank 2019–2021 ASEAN Countries

Country	Rank		
	2021	2020	2019
Singapore	7	3	2
Malaysia	38	34	32
Thailand	54	51	56
Vietnam	63	62	63
Indonesia	66	73	76
Philippines	83	74	71
Cambodia	106	104	107
Laos	110	0	0

Source: [networkreadinessindex.org](https://networkreadinessindex.org)

Table 6.1 shows that Indonesia’s position is ranked fifth out of eight ASEAN countries included in the network readiness index (NRI) list. Compared to all countries listed in the NRI report (that is, 130 countries in total), Indonesia ranks 66th. The number one position in ASEAN is

<sup>13</sup> <https://networkreadinessindex.org/>

Singapore, with a global ranking at number 7th, followed by Malaysia at 38th, Thailand at 54th, and Vietnam at 63rd in the world. Indonesia’s NRI ranking in the last three years has increased from 76th in 2019 to 73rd in 2020 and 66th in 2021.

This shows an improvement in Indonesia’s readiness to prepare information technology infrastructure, which includes four pillars: technology, people, governance, and impact. However, if viewed from the eight ASEAN countries, Indonesia still needs to continue improving its technological infrastructure to catch up with other countries such as Singapore, Malaysia, Thailand, and Vietnam. As in the NRI 2021 report, if the digital transformation that occurs during the Covid-19 pandemic does not occur evenly both within each country and between countries in the world, in this case between countries in ASEAN, this will cause a positive impact on digital transformation to only be able to enjoyed by countries that have adequate infrastructure readiness, so that it will further increase inequalities between nations. International cooperation at the ASEAN level is needed to optimize technological factors in increasing economic recovery due to the Covid-19 pandemic.

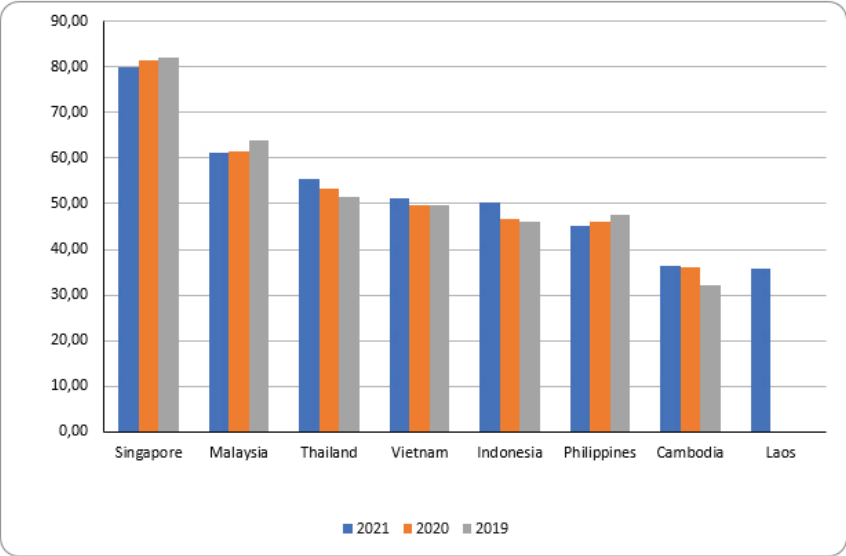


Figure 6.2 Overall Score NRI 2019–2021 ASEAN Countries

Source: networkreadinessindex.org

Figure 6.1 shows the total score of Indonesia’s NRI index compared to other ASEAN countries. The highest total score that a country can achieve on the NRI index is 100. Indonesia’s NRI score in the last three years (2019–2021) has increased quite well, especially in the previous year. In 2019 Indonesia’s total NRI score was 46.15, then it rose to 46.71 in 2020 and grew to 50.37 in 2021. Hopefully, this increasing trend will continue so that Indonesia can achieve a better position.

Table 6.2 Network Readiness Index 2021 Rankings by Pillar—ASEAN Countries

Country	2021 Score				
	NRI Ranking	Technology	People	Governance	Impact
Singapore	7	8	9	12	1
Malaysia	38	37	39	40	38
Thailand	54	45	58	52	53
Vietnam	63	61	80	73	44
Indonesia	66	48	79	68	79
Philippines	83	97	81	91	52
Cambodia	106	98	107	120	94
Laos	110	92	100	126	95

Source: networkreadinessindex.org

If viewed in more detail from the four pillar components of NRI: technology, people, governance, and impact, in 2021, Indonesia will have the best pillar among the other four pillars, namely the technology pillar (score 48), followed by the governance pillar (score 68). The other two pillars, people and impact, have the same score (79). This data shows that the development of digital technology that has occurred in the last one or two years has positively impacted Indonesia’s readiness in the digital transformation process. However, this has not been followed by human factors and governance readiness. These two factors must be the Indonesian Government’s primary concern in the future.

**INDONESIA vs G20**

Furthermore, how is Indonesia’s network readiness position compared to other G20 countries?

Table 6.3 Overall Rank NRI 2019–2021 G20 Countries

Country	Overall Rank		
	2021	2020	2019
United States	4	8	8
Germany	8	9	9
United Kingdom	10	10	10
Canada	11	13	14
South Korea	12	17	17
Australia	13	12	13
France	14	17	18
Japan	16	15	12
Italy	28	32	34
China	29	40	41
Saudi Arabia	40	41	45
Russia	43	48	48
Turkey	45	57	51
Brazil	52	59	59
Argentina	58	60	58
Mexico	59	63	57
Indonesia	66	73	76
India	67	88	79
South Africa	70	76	72

Source: [networkreadinessindex.org](http://networkreadinessindex.org)

Of the 19 G20 member countries on the 2021 NRI list (NRI does not score for the European Union), Indonesia is in 17th position. There are two countries behind Indonesia, namely India and South Africa. Indonesia's position is also the same for 2020 and 2019 (see Table 6.3 and Figure 6.3).

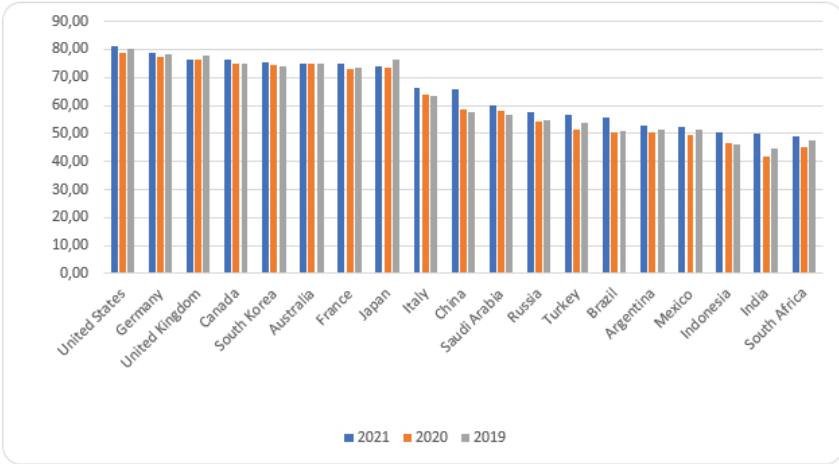


Figure 6.3 Overall Score Network Readiness Index 2019–2021 G20 Countries  
 Source: networkreadinessindex.org

Table 6.4 Comparison of Score Values for the 4 Pillar NRI 2019–2021—G20 Countries

Country	Technology			People			Governance			Impact		
	2021	2020	2019	2021	2020	2019	2021	2020	2019	2021	2020	2019
United States	87.81	82.88	87.32	75.65	74.59	73.59	87.26	86.23	88.74	73.64	71.96	71.65
Germany	80.03	79.18	77.51	75.12	70.54	72.60	84.22	83.52	83.94	76.41	76.69	78.87
United Kingdom	76.78	78.34	78.16	69.44	69.69	69.81	83.64	82.65	88.32	76.52	74.40	74.62
Canada	75.30	73.59	73.13	70.35	68.71	67.20	87.27	85.85	86.39	73.00	71.53	72.14
South Korea	67.53	79.60	70.70	80.63	79.60	76.43	80.69	81.44	73.84	73.38	72.33	73.94
Australia	71.41	70.38	70.70	72.10	71.91	71.66	85.07	86.77	85.68	71.27	71.30	71.17
France	71.46	69.52	69.93	71.47	67.77	65.88	81.97	82.56	84.85	74.25	72.85	73.04
Japan	70.81	65.55	72.87	73.20	76.79	74.24	77.71	77.53	80.05	73.97	74.29	77.54
Italy	62.47	58.55	61.06	61.72	57.63	56.26	74.28	73.25	71.58	66.54	65.31	63.93
China	57.27	49.80	54.46	66.48	58.47	53.89	63.98	66.33	65.42	74.77	59.17	56.73
Saudi Arabia	59.73	49.78	52.47	61.73	63.01	54.02	64.87	64.92	67.99	54.60	54.17	51.49
Russia	53.71	59.68	50.16	58.80	59.68	53.32	59.97	56.98	62.44	58.49	53.65	53.98
Turkey	50.98	42.44	51.27	60.22	51.41	47.45	63.16	62.35	67.79	53.17	48.76	48.49
Brazil	49.08	38.95	43.39	57.35	52.41	48.02	62.89	60.51	62.79	54.12	50.45	50.08
Argentina	44.92	38.66	44.39	56.45	51.87	48.72	56.15	58.62	58.21	54.15	52.28	53.78
Mexico	45.24	37.92	43.29	53.45	48.89	45.73	54.65	54.92	59.87	56.95	56.96	56.86
Indonesia	50.07	38.38	41.56	44.69	43.26	34.77	55.02	54.99	60.57	51.70	50.20	47.70
India	49.24	36.58	42.76	45.96	40.15	35.87	48.71	50.45	63.66	55.07	39.08	36.96
South Africa	45.59	40.23	47.88	46.42	41.16	37.87	61.25	60.88	66.61	42.25	38.80	37.14
Average Score	61.55	57.37	59.63	63.22	60.40	57.23	70.15	70.04	72.57	63.91	60.75	60.53

Source: [networkreadinessindex.org](http://networkreadinessindex.org)

Table 6.4 shows the scores for the four NRI pillars in the last three years from all countries that joined the G20 group compared to the average score for each pillar. From the table above, it can be seen that nine countries have scores above the average of all G20 members. The nine countries are countries that are included in the high-income countries group. For other countries in the G20 group, the average score for each pillar of their NRI is below the average score for all G20 members. These countries are included in the upper-middle and lower-middle-income countries. From these data, it can be concluded that high-income countries are more prepared in digital technology to support digital transformation in their countries.

On the other hand, upper-middle and lower-middle-income countries are quite far behind in terms of digital technology readiness in their countries. This inequality needs to be realized by all G20 members. It requires solid international cooperation between G20 countries to help other G20 members who do not yet have digital technology readiness in the four pillars contained in the NRI. If this can be done, the positive impact of digital transformation will have far-reaching implications, reducing inequality in economic recovery during the pandemic and in the post-pandemic period.

## **6.8 RECOMMENDATIONS FOR THE ADVANCEMENT OF MSME DIGITAL TRANSFORMATION IN INDONESIA**

The double disruption that has occurred has presented a severe challenge to MSMEs. MSMEs cannot easily carry out digital transformation in response to bounce-backs during and after a pandemic. This is because MSMEs have challenges such as lack of access/adequate experts in digital knowledge and challenges in implementing digital solutions in their business (Fechtelpeter et al., 2018; Mandviwalla and Flanagan, 2021). The phenomenon of the unpreparedness of MSMEs in digital transformation has occurred for a long time and is increasingly critical in the era of the pandemic and post-Covid-19 pandemic (PWC Global Industry, 2016). With the challenges that exist in MSMEs, there needs to be a breakthrough from various parties in helping MSMEs overcome the existing challenges, such as the government, private companies, universities, and the community.



### **a. Important Role of Government**

The negative impact of the Covid pandemic on SMEs must be addressed immediately through government policy interventions (Asia-Pacific MSME Trade Coalition, 2020) both at the national and local levels. It is also hoped that international cooperation initiatives can be carried out so that the macro impacts of the Covid pandemic can be overcome together. The Asia-Pacific MSME Trade Coalition predicts that more than 50% of MSMEs workers are at risk of being laid off due to the negative impact of Covid-19.

Government policies to help MSMEs are expected to enable MSMEs to survive during the pandemic and thrive in the post-pandemic period. Macro policies need to be coupled with policies that help MSMEs at the corporate entity level to survive and thrive in the aftermath of the pandemic. The digital transformation of MSMEs is an essential agenda that the government must focus on to enable MSMEs to emerge from the crisis and thrive. The government needs to help MSMEs carry out digital transformation by making various policy breakthroughs and providing information technology infrastructure and technical training support for MSMEs. Of course, apart from the government, other parties such as private businesses, educational institutions, and other international institutions such as ASEAN and the G20 can play a role in helping SMEs carry out digital transformation effectively.

The Indonesian Government can learn from the experiences of other ASEAN and G20 countries in helping MSMEs carry out digital transformation effectively. For example, to assist the digital transformation of SMEs, the Thai Government is running a SMEs digital transformation project carried out by the Ministry of Digital Economy Thailand in collaboration with universities in Thailand. This project aims to encourage the use of new technologies and facilitate the digital transformation of SMEs in Thailand. This project has assisted more than 3,600 SMEs in Thailand (Chernbumrongs et al., 2021). The digital technology used in this project includes the latest technologies such as e-Commerce, Internet of Things, ERP, CRM, POS, and others. This project involved around 2,400 students from 13 universities trained to become digital human resources to help implement the digital transformation process in Thai SMEs.

### **b. The Important Role of Private Companies, Universities, and Society**

Of course, not only the government that can play a role in helping to increase the readiness of MSMEs to carry out digital transformation. Parties outside the government, such as the private sector, universities, and non-governmental organizations, can also assist MSMEs. For example, Fechtelpeter et al. (2018) offer a pattern of collaboration between MSMEs and research and technology organizations (RTOs). The RTO, in this case, acts as an innovation center that oversees MSMEs in managing their innovation potential. Experts at RTO act as researchers and developers of digital technology, which can later be transferred and utilized for the benefit of the digital transformation of SMEs. Experts from the RTO can support MSMEs in assessing, planning, and implementing new technologies.

The private sector can also act as consultants who provide technical assistance to MSMEs in preparing their digital transformation process. This has been done in several developed countries, such as Germany (Fechtelpeter et al., 2018). Indonesia has also done this. However, the intensity and quality need to be increased considering many MSMEs in a country. Non-governmental organizations, national and regional, can also play a role in the digital transformation process for MSMEs. This collaboration between the government, the private sector, universities, and non-governmental organizations, if carried out with good planning and coordination with the majority of MSMEs, will further accelerate the occurrence of effective digital transformation, reducing the digital gap that exists between MSMEs in both at the national and regional levels (ASEAN and G20).

### **c. The Role of ASEAN and the G20 Countries**

Currently, the G20 has issued G20 commitments to support world trade and investment responses to Covid-19, for example, related to trade regulation, operations of logistics networks, support for micro, small and medium-sized enterprises (MSMEs), supporting the multilateral trading system, building resilient supply chains, and strengthening international investment. Some of these commitments have also entered the realm of the digital economy involving MSMEs, for example, “Encourage G20 Digital Ministers to promote the application of online services and e-Commerce” and “Encourage enhancement of communication channels and networks for MSMEs, including through deepened collaboration with the private sector”,

“Ensure the transparency and availability of trade-related information and global market information useful to MSMEs, noting inputs from the Business 20”, and “Encourage connection and policies to strengthen the cooperation between multinational corporations and MSMEs, noting inputs from the Business 20”. However, of all the existing commitments, no initiative have led to increasing the ability of MSMEs, especially in developing countries within the G20 group, to carry out effective digital transformation. ASEAN and G20 countries need to increase cooperation between nations, for example, by sharing best practices on how ASEAN and G20 member countries help MSMEs in their digital transformation process. High-income group countries in the G20 need to increase cooperation with medium-low-income countries in the G20 for increased technical assistance and capacity building for MSMEs.

## **6.9 CONCLUSIONS**

The pandemic has changed business environment drastically and driven digital transformation. Digital transformation occurs in all sectors, both private and public sectors. MSMEs cannot be separated from the phenomenon of digital transformation. MSMEs must adapt quickly in the pandemic era to survive and develop further in the post-pandemic period. Digital transformation requires serious effort from within MSMEs. The government must also support MSMEs to implement the digital transformation well and not be left behind by large-scale companies. Digital transformation is a continuous process that must be taken seriously.

The government, private companies, universities, and community institutions are expected to oversee the digital transformation process of MSMEs. However, it should be realized that the digital transformation process of MSMEs in every country is not the same. One factor that distinguishes MSMEs’ readiness for digital transformation is the extent to which digital technology is ready at the country level. The Network Readiness Index is one of the indexes used to assess the extent to which a country’s digital transformation readiness can be used as a parameter of a country’s digital transformation readiness. NRI data for the last three years shows the inequality between nations, for example, in the ASEAN region, and between countries in the G20. If this inequality is not addressed, it will cause the economic recovery process due to Covid-19 to be uneven.

Countries with an adequate level of readiness for digital transformation will be better at improving their economy than countries with a lower level of readiness for digital transformation.

There is a need for awareness of this and the need for international cooperation between countries worldwide, especially countries in ASEAN and the G20. In its capacity as the G20 presidency in 2022, Indonesia needs to promote these cross-country collaborations between ASEAN and G20. These collaborative initiatives, if carried out well-planned and implemented, can reduce the gap in readiness for the digital transformation of MSMEs between developed and developing countries in the G20. If the gap in digital transformation readiness between countries is significantly reduced, the economic recovery due to the pandemic will occur evenly; there will be no k-shaped recovery but a global v-shaped recovery (Portulansinstitutefrei.com). If this happens, then the G20 motto carried by Indonesia will be even more meaningful: **Recover Together, Recover Stronger**.

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## CHAPTER-7

# UNDERSTANDING DIGITAL TRANSFORMATION IN PUBLIC ORGANIZATIONS: DISRUPTIVE ENVIRONMENT, GOVERNMENT POLICY, AND PUBLIC SERVICES IN INDONESIA

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### 7.1 BACKGROUND

The ubiquity of smart devices and evolving digital communities are promising easier life and more productive society in many parts of the globe. Much of such promise has been set forth in various concepts of Industry 4.0, Society 5.0, and many theoretical explanations about how nations would transform into digital and modern society. However, the massive use of Information and Communication Technology (ICT), the new hypes for Internet of Things (IoT), the advance of Artificial Intelligence (AI) do not always result in more prosperous and equal society and better quality of life. Not only because there is a risk of aggravated disparity due to the digital divide, but also because much of digital transformation is not supported by adequate and appropriate public policy from the parts of government agencies. Uncomprehensive public policy, short-sighted decision making, lack of sense for priorities and flaccid culture within the government bureaucracy are partly to blame for failures in digital transformation.

This chapter is aimed at explaining the most pressing issues with regards to public policy, digital governance and digital public services in Indonesia. Three elements of theoretical explanation will be presented to provide a

framework for analyzing these issues. First, the theory on sharing-economy and disruptive environment will be explained to provide better understanding about the new public policy challenge under governance 4.0 environment (Christensen, 2016; Schwab, 2017; Harari, 2018). An analysis on case of the Indonesian Government policy on application-based transport will be presented. Second, the theory on digital governance aims to provide the ideals of how the government should respond to new challenges with the availability of information technology. The Indonesian experience might not represent actual issues in developing countries as there are various elements and variables to be considered with regards to digital governance. Nevertheless, a country-based case might help to understand general issues that are faced by decision makers in developing countries. Three, the role of government in using ICT and the new digital environment to provide better services for the society is fundamental in any forms of digital transformation. Therefore, empirical explanations on whether or not information technology would improve public services will be provided. It is expected that the Indonesian experience might be referred to as a lesson for the G20 member countries, of which many are still struggling to formulate the best policy for harnessing the new digital environment in order to provide the best for the society.

## **7.2 SHARING-ECONOMY, DIGITAL GOVERNANCE, AND PUBLIC SERVICES**

There have been many terms to represent business processes under digital environment. Among others, the most currently cited terms are “sharing economy”, the “gig” economy, the platform-based economic activities, or the mesh economy. Dredge and Gyemonthy (2015) listed out 17 terms related to sharing economy, including social sharing, collaborative consumption, and peer-to-peer economy, while Ranjbari et al. (2018) found no less than 67 different definitions in the current literature. One of the simple definitions states that sharing economy is a system of consumption that “takes place in organized systems or networks, in which participants conduct sharing activities in the form of renting, lending, trading, bartering, and swapping of goods, services transportation solutions, space, or money” (Möhlmann, 2015).

In practice, what is meant by scholars as sharing economy actually contains a broad range of industries and occupations. There are platforms



with highly skilled and specialized workers with direct access to work and “loose” connection between the company and its “employees”, such as Topcoder, Expert360, and Kaggle. However, there are some other platforms that make it possible to access low cost and relatively “unskilled” labor such as Uber, Taskrabbit, formerly Homejoy (Wright et al., 2017) and Go-Jek for the Indonesian prominent case that will be discussed in detail. Therefore, it would be a mistake to interpret that sharing economy is always related to sophisticated or highly trained IT workers because the main fundamental concept is the use of technology platforms to link the providers and the consumers.

Under such general terms, the perspectives that are used for defining the contents and explaining the phenomena can be varied. Schor (2016), for example, categorized sharing economy products into four main types: recirculation of goods such as eBay and Craigslist, increased utilization of durable assets such as Airbnb and Uber, exchange of services such as TaskRabbit and Zaarly, and sharing of productive assets such as Hackerspace and Skillshare. Meanwhile, Palgan et al. (2017) using the nature of sharing the platform types into three categories, namely: rental such as 9flats, Airbnb, and HomeAway; reciprocal such as Behomm, Guest to Guest, and Home Exchange; and free such as Be Welcome, Trustroots, and Couchsurfing. All of these categories might encompass a broad range of services that can be included in the concept of sharing economy.

In many developed countries, the sharing economy covers a wider range of peer-to-peer activities in which most of the actors consider the societal consequences and push for the non-commercial concepts. However, in most developing countries, the working platforms are mostly to accommodate the commercial activities while the platforms for social and/or altruistic purpose is less popular. For example, Gifood is a downloadable application aimed at connecting the people who have food excess and those who need consumable food. The idea is to prevent so much food waste that cost the society of a staggering amount of Rp330 trillion every year in the country (*Kompas*, 19/5/2022). It is developed by Gadjah Mada University students, who worked with big restaurants and canteens and connect the information about good food excess to those who need it for free. Initiated in December 2017, Gifood has been used by 3,500 users in September 2018. The startup venture is also won Hackathon, Best Fintech App, and other Indonesian

awards ([www.startupfounder.id](http://www.startupfounder.id)). Nevertheless, this non-commercial application has not been able to reach out more people and its development remain stagnant. On the other hand, Go-Jek as the commercial application for transport have been able to get more users in comparison to Nebengers or Noompang, the Indonesian non-commercial sharing economy platforms that are resemble to Ridesharing or Mitfahren in Germany.

The general perception on the sharing economy activities is still divided between those who are optimistic with its sustainability and those who are worried that the disruptive innovation would create hyper-consumption, over-exploitation, and further put global environment in danger. Using an analytical tool for identifying how actors are framing the sharing economy concept, Martin (2016) presented that those who have positive perceptions are generally framing the concept of sharing economy as: an economic opportunity, a more sustainable form of consumption, and a pathway to a decentralized, equitable, and sustainable economy. On the contrary, those who have negative perceptions are generally framing it as: creating unregulated marketplaces, reinforcing the neo-liberal paradigm, and it is considered as incoherent field of innovation.

### **7.3 POLICY WOBBLES UNDER DISRUPTIVE ENVIRONMENT: THE CASE OF GO-JEK**

As a typical developing country, the provision of public transports in Indonesia is not fast enough to keep up with the pace of urbanization and the increasing population. Trains, buses, and smaller vehicle transports are available in big cities. However, due to its limited numbers and inconvenience, using such facilities is not always practical for people to go to their office and to reach remote areas. Therefore, private transports such as cars and motorcycles are significantly increased in most Indonesian cities during the last three decades. In 2020, there are 15.79 million private cars and 115.02 million motorcycles are only 5.31 million trucks, buses and pick-up vehicles (Central Bureau of Statistics, Katadata). Although it is understood that riding a motorcycle for work is riskier than driving a car, people remain op to use motorcycles. Motorcycles are a cheaper alternative to cars and in China, India, Nigeria, Bangladesh and Indonesia, as cars are beyond the means of average family.

Since 1980s, in many cities where residences are not accessible by buses and cars, people use their motorcycles to offer services to short distance rides. This mode of transport is popularly known as “*ojek*”. In 2010, a completely different kind of *ojek* company was established by Nadiem Makarim, a young entrepreneur who formerly work for McKinsey in Jakarta. He named his company Go-Jek, with the typical business mission for tapping the demands of frustrated commuters in Jakarta who have to live with notorious traffic congestion in their daily activities. Go-Jek drivers were among the early adopters of motorcycle ride-hailing services who received orders by phone, SMS (short messaging service), and BlackBerry Messenger (BBM).

In January 2015, Go-Jek launched its first application software to connect drivers with their consumers. With the more wide-spread smart-phone users in the country, the Go-Jek application was really a hype. A report recounted that within three months Go-Jek application had been installed 131 thousand times and the number of its drivers rose from 700 to 3,700 (*Antara*, 8/04/2015). Go-Jek was not the first operating app-based ride-hailing service in the country. There were two strong competitors; Uber, a company based in the USA, and Grab Car that is based in Malaysia, both were launched even earlier in 2014. Yet the general perception that Uber and Grab were meant for car taxis while Go-Jek was mainly motorcycle taxis could help Go-Jek as the first mover in the industry.

Go-Jek management moved more aggressively by developing more *layanan daring* (online services) to meet the demand of the more enthusiastic customers for various services. The brand of motorcycle services was changed into Go-Ride with additional car services under Go-Car. Courier and removal services are operated with Go-Send and Go-Box. Food purchasing and retail shopping are served with Go-Food and Go-Mart. Even unprecedentedly, cleaning, massage, beauty, and entertainment services can be assisted with Go-Clean, Go-Massage, Go-Glam, and Go-Tix. The customers can also have additional convenience to pay for any Go-Jek related services by using Go-Pay, a virtual wallet that link the customers to their bank account and can be used using ATM, internet, and mobile banking. The geographical coverage of Go-Jek was also quickly expanded, from the main cities in Java Island of Jakarta, Bandung, Surabaya, to the city of

Medan and Padang in Sumatra Island, the City of Balikpapan in Kalimantan Island, and the City of Makassar and Manado in Sulawesi Island.

However, the fact that there was a legal vacuum on app-based taxis has made the government to take stern actions. On November 9th 2015, Ignatius Jonan, the then Minister of Transport, officially stated that app-based transport was “illegal” and must be cleared from streets. The ministry claimed that they did not mind with the business startups and all the entrepreneur ventures, but argued that personal motorcycles and cars should not be used for public transports as it violated Law No. 22/2009 on traffic and road transportation and specifically Government Regulation No. 74/2014 on road transportation. The ministry also sent a notice to the National Police with a request to ban all the app-based transport services and confiscate the vehicles. The same letter was circulated to Regional Police and the provincial governors (*Merdeka*, 17/12/2015).

Following massive strikes and defensive reactions from the old players in public transportation in early 2015, the government banned the app-based transportation companies and vowed, albeit precariously, to reinforce Law No. 22/2009 on road traffic and transportation and the Transportation Ministerial Regulation No. 32/2016 on taxi businesses. Nevertheless, within a few months there were furious criticisms from the experts, enthusiastic customers, young entrepreneurs, and the public at large. Given the fact that the app-based transportation facilities brought about new job opportunities and economic wealth and partly solved the hassles that previously faced by customers, the government then drastically changed the course of policy by allowing Go-Jek and Grab to operate in many Indonesian cities. In May 2018, the government even backed the Go-Jek, with more than 1.2 million drivers and 18 app-based on-demand services, to expand its investment to Vietnam, Bangladesh, and the Philippines.

Although Go-Jek offered new and more convenient ways for commuting and its drivers regarded the system as good job opportunities, not everybody was happy about Go-Jek and all the offered online services. With its convenience and cheaper fares, Go-Car substantially eroded the market of conventional taxi operators. Blue Bird, the biggest taxi company in Jakarta, lost three quarters of its market value in 20 month period after the emergence of Go-Car, Uber, and Grab. The Director of PT Jalur Nugraha Ekakurir (JNE), one of the prominent logistic companies in the country, said

that Go-Send and Go-Box has disrupted its same-city deliveries (Asia News Monitor, 28/06/2017). Organda, the Association of Local Transport Operator, complained that Uber, Go-Car, and Grab do not follow Law No. 22/2009 and are practicing unfair competition against the standard taxi operators.

Jonan's stand on app-based transports resulted in negative responses from non-government agencies and the public at large. BPKN, the National Consumer Protection Board, stated that the policy was too premature and must be reconsidered as it was against the interest of the consumers and the whole economy. Aside from noting that traditional *ojek* has been operating in the country for decades and it helped people's daily activities, BPKN argued that the government had actually acknowledged the motorcycle ride-hailing as one of an important job opportunities ([www.detik.com](http://www.detik.com), 18/12/2015).

Nevertheless, Basuki (Ahok) Tjahaja Purnama, the Governor of Jakarta Capital Province, backed the Organda claims and ordered local police arrest app-based taxi drivers (*Kompas*, 4/03/2016). He argued that all the transport operators must obey the rules on the license, taxes, and safety standard, something that admittedly unclear with regards to app-based taxi services. In fact, the earlier independently employed Go-Jek drivers did not pay for an annual transport permit as applied to the traditional taxi drivers. Then, there were cases that Jakarta metropolitan police confiscated Uber cars and threatened to charge them, although later the cars were returned (*Jakarta Globe*, 5/09/2015; *Berita Jakarta*, 17/09/2015).

However, Rudiantara, the minister of Communication and Information, took a different stand by refusing to ban any mobile transportation apps because a ban would be a blow against Indonesia's growing digital economy. Data from the Central Bureau of Statistics showed that the advent of online taxis has helped to reduce the rate of unemployment in Indonesia. It was reported that transport, warehousing and communication have contributed to create 9.78 percent of new jobs (*Kompas*, 07/11/2016). Some members of the parliament also supported the fact that the online taxis have helped the growth of national economy and created new jobs among urban population (*Merdeka*, 24/03/2017).

Finally, it appeared that the online businesses have gained a full support from the national leadership. President Joko Widodo invited the CEO of online business start-ups, including Nadiem Makarim of Go-Jek, Ferry Unardi of Traveloka, and Achmad Zaky of Bukalapak in his visit to US-

ASEAN Summit ([www.kontan.co.id](http://www.kontan.co.id), 21/10/2015). On the issue of taxation, Uber, Grab, and Go-Jek managements tried to convince the government authorities that they should be designated as technology companies instead of transport companies, and therefore should be treated differently.

In order to accommodate the inevitable fact that people have been accustomed with online transport services, Budi Karya Sumadi, the new Minister of Transport initiated a regulatory framework that allow the use of private motorcycles and cars for online transport services. Ministry of Transport Decree No. 32/2016 provided for the first time that online transport services are legal. Nevertheless, direct recruitment of the Go-Jek drivers must comply with the government regulations on licensing (which means a non-tax revenue to the government), the drivers must have driving licenses, the company’s regulations on tariff must be reported to the government, and the private motorcycles and cars being used must be registered as public transport facilities.

Table 7.1 Policy Multiple-Rationalities on App-Based Transport Services

No.	Criteria	Remarks
1	Technical	It is ubiquitous, government cannot simply crack them down (As of 2018, Go-Jek has 1.2 million drivers in 50 Indonesian cities). Smart-phone users, and access to app-based transports, increased substantially.
2	Economic	It creates new job opportunities. GDP growth is strongly supported by tech investments. Sharing economy and peer-to-peer businesses are the inevitable models at present and in the future.
3	Legal	It is not in line with conventional industrial relations. The regulatory frameworks cannot keep up with rapidly changing business alliances. Policy directions must be comprehensive and anticipative to advanced technology applications.
4	Social	Consumers are seeking the most user-friendly applications. Public opinions are quickly changed with the social media; government must be responsive in all fronts. The government have to protect the disrupted workers, new business must be inclusive.
5	Substantive	App-based transport services do not necessarily solve stubborn issues of traffic congestions in big cities. It is fundamental to prevent monopoly and to create equal and fair policy on various modes of transportation.

Source: Adapted from Various Sources

The wobbling and evidently incoherent policy on Go-Jek, Grab, and other app-based transport services are not only because of its tendency for using formalistic and regulatory approach, but also because of insensitivity to new digital and disruptive business environment. Learning from the twists and turns of the Indonesian government policymaking, the new phenomena of sharing economy, and the challenges of governance 4.0 environment, it is crucial that all decision makers must be able to use more comprehensive and anticipative criteria in order to make the best policy directions in the future.

For the government or public policy makers, therefore, a model that is accommodated from literatures of policy analysis written by Dunn (1981), Weimer and Vining (1992), and Fischer et al. (2007) need to be developed. In general, such literatures talk about multi-criteria to analyze the best policy direction to be chosen among available alternatives. As concisely described in Table 7.1, the government policy direction on app-based transport services must be based on multiple and comprehensive criteria in order to give its benefits for all, and it appears that a level of playing field for all the taxi operators is the key. The government must be able to address issues on monopoly and ethical standard in order to create equal treatments for all. Complexities surrounding ownership and cash flows of Go-Jek drivers, for example, could result in dwindling tax revenues for the state (Klyngé and Rehnberg, *Jakarta Post*, 11/09/2016). The most fundamental element under substantive criteria is the fact that Go-Jek and other app-based transport might not able to solve the problem of traffic congestion in Indonesian big cities. Along with this are other pressing issues such as air pollution, public health, fossil fuel, and energy crisis, all that are ultimately related to the global issues of climate change.

The pattern of tech businesses on the global level is a combination of disruption and gradual evolution. The application technology in smart-phones, which easily connect people at the global scale, is undoubtedly brings about opportunities. Any competitive businesses will have to be ready for rapid changes, all that need courage and agility. But the government must ensure that nobody is left behind under such rapid changes and fierce competitions.

## **7.4 TRANSFORMING TOWARDS DIGITAL GOVERNANCE: THE INDONESIA EXPERIENCE**

The strategic master-plan for E-Government and/or Digital Governance in Indonesia can be found in national documents drafted before the political reform in late 1990s. This could be seen, for example, from the document of SIMNAS (National Management Information System) drafted in 1987 and the Nusantara-21 Project in 1997, both of which consist of frameworks to connect the archipelago with ICT. Unfortunately, the national comprehensive plans were not adequately carried nor implemented consistently. The content of SIMNAS document was too general and was not referred as a guideline for government agencies at the national and sub-national governments. The Nusantara-21 Project was quickly discarded when the country was hardly hit by the economic crisis and the national political landscape was substantially changed in 1998.

After the large-scale political reform, several government regulations were issued. Most of the regulations were related to the use of ICT and national task-forces to carry out policies on e-Government. More specifically, the regulations are:

1. Presidential Decree No. 20/1999 on National Telematics Coordination Team (TKTI), that is subsequently replaced by Presidential Decree No. 50/2000 and then Presidential Decree No. 9/2003. TKTI was a team consisted of government agencies, private sector representatives, and the community elements. The objective was to coordinate ICT-related activities at the national level.
2. Presidential Instruction No. 2/2001 on utilization of Indonesian language for computer applications.
3. Presidential Instruction No. 6/2001 on ICT development and use in Indonesia. For the first time, the government acknowledged the importance of incorporating ICT use in the Five Year Development Plan.
4. Presidential Instruction No. 3/2003 on national policy on e-Government development. Together with the national policy on decentralization, this regulation is aimed at encouraging provincial and local governments to consider e-Government as an important tool for improving public services quality.



In general, the Indonesian government approach to transform itself and to adapt with digital environment in the earlier stage was somewhat normative and legalistic. The basis for the government policy was not linked to the empirical issues and the challenges that had been brought about by ICT. The fact that conflicts and personal relations could be highly affected by the use of information technology, new media, the internet, and mobile smart-phones, were not anticipated appropriately. That is why the spirit of this legalistic approach should be followed through by actual policy transformation. It is true that the extensive use of ICT has opened a great opportunity to manage large-scale information efficiently and accurately. Therefore, the use of ICT should also increase effectiveness, transparency, and accountability of the government agencies. However, the strategic implementation of e-Government has to be able to foster better understandings about the people's need, to ensure professional services and to maintain integrity of all the government agencies at all levels. The ultimate goal of using information technology is to create good governance and to ensure that public services can be delivered efficiently, professionally, and equally for all citizens along with the people's demands and expectations.

Hence, it is important to ensure that the legal provisions on e-Government should be adequately translated into measurable indicators and by doing so the achievement of the policies can be evaluated accordingly. The national policy that has been laid out in the government regulations, for example, should be implemented with clear guidelines for the decision makers in the government agencies. Figure 7.1 describes the general architecture of E-Government policy in Indonesia. The framework of E-Government architecture, as explained in the appendix of the Presidential Instruction No. 3/2003, consists of four layers:

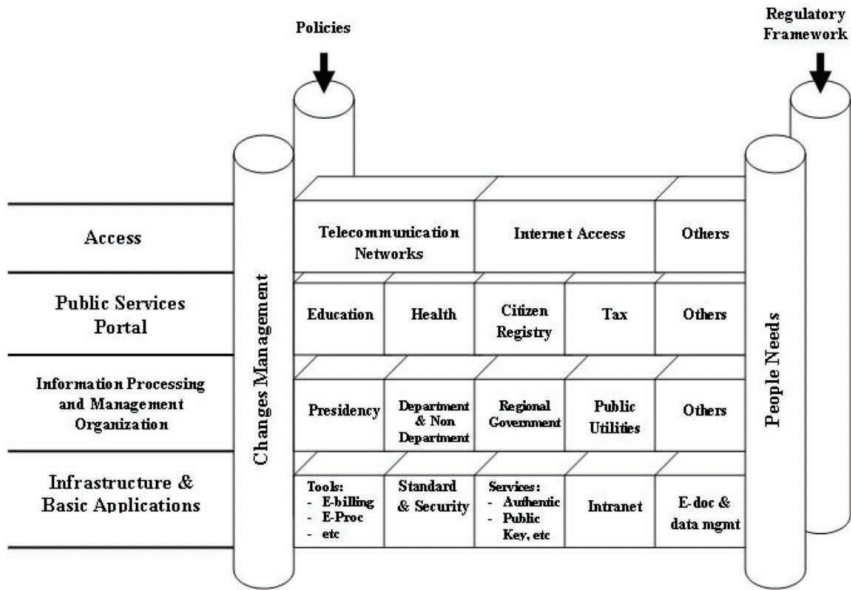


Figure 7.1 The Architecture Framework of E-Government  
 Source: Presidential Instruction No. 3/2003

1. Access, which contains networks of telecommunications, internet infrastructure and other communication media that can be utilized to support public service delivery.
2. Public service portal, which contains websites for the integrated systems of public services, such as national identity numbers, education, health, taxation, and others.
3. The organization for managing and processing the information, which contains strategic government agencies that undertake manual as well as electronic documents.
4. Basic infrastructures and applications, which contains all the hardware and software that are necessary to carry out information processing in a reliable, accurate, and secure manner.

Along with the transformation of the Kementerian Penerangan (Ministry of Information) during the New Order Government under President Soeharto to the Kementerian Komunikasi dan Informasi (Ministry of Communication and Information) under post-reform regimes, there have been a lot of

policy changes as the country went through accelerated democratization in nearly all aspect of the society. In order to describe the ongoing digital transformation that is prepared by the government and general public organizations, two areas of public policy merit to be highlighted: (1) The SPBE (Sistem Pemerintahan Berbasis Elektronik) program that is basically formulated by the Ministry of Administrative Reform (Menpan), and (2) The smart city program that is formulatid by Ministry of Communication and Information (Menkominfo).

#### **a. The SPBE Program**

In response to the fact that substantially larger number of people are engaging in activities with the ICT and that features of public services would be depended on electronic equipment, the government and the lawmakers in the parliament enacted two relevant laws, namely: Law No. 11/2008 on information and electronic transactions, and Law No. 25/2009 on public services. The first was aimed to ensure that people are well protected in any activities involving ICT, especially with the increasing use of e-Commerce and the social media via the internet. The second was to give a legal basis for efficient and responsive services that are increasingly needed in a modern system of governance.

However, having been implemented for almost a decade, the laws on information and electronic transactions and on public services could not significantly increase the role of e-government in public services. People complained Law No. 11/2008 has in fact resulted in a negative impact as there were cases of certain individuals being prosecuted for defamation while using the social media via the internet. Law No. 25/2009 has not been able to increase the quality of public services as it mainly laid out the principles and code of conducts within the government agencies, and it could not force individual public officials to perform better using all the knowledge and available technology. The use of digital technology in the government agencies did not change much of the business process and the service delivery. The bureaucracy under the Ministry of Home Affairs remained flaccid and was not opened to new ideas and innovations. Service units under technical ministries (agriculture, transport, trade and industries, etc.) were not adequately supported by the ICT and remained inefficient.

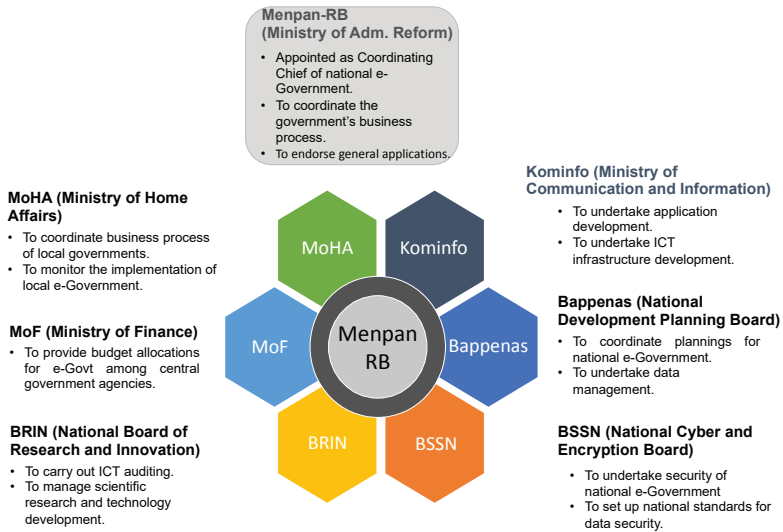


Figure 7.2 The Institutional Framework of the Electronic Government (SPBE)  
 Source: Ministry of Administrative and Bureaucracy Reform, 2021

President Joko Widodo considered that the digital reform within the government agencies could only be implemented if all e-government units are coordinated under the Ministry of Administrative Reform (Kemenpan). Therefore, in 2018 he established the national coordinating team of e-government or the SPBE (Sistem Pemerintahan Berbasis Elektronik) with the Presidential Regulation (Peraturan Presiden) No. 95/2018, in which the Kemenpan is assigned to chair the national SPBE team. The team consists of representatives from strategic ministries and is expected to formulate e-government policies and to implement it accordingly. Officially, the regulation laid out that the SPBE team is assigned to coordinate policies on e-government at the national and sub-national levels, to harmonize regulatory frameworks for e-government, to supervise technical teams at different level of governments, to monitor the e-government programs regularly, and to promote e-government literacy.

As described in Figure 7.2, the Ministry of Administrative Reform is assigned to chair the national SPBE team and to work with six strategic ministries and agencies, including the Bappenas, Ministry of Finance, Ministry of Home Affairs, Ministry of Information and Communication, the National Board of Research and Innovation (BRIN), and the National Board

of Cyber and Encryption (BSSN). Huge and ambitious tasks to coordinate national policies, to supervise the implementation, and even to endorse applications among technical ministries are given to this team. Details of the programs, as described in the architecture of SPBE in Figure 7.3, also cover a wide range of activities such as formulating policies, preparing budgets, arranging technicalities such as ICT and government platforms, managing national data, and endorsing general as well as specific applications.

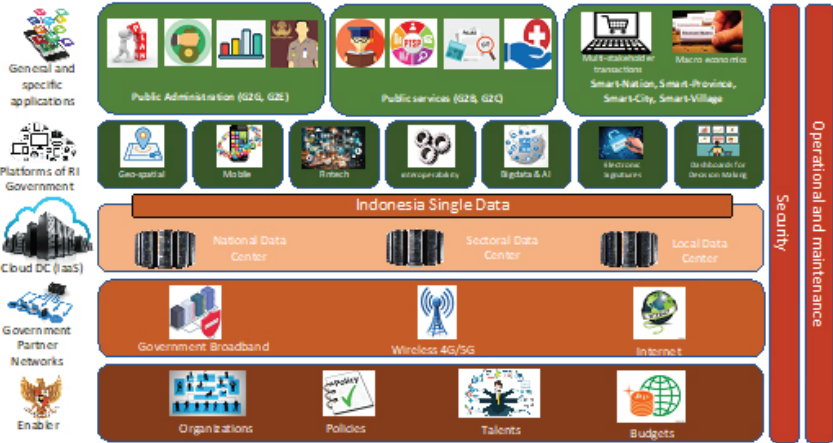


Figure 7.3 The 4.0 Architecture of SPBE  
 Source: Ministry of Administrative and Bureaucracy Reform, 2021

As the Kemenpan has already overwhelmed with its routine task for planning and allocating the manpower for national agencies while the ministry is obviously lack of resources to carry out such huge and wide-range of tasks in SPBE, it turned out that the team has been using more regulatory than facilitating approach. Although regular meetings among the ministerial representatives are held, not many strategic policies are resulted from the SPBE team chaired by the Kemenpan. In fact, for the development of applications to support their functions, MoHA, MoF, and Kominfo have been working separately without consulting to the members of the national SPBE team. The MoHA, for example, has been developing the system for national identity card and manage the citizens’ data almost exclusively. The similar tendency also applies for the MoF in developing the system for taxation, and for the Kominfo in developing infrastructures

for the internet broadband connection. Therefore, the idea to nationally integrate e-government policy is failed. Lack of leadership, silo-mentality among ministries and agencies, and limited resources within the Kemenpan are the fundamental pitfalls in the SPBE program.

### **b. The Smart City Program**

The idea of smart city came forward with a strong sense that widely available ICT should be able to support an urban life that is using resources more productively and efficiently, which in effect reduce costs and save more energy, increase quality of life and ensure sustainable development. The role of government, corporates, communities and people at large is crucial in order to develop a digital and intelligent society (Lombardi et al., 2012). The conceptual basis of a smart city, therefore, is not only that a city should be governed and operated using seamless ICT, but it is also supported by creativity-driven people with fundamental principle of sustainability. Information technology, the broadband connections, and all the digital infrastructures constitute the means to achieve more substantial objective: a productive society with better quality of life and sustainable use of resources.

In 2010, *Warta Ekonomi*, a prominent economic magazine initiated a collective evaluation on the use of ICT in Indonesian cities. Since then, the importance of ICT in building quality life in Indonesian cities has taken up by various institutions, including the seminal conference held by Universitas Gadjah Mada in 2014, the Institute of Bandung Technology in 2015 and the introduction of systematic evaluation on smart city by the Bappenas in 2016. After Surabaya, Bandung, and Bogor were awarded as smart cities, many local government authorities were motivated to adopt the new way of planning cities with the ICT. For his second term in office, President Joko Widodo in 2019 envisaged the importance of infrastructure development and bureaucracy reform, which in effect urged ministries and central government agencies to give priorities for developing smart cities.

Unlike the SPBE program that was primarily coordinated by Kemenpan, the smart city program was led by the Ministry of Communication and Information (Kominfo), which already has a strong portfolio on information technology. In 2017, Kominfo started a nation-wide smart city program, by setting a target that staffs and decision makers in at least 25 cities/districts

and provinces have to be trained to upgrade their knowledge and skills on smart cities. A concept similar to those that have been stated by Giffinger et al. (2007) is adopted to provide a framework for the trainers, who are called mainly from Indonesian outstanding universities and think-tank institutions. Smart city concept is spelled out further to include: smart governance, smart economy, smart branding, smart society, smart living, and smart environment.

The theme for programs each period of programs varied according to the local potential sectors formulated by the Kominfo. For example, in 2021 Kominfo gave priorities to districts and cities that have potentials in tourism industry. Then, in 2022 Kominfo give priorities to districts that are close to the newly designated capital (Ibukota Negara Baru) in the Province of East Kalimantan and those which have met the technical criteria for smart cities. According to Kominfo, the stages to build smart cities in Indonesia can be divided into four levels of grand strategies as follows:

1. Level-1, Preparation:
  - (a) Production of sites of information in all agencies
  - (b) ICT human resource management
  - (c) Access for ICT, such as Multi-purpose Community Centers, Internet Kiosks, SME-Centers, etc.
  - (d) Dissemination and socialization of information sites
2. Level-2, Maturity:
  - (a) Production of websites for interactive public information
  - (b) Inter-connections among government agencies
3. Level-3, Stabilization:
  - (a) Production of websites for transactions in public services (taxes, licenses, voucher provisions, etc.)
  - (b) Interoperability among data centers and applications in government agencies
4. Level-4, Utilization:
  - (a) Production of seamless applications for services
  - (b) Integrated services based on the Government-to-Government (G2G), Government-to-Business (G2B), and Government-to-Community (G2C) interactions

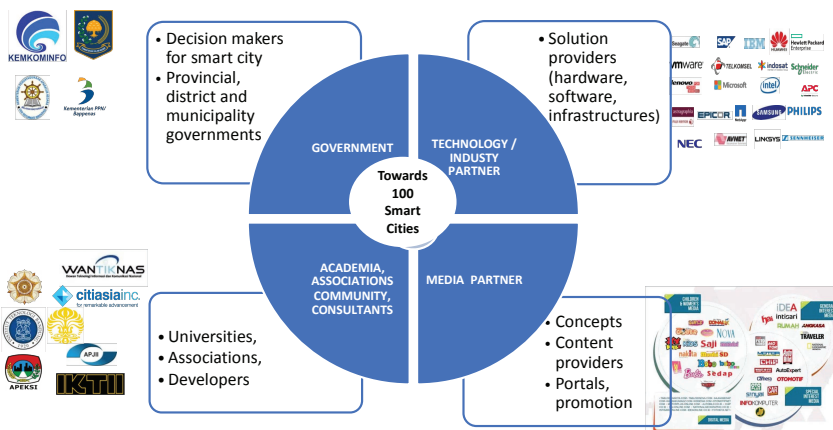


Figure 7.4 Partnerships in Building Smart Cities  
 Source: Ministry of Communication and Informatics, 2021

As described in Figure 7.4, the smart-city undertaking requires close collaborations among the government, academia and think-tanks, technology and industry partners, and media partners. All such collaborations and partnerships would be the key for encouraging the six dimensions of smart city as stated by the Kominfo: smart governance, smart economy, smart branding, smart society, smart living, and smart environment. Therefore, the success of smart city program is not only depended on the government initiatives, but also how such initiatives are communicated and collaborated with other partners in private companies, think-tanks, communities and the people at large.

**7.5 SERVICE-ORIENTED USE OF ICT: BREAKING THE MENTAL BLOCK**

As explained in the earlier sections, disruptions in many aspects of businesses are inevitable and people have just to live with it. Not only that ICT disruptions would change the way people are doing businesses, but also the way the government actors should make decisions and carry out public services according to the changing demands of the people. All countries are competing to have a leading edge in ICT, and by doing so to keep up with changing demands for efficient services, and the ordinary people also have to be able to adapt with disruptive environment. The availability of



microchips at significantly lower cost is an essential part of such disruptive environment. Amid the pandemic, the value of microchip sells around the globe in 2021 was USD 555.9 billion, an increase of 26.2 percent. Chinese companies that are able to produce microchips at a lower cost would disrupt the world's digital environment ([www.cnbc.com](http://www.cnbc.com)).

Within the new dynamics of disruptive environment, the government should not only make strategic policies based on reactive measures. The government should be ready to openly collaborate with stake-holders from various organizations. Conventional public management should be replaced with new paradigms of networking, cooperation, and concerted actions. On the Indonesian context, research shows that the failures of electronic governance are frequently attributed to organizational culture, bureaucratic flaccid, issues of coordination, and lack of initiatives to collaborate with private companies, non-government institutions, and other elements in the society (Utomo et al., 2020). There is an urgent need to break the mental block among decision makers within the government.

Aside from providing adequate infrastructures, the government must be ready to facilitate more valuable use of digital technology. The availability of digital equipment at a lower cost created a lot of opportunities for new entrepreneurs and small-scale businesses. But research found that technology adoption and the use of digital technology might result in both positive impacts, such as optimism and innovation, and negative impacts such as discomfort and insecurity (Rosalina et al., 2020). The actual benefit of digital technology can only be realized if entrepreneurs have the skills and capacities to seize business opportunities (Hartanto et al., 2021). There are also cases of negative side-effects from using digital technology in developing societies. In Indonesia, there are issues of negative effect from the extensive use of internet and electronic gadgets such as game addiction, online gambling, child pornography, cyber-bullying, and any sort of cyber-crime (Sugihartati, *Kompas* 22/06/2022). Hence, digital literacy should be included as an integrated part of the electronic governance and smart city programs in the country.

The success of using digital technology is depended on administrative orientation towards intensive engagement with the citizens. Other studies found out that prioritizing efficiency over participation and community responsiveness can marginalize technology enactment for participatory

activities and processes (Zhang and Feeney, 2020). To ensure that initiatives for smart cities are bringing about benefits for all, the use of digital technology should be able to promote active participation and to improve the quality of public services according to the people's expectations. The smart city projects and any ICT adoption policy should not only aim at improving image and legitimacy, but should also achieve more fundamental goals such as increasing citizen trust and strengthening democracy.

Again, digital transformation is very much depended on the willingness and the commitment of government leaders to engage with many elements in the society. Comparative studies on smart cities suggest that leaders should be able to look beyond the technology, to move towards collaborative model, to combine top-down and bottom-up approach, to build strategic framework, to establish smart city accelerators, and to adopt an integrated intervention logic (Mora et al., 2019). At the local level, it is crucial to help the people to take ownership over technical devices and over their life, which means that the idea of smart cities should put the citizens at the centre of the goals and put the inhabitants at the heart of the design and decision-making process (Mancebo, 2020).

In relatively paternalistic social systems of many developing countries, political will is the key for success in digital transformation. Having been carrying out e-government programs since late 1990s and smart city programs since 2016, it turned out that political will has a significant effect on policy implementation in Indonesia (Defitri, 2022). Even for some technical aspect of setting the priorities for digital infrastructures, local leaders' political will and human resources on IT appeared to be the crucial determinants (Antoni et al., 2019). The commitment and role of district heads have been particularly crucial for the implementation and the optimum result of e-government programs (Yusuf et al., 2020).

Finally, it is fundamental to consider that digital transformation should not only consider application of ICT, faster data processing, and other efficiency goals. All of the efforts have to be directed to achieve more substantial goals, such as participatory public services, open governance, and clean bureaucracy. The big data on head-count poverty in a district, for example, can be processed more efficiently with a greater accuracy with digital technology. Nevertheless, the use of such data to deliver appropriate

programs to alleviate poverty in the district is much more essential benefit, which make digital transformation more meaningful for the people.

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## CHAPTER-8

# DIGITAL TRANSFORMATION AND LOCAL GOVERNANCE

Achmad Djunaedi

### 8.1 INTRODUCTION

The development of information technology affects changes in business processes. Furthermore, changes in business processes affect the way to compete (especially in business/business world). Digital transformation in the business world has been going on for a long time and is experiencing rapid development, while digital transformation in government has just started and is running slower. Thus, digital transformation in government needs to learn a lot from similar efforts in the business world. However, the public sector or government is different from the business world, so knowledge of digital transformation in the business world needs to be adapted to government by adjusting to the conditions of the public sector or government. Examples of digital transformation in government that have begun in Indonesia are: the e-Government movement, and the Smart City movement.

Before continuing the discussion about digital transformation, it is best to first understand what is meant by digital transformation. There are many definitions of this in the literature. Morakanyane et al. (2017) state that digital transformation is an evolutionary process. The process relies on the ability of digital technology to create or change business and operational processes as well as customer and employee experiences to create new value. This understanding is reinforced by Citrix who states that digital transformation

is the strategic adoption of digital technology. The technology can be used to improve business processes and productivity, provide better customer and employee experiences, manage business risks, and be able to control costs.

Around the world, governments implement digital transformation for various reasons. One of the reasons is the changing of citizen's satisfaction and experiences, so citizens demand that government services and business processes also need to adapt. This transformation occurs at all levels: local, regional, national, and global. According to the i-scoop website, the reasons for local and international drivers to carry out digital transformation in government, among others, are to raise the level of efficiency and transparency, improve and align processes, realize smart government and smart city, invite new investors, bridge the digital divide, remodel government transaction services, realize data-based governance, provide better access and management of information, increase citizen satisfaction and trust, meet rapidly changing demographic needs, and balance costs while optimizing efficiency.

## **8.2 THE BEGINNING OF DIGITAL TRANSFORMATION IN INDONESIA**

Before going into the discussion of digital transformation in Indonesian local governments, we need to understand the current condition of Indonesia from many aspects related to ICT. Indonesia has around 250 millions population, around 17 thousands islands, and around 746 local languages. These conditions affect the availability of, among others: ICT infrastructure, ICT human resources, quality of public services, and economic growth rates (which are varied from one region to another). Regarding local government, Nurdin et al. (2012) explained that "Indonesia has a unique local government power structure where the greatest autonomy is transferred to the second level of local government (regencies and cities) not to provincial levels; the Indonesian central government has granted full autonomy to the regencies and cities levels to manage their development (except law, monetary, defense, and foreign affairs)."

Digital transformation has become a global need, all countries need to undergo it. Likewise, local governments in Indonesia have started to carry out digital transformation starting in 2003 in the form of the e-government movement. Currently departing from e-government, local governments



in Indonesia have gone further into the form of a smart city movement starting in 2017. The present e-government and smart city movements which focus in the utilization of utilizes information technology need to be developed further by adjusting business processes and organization as well as encouraging stakeholder collaboration. This paper reports on the experience of local governments in Indonesia since 2003 in carrying out digital transformation until now, and this paper also provides recommendations for furthering development of digital transformation in the future.

### **8.3 DIGITAL TRANSFORMATION: E-GOVERNMENT MOVEMENT**

A simple definition of e-government is given by UNESCO (Kumar, 2015), namely: E-Governance is the application of ICT in the public sector aiming to improve information and service delivery, increasing the level of citizen participation in decision-making processes and making government more effective, efficient, accountable, and transparent. More details, Fang explains that “E-Government refers to the use by government agencies of information technologies, such as web-based Networks, the Internet, and mobile computing, that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and/or cost reductions” (Fang, 2002).

E-government in Indonesia was formally adopted in 2003 when the government enacted Presidential Instruction Number 3 of 2003, on National Policy and Strategy of e-Government Implementation. Since that time, many local governments have adopted and implemented e-government. The adoption is supported by the availability of information and communication infrastructure such as telephone lines and the internet. Some cities/regencies had experienced best practices in e-government, such as Jembrana (Bali), Surabaya (East Java), and Special Region of Yogyakarta. However, during the period 2009–2016, the development of e-government in Indonesia was decreasing; probably because of the merging of information technology agency and transportation agency became a single agency (less attention

from the Central Government; decreasing in funding for e-government development efforts). Eventhough, some cities were still developing their e-government in a good achievements, among others is the City of Surabaya (in East Java Province).

According to UN/ASPA (2000, in Fang, 2002), development levels of (web-based) E-Government are as follows: Level 1: Emerging web presence; Level 2: Enhanced web presence; Level 3: Interactive web presence; Level 4: Transactional web presence; and Level 5: Fully integrated web presence. Based on the development levels, e-government progress in 2011, according to Nurdin et al. (2012): 55% is still at the emerging level, 28% have achieved an enhanced level, 17% experiencing interactive level, one local e-government has gained transaction level (that is the City of Denpasar), but none has achived the final level of e-government.

Since 2017, the President of Indonesia has a big concern to the development of Indonesian e-government. In 2017, he ordered several ministeries to further develop e-government in Indonesia: Ministry of Administration and Bureaucratic Reform, Ministry of Communication and Information Technology. Responding to the President's directive, Ministry of Administration and Bureaucratic Reform launched seven e-government applications, namely: Command center, e-Office, e-Salam (public information services), e-Karpeg (Government official ID card information system), e-Data, e-Performance, Seleksi Jabatan Pimpinan Tinggi (SIJAPTI)—selection process of high rank officers. In general, so far e-government in local government includes, among others: one-way or two-way communication websites, information systems for internal use (personnel information systems, payroll information systems, and so on), and online applications for serving the public (usually android-based).

In 2018, the Central Government launched a Presidential Regulation concerning the further development of e-government in Indonesia. Every year, the Ministry of Administration and Bureaucratic Reform conducts a national-wide survey to evaluate the existing conditions of e-government at each government unit in the national level as well as in the local level. Based on the annual survey results, the government hopes to formulate a better policy in the development of e-government in Indonesia.

## **Digital Transformation: Smart City Movement**

Smart city is a city that utilizes the advancement of information technology in managing its city intelligently and efficiently so as to be able, among others: efficient and effective in using resources (reducing costs, saving energy), improve public services, improve the comfort of life, and reduce environmental pollution. The smart city concept covers all aspects of urban life. All aspects of life by Giffinger et al. (2007) are categorized into six dimensions, namely smart governance, smart economy, smart mobility, smart people, smart living, and smart environment.

There is no exact information about when a smart city was developed for the first time in Indonesia. However, in 2010, Surabaya City was inaugurated as rank number one in Smart City Competition held by “Warta Ekonomi” magazine in Jakarta. In March 2014, Universitas Gadjah Mada conducted a national seminar on the Development of Smart Cities in Indonesia. In 2016, the National Planning Board made a presentation about a smart city development concept and mentioned that there were already three cities that had been developed as smart cities: Surabaya, Bandung, and Bogor. Since then, many cities in Indonesia are motivated to become smart cities.

Following India which planned to develop 100 smart cities in three years (2016–2018); the Government of Indonesia (under the coordination of the Ministry of Communication and Information Technology) also has the same plan starting in 2017. In 2017, 25 cities/regencies were selected to join the efforts. In 2018, 50 regencies/cities joined the development. Then in 2019, 25 cities/regencies joined the movement. Indonesia defines a smart city framework that is slightly different from the dimensional framework of Giffinger et al. The framework for the dimensions of a smart city in Indonesia includes smart governance, smart economy, smart branding, smart people, smart living, and smart environment. The difference with dimensional framework of Giffinger et al., the Indonesian version of the framework has a smart branding dimension (see Figure 8.1).

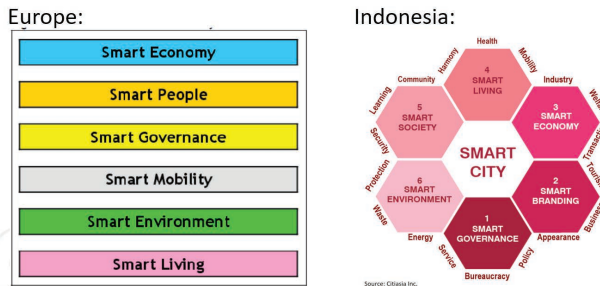


Figure 8.1 Frameworks for the Dimensions of a Smart City in Europe and Indonesia  
 Source: Griffinger, 2007 (left); Kemenkominfo, 2017 (right)

In the 2020–2022 period, the development of smart cities in Indonesia increases with the preparation of smart city master plans for cities and regencies located around 10 national strategic tourist destinations plus the capital of the archipelago. The development of cities and regencies around these strategic tourist destinations is intended to support tourism activities in these locations.

In addition to being implemented in cities and regencies, the smart city concept in Indonesia is also applied at the village and provincial levels. One of the districts that has developed smart villages is Banyuwangi Regency, while the province that has developed smart provinces is the Special Region of Yogyakarta in 2018 (referred to as Jogja Smart Province).

## 8.4 LESSONS LEARNED FROM INDONESIA’S LOCAL GOVERNMENT EXPERIENCE

Basically, e-government and smart city movements are parts of digital transformation in local governments. However, until now in Indonesia there is no institution that coordinates digital transformation which includes e-government and smart city movements. The e-government movement is coordinated by the Ministry of Administration and Bureaucratic Reform, while the smart city movement is under the coordination of the Ministry of Communication and Information Technology. As far as the author observes, the lessons learned from the e-government movement in Indonesia are as follows: difficulty in integrating data across work units, lack of change management efforts, less strong cyber security, no position of chief

information officers or chief digital officers, and unequal distribution of e-government development throughout local governments in Indonesia.

A consultant who has experience helping many local governments in developing e-government, namely Yuniantoro (2022) shows the latest portrait of digital transformation in the Indonesian government, as follows:

1. Regulations: several regulations have been made, including Presidential Instruction Number 3 of 2003 and Presidential Regulation Number 95 of 2018 regarding e-government, as well as Presidential Regulation number 39 of 2019 concerning One Data.
2. Infrastructure: most of the internet network infrastructure is built by internet providers so that the development is less evenly distributed, mostly built on densely populated islands, namely the island of Java. The government is trying to catch up in the distribution of this internet network infrastructure.
3. Digital Services: digital services make use of applications. There are two kinds of applications, namely applications that are standardized by the Central Government, and applications that are innovations developed in each region. The two kinds of applications have their own problems: the uniform application from the Central Government is difficult to implement due to the varying conditions between regions, and this diversity creates an imbalance in the number and quality of applications developed by each region.
4. Data: data management has not become a concern (despite the One Data policy). The main problem is the availability of data and data storage that is difficult to retrieve.
5. Human resources: related to human resources to support digital transformation is still lacking in terms of quantity and quality. In addition, the digital mindset and digital culture have not yet been formed.

In fact, if e-government has developed into smart government and then developed further into smart governance, it can become one of the dimensions of a smart city. Smart government is e-government that utilizes smart technologies. The difference between smart government and smart governance lies in collaboration. Smart governance is developed by collaborating with stakeholders in developing a smart city.

Based on the author's observations since 2017, the lessons learned from the smart city movement in Indonesia can be explained at the national and local levels, as follows:

1. **Integration of National Policies related to Digital Transformation:** smart cities are related to e-government, but there has not been adequate coordination between the ministries that handle smart cities and the ministries that handle e-government. There should be a kind of Coordinating Minister who serves as chief digital officer (CDO) for the development of digital transformation in Indonesia (including smart cities and e-government).
2. **National Policy related to Data Integration (Digital):** it is necessary to start with increasing attention to digital data/information management. Then it is necessary to integrate data vertically (between the Central Government and local governments) and horizontally (between work units within each local government). Related to digital data/information management, it is also necessary to readjust the organization and business processes so that data integration occurs as well as achieving good digital data/information management.
3. **National policies related to local government:** since the essence of smart city development is innovation, local governments need flexibility (to a certain extent) to innovate in digital transformation to support urban management/regional development through smart city movement. When a smart city has developed, which requires a readjustment of the organization and business processes, the local government also needs flexibility in such readjustment. When the smart city has reached the status of collaborating, then flexibility is needed to be able to share public service affairs with stakeholders. The development of smart city types in Indonesia, proposed by the author, is illustrated as in Table 8.1.

Table 8.1 Proposed Transformation of Smart Cities in Indonesia

Smart City 1.0	Smart City 2.0	Smart City 3.0
Prioritizing ICT-based innovation. Smart city development is driven by the communication and information technology.	Prioritizing data integration, and business process integration. Smart city is developed across sectors (not only driven by the communication and information technology).	Smart city is developed in collaboration with all stakeholders. Rearrange the organizational structure and business processes of local government (so that it becomes more streamlined).

Source: Ministry of Communication and Informatics, 2020

Lessons learned from smart city movement in Indonesia in local level, among others, are as follows:

1. Leadership: because there is no obligation to apply the smart city concept, it is obvious that if the regional head is concerned about smart cities, the development of smart cities will be faster. Sometimes, if the regional head ends his/her term of office and is replaced by someone else, then the new leader does not necessarily concern to smart city development.
2. Institutional: according to current policy, it is not allowed to create new work units, so the development of smart cities is only handled by the ad hoc team. At first it was still possible to use an ad hoc team as long as it functioned as a program management office (PMO). Ideally, to develop a smart city, it is necessary to also rearrange the organizational structure and business processes. With the integration and utilization of information technology, the institutional structure and the way it works should need to be reorganized (because the business processes have to be integrated).
3. Planning: a smart city planning document is written in the form of a smart city master plan; but it is not clear where the funding for the implementation of the smart city master plan will come from. What can be done at this time is to “stick” the smart city programs to the RPJMD (middle range regional development plan) and its derivatives so that they can receive funds from APBD (annual regional development budgets). Actually, anything that is planned in a smart city can be listed in the

RPJMD and or its derivatives, because the essence of a smart city is innovation that makes people safer, more comfortable and prosperous in all aspects of life, using information technology whenever possible. So the RPJMD and the smart city master plan have the same goals. In the future, it is better if the RPJMD and smart city master plan are combined becoming a “Smart” RPJMD.

4. Operations and Control: in a smart city development, usually every local government unit is asked to innovate, so that many applications are launched; but actually the number of applications that are effectively used by the community is only a small part. However, these applications are not integrated with each other. So application development (as a form of innovation) needs to be well-coordinated so that it is operational, and also integrated so that all aspects of urban/regional life can be monitored in the “command center” or dashboard.
5. Innovation Development: by whom? Is it charged to each local government unit? Or there is a particular local government unit that conducts research and development that produces innovations to prototypes and conducts trials until an innovation is operational. In fact, we need to “revitalize” the role of research and development institutions in local governments (such as the functions of R&D in large companies).
6. Collaboration/involvement/participation: smart cities require the collaboration of all stakeholders, but currently smart cities are only driven by local governments. Perhaps there has not been enough socialization and promotion to invite all parties to collaborate in the development of smart cities. Is this because there is no particular local government unit that specifically handles (integrated) smart city development?
7. Development of human resources: smart government requires intelligent human resources as well, it is necessary, among others, human resources who master smart technology (such as big data analytics, artificial intelligence, sensors), as well as cyber security, cloud computing, data science, digital information management, and so on. Universities need to have study programs that educate and train the required human resources.
8. Development of digital society and digital culture: the development of digital transformation needs to be inclusive; no one left behind. Therefore, it is also necessary to carry out programs to improve digital



society and digital culture in the community, so that people are able to participate in collaborating in the development of digital transformation in regional and urban life.

9. Change Management: change will not occur only by regulation and orders, but needs to be monitored and driven by systematic change management efforts. There needs to be a team tasked with carrying out change management in the long term to oversee so that digital transformation can occur according to the roadmap that has been prepared.

### **Digital Transformation: Challenges and Recommendations for the Future for Indonesian Local Governments**

Why is the promotion of digital transformation in government inevitable? Government agencies are facing renewed pressure from all directions to adopt solutions that will streamline workflows and save money. From policy mandates to rising citizen expectations, these are some of the factors that make change inevitable. According to Adobe (2016), the benefits of digital transformation are clear: local government units can significantly reduce costs and overhead through a lighter, more efficient infrastructure that requires less IT engagement, reduces development and support, and helps accelerate content deployment and agility. Improving the user and employee experience is the easiest way to improve an agency's image/branding. People are more likely to engage and recommend digital services if they have had a positive experience.

Indonesia has been determined to promote digital transformation. In August 2020, President Joko Widodo said that digital transformation during the pandemic and after the pandemic would structurally change the way of working, doing activities, consuming, studying, transacting, which was previously offline with physical contact, will turn into online. Promoting digital transformation in Indonesia into the future is not without challenges. Based on the lessons learned above, it is possible to predict the challenges that will be encountered in the future and recommendations can be made to deal with these challenges. The challenges and recommendations, among others, are as follows:

The challenge of the first stage: the development of e-government towards smart government. The difference: e-government is about providing services for and engaging with citizens, by increasing the use of internet-

based technology, while smart government is about optimizing the use of data to make decisions by leveraging the dimensions of intelligence, including: open data, AI, big data, and IoT. This can be implemented at a tactical/operational level, a strategic/policy level, or both. Data can come from within the government, outside it, or both.

The second stage of the challenges: the development of smart government towards smart governance (as part of smart city development). Smart governance is defined as the capacity to apply digital technology and intelligent systems in processing information and making decisions; data and evidence-based policymaking; a collaborative, open and citizen-centric form of government.

The challenge of the third stage: the development of smart cities and together towards what we can call a smart nation. We need to formulate the smart nation concept together, perhaps considering the Society 5.0 concept proposed by the Japanese Government (see Figure 8.2).

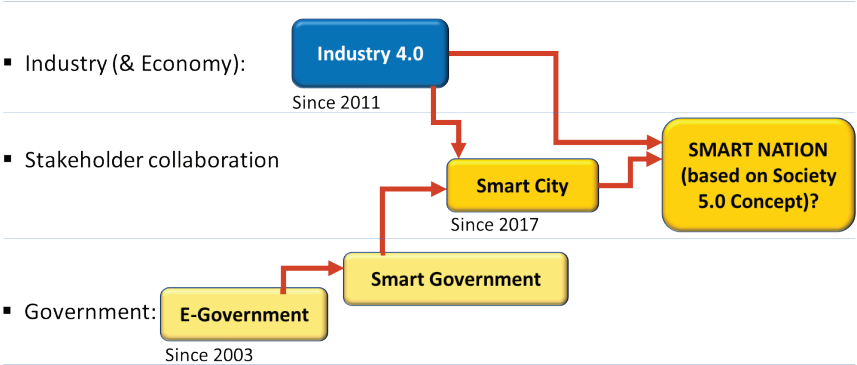


Figure 8.2 Future Vision towards Smart Nation  
 Source: Kitsuregawa, 2018; Hayashi, 2019

In addition, in general we need to develop a digital transformation model that is appropriate to the situation and conditions faced by local governments in Indonesia. This model can also be developed by studying the digital transformation that has developed rapidly in the business world. It is necessary to properly define the role that will be carried out by local governments in digital transformation in their region. Local governments need to act as drivers of the digital transformation journey, including

increasing awareness of the needs and interests of citizens and businesses towards digital transformation.

Regarding the development of digital transformation in Indonesia, Gadjah Mada University has a special graduate school to prepare its human resources, namely the Public Sector Digital Transformation Study Interest, which is in the Leadership and Policy Innovation graduate study program (Kepemimpinan dan Inovasi Kebijakan), Graduate School, Gadjah Mada University. This digital transformation school has accepted students since 2020 and has produced many graduates who are ready to support the promotion of digital transformation in the public sector in Indonesia.

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## CHAPTER-9

# DIGITAL LITERACY AND THE ISSUES OF INCLUSIVENESS AND EQUALITY

Hermin Indah Wahyuni

### 9.1 INTRODUCTION

The digital transformation agenda is a priority that Indonesia will realize in the next decade. The government has set four priorities: digital infrastructure, digital governance, digital economy, and digital society. These priorities will show that Indonesia's condition is still not encouraging and requires comprehensive efforts to achieve its goals. In other words, there are many issues to solve and realize the digital transformation agenda envisaged to prosper and support sustainable development. The significant number of regions that the internet has not reached, the non-integration of national and regional digital government systems, the rise of cybercrime, and the immature digital culture are some of the many challenges and obstacles. In a global scope, it can be said that the same portrait has also become a severe concern for the government and many interested parties.

This article aims to illustrate the efforts toward an inclusive and equitable Indonesian digital society. These two ideal goals become a challenge because of the digital divide problem for various reasons and factors. At the same time, if this gap condition is not balanced by solid digital literacy, Indonesia will be further away from the conditions of inclusiveness and equitableness that it aspires to. This article will consist of three parts, beginning with a short theoretical exploration that captures the heart of the problems in the current society and the interrelationships between the transition to a digital

society, the issue of inequality, and literacy. The second part is a portrait on Indonesia transforming into a digital society through some compelling cases and a review of the Digital Literacy Roadmap 2020–2024 compiled by the Ministry of Communication and Information and the impact of Covid-19 pandemic on Digital Transformation. The last section is a few notes on efforts and possibilities to eliminate several digital transformation problems.

## **9.2 THEORETICAL FRAMEWORK**

### **a. Digital Divide as a Fundamental Problem of Digital Society**

The digital divide can be called the main problem in contemporary society. This problem is generally understood as a mere issue of access or infrastructure, or the quantification between the population with access to technology (the internet) and those without. However, the digital divide is a more complex, dynamic, and multi-dimensional phenomenon (Min, 2010; Van Dijk and Hacker, 2003). The Organization for Economic Co-operation and Development (OECD) explains that “the term ‘digital divide’ refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the internet for a wide variety of activities” (OECD, 2001).

At least there are three dimensions to understanding and solving the digital divide problem, namely access, use, and consequences (Selwyn, 2004). Van Dijk (2006) offers a framework for understanding the digital divide through four dimensions: motivation, access, ability, and the use of communication and information technology. A more straightforward framework frames the digital divide into a first-level and second-level digital divide (Min, 2010). The first-level gap relates to the issue of material access, while the second-level gap relates to the aspect of use and is more broadly directed to the issue of knowledge gaps or information gaps. The concept of the digital divide is indeed very close to the concept of the knowledge gap (Rogers, 2001).

In general, there are four approaches to understanding the digital divide, namely: (1) the technocratic approach, (2) the social structure approach, (3) the information structure and exclusion approach, and (4) the modernization and capitalism approach (Sassi, 2005). The issue of the

digital divide is not only limited to the issue of material access. According to Jan Van Dijk (2006), the digital divide can be explained in 4 dimensions of technology access: motivational, material, skill, and usage.

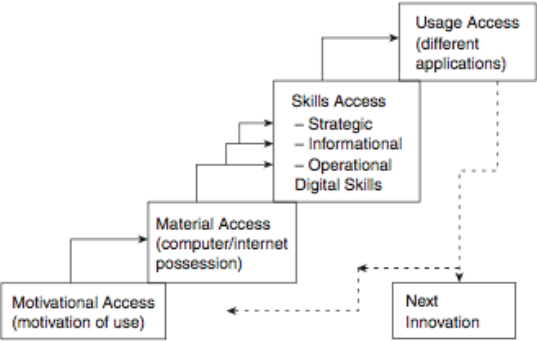


Figure 9.1 Four Stages of Access to Digital Technology  
Source: Van Dijk, 2006

**b. Digital Equality: Digital Equality as the Ideal Achievement of Digital Society**

Digital equality is a condition to be achieved in digital transformation and is synonymous with inclusiveness. A state of digital equality is achieved when no one (individual or group) is left behind in the process of transforming society. This is an ideal condition that is expected, but every society has its own challenges in realizing this equality. That is, what is faced by one country can be different from other countries, and what is faced by one group will not be identical to those experienced by other communities. Digital inequality or exclusion can be caused by the absence of access infrastructure and inadequate digital skills and is generally associated with low digital literacy.

Along with the discourse on digital equality, a relevant concept discussed is understanding the various variations of digital inequality. That is, understanding this problem at the empirical and academic levels is not limited or narrow. Asmar et al. (2022) show in their research that there is at least a broad landscape in understanding and interpreting the conditions of digital equality, from deep exclusion to deep inclusion. They show eight profiles of digital inequalities, ranging from deep exclusion to deep

inclusion, and is based upon a combination of five key indicators at the social level (income, education, social participation, agency, well-being) and eight key indicators at the digital level (access, attitudes, digital skills, soft skills, media richness of the environment, autonomy of use, user practices and social support). The eight profiles are (1) Digital Outcasts, (2) Hopelessly Undigital, (3) Digital Fighters, (4) Smoothly Digital, (5) Digital All-Stars, (6) Unexpected Digital Master, (7) Digital Drop-Out, and (8) Digital Self-Excluded.<sup>1</sup> These eight profiles can be used to describe the complex problems of digital inequality in Indonesia.

When the digital transformation process occurs, at the national level or the global level, digital inequality is a real threat that occurs widely. The ability of a country to reduce and encourage the involvement of its citizens in a digital atmosphere is a test. This will show the seriousness of the state in stimulating or conditioning people to enter the digital world with all its potential and benefits. The dynamic conditions of inequality (in Indonesia and globally) have led to the importance of systematic efforts to reduce the high exclusivity that occurs in various community groups.

### **c. Digital Literacy: An Essential Prerequisite for the Sustainability of Digital and Knowledge Societies**

By seeing the importance of digital inclusion as a step toward realizing digital equality, the fundamental prerequisite must be to encourage robust digital literacy. This process is challenging because it involves all micro, mezzo, and macro levels. The micro-level involves individual abilities that need to be transformed, the mezzo level is related to organizational involvement in the process, and the macro level is related to macro

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<sup>1</sup> *Digital Outcasts*: individuals are in situations of deep social and digital exclusion; *Hopelessly Undigital*: groups that experience many barriers to participation in society. They try to keep up with the constant digital evolution, but their social situation makes it difficult for them to succeed; *Digital Fighters*: Individuals in this profile are in a situation of concentrated social exclusion; this means that they are socially included in several life domains but remain excluded from others; *Smoothly Digital*: Individuals in this profile are doing what they can to stay up-to-date with the digital evolution and use digital media in highly functional ways; *Digital All-Stars*: Individuals in this profile are deeply socially and digitally embedded. They participate in all life domains and experience no obstacles in their use of digital media; *Unexpected Digital Master*: demonstrate high motivation to use digital media and learn by practicing. They are constantly experimenting with technology and developing their independent skills; *Digital Drop-Out*: individuals in this profile generally avoid dealing with digital media is not successful in developing their digital skills and usually shows low motivation to engage with digital technology; *Digital Self-Excluded*: Individuals in this profile generally have access to digital media and have the necessary skills to use technology, but they do not see the benefits of using digital media.



breakthroughs by policymakers and the environmental conditions that characterize it. Barriers to digital inclusion exacerbate social inequalities and hinder the achievement of the Sustainable Development Goals (Tsatsou, 2021). Meanwhile, the lack of digital literacy can result in digital exclusion (Aleixo et al., 2012).

The concept of digital literacy itself was first described by Paul Gilster (1997) as the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers. According to Sharma et al. (2016), digital literacy is the ability to use the internet and new media to access and critically evaluate various formats and types of digital information to participate in a community's socio-economic activities through digital content creation, communication, and exchange. Another explanation regarding digital literacy is:

“a set of competences and skills which a person needs in order to use digital technologies, communication media, social networking tools, and networked information and thus become able to be actively involved in a society based on information and knowledge. Digital literacies can be seen as a combination of technological and cognitive competences and expressed in terms of a set of computer, information, multimedia, and CMC literacies”. (Aleixo et al., 2012).

UNESCO in *A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2*. explain the concept of digital literacy as the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technology for employment, decent work, and entrepreneurship. It includes various competencies called computer literacy, ICT literacy, information literacy, and media literacy (Anonymous, 2018). The concept of digital literacy is often referred to as information literacy, digital competence, digital skills, new literacy, multiliteracies, media literacy, e-literacy, internet literacy, ICT skills, ICT competence, ICT literacy, meta-literacy, computer literacy, computer skills, e-competence, e-skills, and technology literacy (Martínez-Bravo et al., 2020).

Park et al. (2020) analyzed research trends in digital literacy and related concepts since 2000, particularly in the field of education. The results

show that digital literacy is a multidisciplinary field that broadly includes literacy, ICT, internet, computer skills, science, nursing, health, and language education. Meanwhile, research by Martínez-Bravo et al. (2020) shows that digital literacy is a central concept that is integrated and connected with many other concepts and is a process with different actors within the social framework of digital inclusion. This research also shows that the concept of digital literacy can be understood and explained from two perspectives: focusing on skills-competencies for using technology; and teaching and learning and its strategies (Martínez-Bravo et al., 2020).

Digital literacy is also researched concerning sustainable development in knowledge societies and the extent to which digital infrastructure and digital literacy can create an inclusive and equitable transformation of society (Sharma et al., 2016). There is no instant solution for solving digital literacy problems, and digital literacy is not an end in itself but is seen as synergistic with structural capital and human and social resources in society. The question of the extent to which the relationship between digital literacy and the creation of an inclusive digital transformation has not yet been asked completely answered. Social capital is needed for ICT adoption that enables communities to take advantage of digital opportunities for growth and development as part of government cohesion with citizens (Sharma and Mokhtar, 2006). Then, there is no “quick win” as far as rights are concerned digital. Digital apps are not everything, but there will always be a pattern of active consultation, pilots, and publicly announced roadmaps for powerfully impactful transformation. Digital literacy initiatives are in a synergistic relationship with the prevailing structural, human and social capital of a society that is conducive to creating and exploiting digital opportunities to generalize them into best practices (Sharma et al., 2016).

### **9.3 INDONESIA'S DIGITAL TRANSFORMATION**

The Indonesian Government is building a digital vision, namely Indonesia Digital Nation. This vision is developed in three main dimensions: Digital Governance, Digital Society, and Digital Economy. Digital governance includes aspects of regulation and policy as well as control. Meanwhile, the digital society consists of elements of digital activities, applications, and infrastructure, as well as digital human resources. In the

digital economy aspect, it consists of supporting technology and research, and innovation.

The development of a digital society in Indonesia was initiated by President Joko Widodo's vision which consists of 5 points, ranging from infrastructure development to effective use of the budget. Especially in the context of the Covid-19 pandemic, President Jokowi emphasized five things that need attention in realizing digital transformation. First, expansion of access and improvement of digital infrastructure. Second, there is a digital transformation roadmap in strategic sectors. Third, accelerate the integration of the National Data Center. Fourth, preparation of digital talent and resource needs. Fifth, drafting regulations, funding schemes, and financing digital transformation.

Several recent research and reports show the actual condition of digital inclusion issues; for example, three ICT associations in 2017 released a research report entitled *Indonesia's Digital Inclusion Index*.<sup>2</sup> This report uses several aspects to measure digital inclusion: connectivity, affordability, skill and awareness, local related content, and security and sovereignty. Meanwhile, The Economist Intelligence Unit has published *The Inclusive Internet Index* every year since 2017.<sup>3</sup> In this index, internet inclusion in 120 countries is measured through four categories: availability, affordability, relevance, and readiness. The availability category examines the quality and extent of available infrastructure required for internet access and usage levels. The affordability category analyses the cost of access concerning revenue and the level of competition in the internet market. Then, the relevance aspect examines the existence and extent of regional language content and relevant content. Finally, the readiness aspect examines the capacity to access the internet, including skills, cultural acceptance, and supporting policies. In the latest index in 2021, two aspects have become Indonesia's weaknesses so far: affordability related to the relatively high price of internet access and readiness related to digital skills.

#### **a. Indonesia Digital Literacy Framework and Its Challenges**

The Ministry of Communication and Information (Kominfo) has compiled several points of explanation regarding digital literacy that

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2 <https://mastel.id/digital-inclusion-index-indonesia-2017/>

3 <https://impact.economist.com/projects/inclusive-internet-index>

come from sources or frameworks, such as UNESCO<sup>4</sup> and ITU<sup>5</sup>. Kominfo compiled the definition of digital literacy with an emphasis on the following points:<sup>6</sup>

1. Increase knowledge, understanding, awareness, creativity, and digital technology skills.
2. Increase and develop the cultural capacity to use safe digital technology.
3. Encouraging the improvement of basic skills in counter negative content (anti-hoax, anti-cyberbullying, anti-hate speech, anti-pornography, anti-piracy, anti-radicalism, anti-SARA, etc.).
4. Provide, encourage, and improve basic knowledge and understanding of the use of new digital technologies (emerging technology-Robotics, Internet of Things/IoT, Artificial Intelligence, Big Data, etc.).
5. Strengthening knowledge, empowerment, and facilitation of digital technology-based communities.

Furthermore, Kominfo developed an Indonesian Digital Literacy Framework, which became a reference in developing national curricula and programs. The following graph describes the Indonesian Digital Literacy framework:<sup>7</sup>



Source: Roadmap Literasi Digital 2020–2024 Kementerian Komunikasi dan Informatika

Three areas will be developed in the digital literacy program framework above: digital society, digital economy, and digital government. Meanwhile,

4 UNESCO A Global Framework of Reference on Digital Literacy 2018.  
 5 ITU Broadband Commission for Sustainable Development (2017). Working Group on Education: Digital skills for life and work.  
 6 Roadmap Literasi Digital 2020–2024 Kementerian Komunikasi dan Informatika.  
 7 Roadmap Literasi Digital 2020–2024 Kementerian Komunikasi dan Informatika.

the digital literacy curriculum framework will be built with four pillars: digital skills, digital culture, digital ethics, and digital safety. This is a real challenge for Indonesia regarding digital skills because of its huge population. With nearly 300 million people living on thousands of islands, it is not easy to achieve digital transformation through enhancing digital skills that reach everyone. For this reason, the digital skill improvement or digital literacy movement was launched with coordination and collaboration by the Ministry of Information and Communication Technology with various parties concerned on this issue, from campuses to civil society organizations.

Kominfo defines digital culture as an individual's ability to read, decipher, familiarize, examine, and build national insight, the values of Pancasila and Bhinneka Tunggal Ika.<sup>8</sup> The transformation of information and communication technology has changed all aspects of society. The development of digital culture can be interpreted substantively broadly marked by the many characteristics of a networked society that have changed the culture of modern society. Many sides and aspects of life have changed and need to be prepared for the right transformation. In this context, the formulation of Kominfo above, which defines digital culture as more related to nationalism issues, can still be explored and its meaning developed. For example, it is connected with Webster's (2006) perspective when writing about network society that digital culture is not only in the context of culture itself but also concerning economy, politics, and democracy.

The roadmap above explains digital ethics as an individual's ability to realize, model, adapt, rationalize, consider, and develop *netiquette*.<sup>9</sup> In Indonesia's digital ethics context, many facts and phenomena need to be linked or discussed under the umbrella of the ideal concept of *netiquette*. The essence of ethical issues is the sharpness of consideration in choosing and sorting out what is appropriate or inappropriate to be conveyed or communicated. This is also related to public communication skills, ideally as individuals' capability to communicate and use any media on the internet actively. Some difficulties may be encountered when discussing *netiquette* as this requires a lot of other system readiness conditions (adequate education, ability to ethical reflection). In addition, digital platforms are basically free

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8 Roadmap Literasi Digital 2020–2024 Kementerian Komunikasi dan Informatika.

9 Netiquette, abbreviation of internet etiquette or network etiquette, guidelines for courteous communication in the online environment. Source: <https://www.britannica.com/topic/netiquette>

spaces that neutralize many elements in interaction, sometimes without representations and affiliations of users, and are marked by anonymity. *Netiquette* is, therefore, a problem that needs to be solved in a structured or systemic way, not only at the personal level.

Digital security, which is explained as the ability of individuals to recognize, pattern, apply, analyze, weigh, and increase awareness of digital security in everyday life, is the next issue. The main problem with realizing digital transformation is a security issue that impacts all involved in digital interactions, without exception, individual users and institutions. The internet, which is imagined as a common house, requires an ecosystem ready for all the architectural elements that make it up (Parker et al., 2016). Personal data protection becomes a crucial thing to be realized so that all parties involved in cyberspace feel comfortable interacting. How far has the development of the privacy act for Indonesia been? In the economic context, the ITE Law has responded to the security of digital transactions. The dynamics related to security on the internet require a quick response from the community and the government as a regulator. Digital crimes that are rampant require developing systems that are also more responsive.

The three digital dimensions (society, economy, and government) prioritized in the above framework can be seen as developing an integrated and differentiated system. Each dimension requires specific reinforcement or intervention because it has its own unique character or internal dynamics. A multilevel and specific approach is needed for each of these systems. In developing a digital society, for example, discussions about digital skills, culture, ethics, and security will differ significantly from the context of the economy and government. The growth of the digital economy requires special digital skills, for example, those concerning strategic capabilities in business activities or trade transactions. Meanwhile, in the context of the digital government, the crucial issue of growing a culture of political participation facilitated by technology is not something easy. There is an issue of trust in building a culture of digital participation which is not only determined by the government's motives for opening up participation spaces but also by security and privacy factors.

Concerning the issue of inclusivity and justice, some of these theme areas or fields have various and specific problems. Still, as a whole, they will contribute to the condition of injustice and inclusiveness in general. The

common solutions can indeed be done with strong digital literacy. Still, they must also be followed by the readiness of digital infrastructure that all levels of society can access. This priority continues to be pushed through programs encouraging public services, such as Universal Service Obligations.

In Indonesia, Widyasari and Allert's research (2019) analyzes the national digital literacy movement, *Siberkreasi*, which is run by the Government of Indonesia through the Ministry of Communication and Information (Kominfo) by involving community groups. This study found that media literacy in Indonesia is still understood from the point of view of positivism, where literacy only teaches what is positive and what is negative. Furthermore, Widyasari and Allert (2019) explained that the *#SiBerkreasi* movement did not even touch the critical area of how media literacy should be understood in a diverse society like Indonesia. Meanwhile, Kurnia and Astuti's research (2017) which mapped the literacy movement in Indonesia, found that universities are the main actors or motors in the digital literacy movement, socialization is the most frequently carried out activity, youth are the most dominant target group, and the main partners are schools.

#### **b. Covid-19 Pandemic and Digital Transformation**

The Covid-19 pandemic has opened the veil of fundamental social problems, including those related to the development of communication and information technology. Restrictions on offline activities to prevent the spread of the virus, for example, have encouraged many activities to move to the virtual realm, ranging from family gatherings, teaching and learning, buying and selling activities, and cultural arts performances to practical political activities. These various activities require technology and network support, which are not evenly available in reality.

The Covid-19 pandemic occurs when society is in a complex media and technology environment. The development of various technological devices and the emergence of various communication and information platforms give society a different and new character. The number of global internet users has continued to increase in the last decade, so more and more people are connected to information and knowledge networks. The presence of social media platforms encourages the production, distribution, and consumption of information which is different in many ways from the situation where conventional media is the primary source. Knowledge of various things

or in multiple fields is produced continuously through platforms built by individuals and institutions.

The crisis that takes place in a society that is filled with social inequality is a bad scenario. When digital technology comes along and brings unintended consequences in the form of a digital divide, social inequality can become worse than before, as well as the current crisis. Before the pandemic, it seemed as if the digital transformation had been well prepared. During the pandemic outbreak, all fields inevitably experienced acceleration in providing digital services to their constituents. The sectors strongly affected are vital services to the community, namely the world of health, education, and digital government. All public organizations also resonate in response to the pandemic outbreak that prevents humans from freely interacting as before. The world of health, which is at the forefront of the pandemic situation, seems to have difficulty developing public communication, which is also colored by disinformation and misinformation. Below, we will try to explore the condition of the three domains during the crisis due to this pandemic.

In the context of a digital society, the crisis in handling Covid-19 is marked by high levels of hate speech, misinformation, and disinformation. Indonesia, which is among the worst-affected countries in Asia; An overwhelming majority said they primarily seek information through social media. The consequences of viral misinformation are not limited to the digital sphere. When users encounter online hoaxes that they believe are true, they often share them with others in person, spreading fear, anxiety and false cures beyond social media. The crisis atmosphere is increasingly uncertain because the confrontation of opinion on matters related to Covid-19 is immediately debated on social media. This creates public confusion and reduces public trust in the government. The high number of WhatsApp users in Indonesia causes information to be disseminated quickly. Still, at the same time, the spread of hoaxes and various misinformation is also unavoidable.

In the context of the digital economy, the Covid-19 crisis has prompted a series of significant progress and breakthroughs. Restrictions on social space and the impossibility of direct economic transactions encourage more intense use of digital platforms. Efforts to encourage MSMEs (Micro, Small, and Medium Enterprises) that have been carried out in the last ten years before the pandemic got their moment to expand the market through



digital platforms. APJII data (2022) shows that the internet use by MSMEs has increased significantly; the percentage is 87.43% using it, and only 12.57% state that they do not use the internet for their activities.<sup>10</sup> Then, Indonesian MSMEs prefer social media to sell their products/services rather than websites.<sup>11</sup> The presence of new media has changed how MSMEs conduct their activities. The high number of young people in Indonesia who are active in new media has a strong interrelationship effect that strengthens Indonesia's digital atmosphere.

In the realm of digital government or electronic government, studies have shown that digital platforms are developed for vertical communication between the government and the public but do not provide a space for participation (Wahyuni, 2021). The enthusiasm for using technology to provide public services is robust, but in this context, the biggest obstacle is the weak readiness of single data in accelerating services. Many platforms are built for different purposes; for example, the Ministry requires government services to use a centralized platform. Meanwhile, regional needs with different demands have caused local governments to build different platforms, and this causes a clash of programs with each other that is not easily avoided. As an effort to improve, there have been several problems with the digital government in Indonesia so far. First, infrastructure has not been sufficiently developed to optimally make e-government a tool for capturing input, assessing its quality, and choosing it to be material for decision making. Outreach is still limited and has not varied in the determination of end-users. End users are still dominated by citizens and not yet varied enough for specific elements such as businesses or other particular groups. On the issue of substance, there are still limited governments that provide optimal space for developing substantive discussions that require extensive input from the community (Wahyuni et al., 2021).

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10 Micro-businesses that run online businesses reach 63.59%, small businesses reach 65.04%, and medium-sized businesses reach 72.04%. Source: APJII (2022). *Profil Internet Indonesia 2022*. Diakses dari <https://apjii.or.id/content/read/39/559/Laporan-Survei-Profil-Internet-Indonesia-2022>.

11 Based on the APJII report, 84.75% of MSMEs use social media. Meanwhile, those who own or use a website for their business activities are only 23.75%. In addition, MSMEs also use marketplace platforms, and the most popular ones are Shopee 39.30%, Bukalapak (24.38%), and Lazada (14.93%).

## **9.4 CLOSING: NOTES FOR EQUITABLE AND INCLUSIVE DIGITAL TRANSFORMATION**

From the data and the growth of the atmosphere of the digital environment in Indonesia, it can be said that Indonesia is growing to build a Digital Nation in ways that are considered appropriate according to the existing environmental conditions. However, several closing notes can be drawn from these facts and phenomena.

Internet or digitalization is not everything, but a social, economic, and political environment is needed to determine the success of the digital transformation. The approach that must be developed is a comprehensive approach in terms of quantity and the quality of the digitization process. The political, economic, and socio-cultural systems of society as a context are essential in determining the direction of the digital transformation process. Indonesia needs to continue to sharpen its digital vision systemically. Strengthening and specifically developing social, political, and economic systems internally will contribute to accelerating the achievement of adequate digital literacy to reduce various problems that arise and determine the quality of the digital nation. Currently, it is still felt that the development of this sector is focused on the main infrastructure in the development of various technology platforms, even though a good and robust ecosystem should support this development to strengthen and ensure sustainability and optimization.

The problems of inequality and exclusivity that still occur today can be understood as real problems that are visible in terms of quantity and quality. Sporadic growth as a feature of the early development of digital society still shows immaturity in many areas and has sustainability problems that still need to be answered. Equitable infrastructure distribution is still a natural obstacle between Java and outside Java, especially for remote areas and islands. Natural challenges such as these choose technology transition, not the only answer. The terrestrial system approach is sometimes still robust and is the most likely option in these conditions. Network technology requires the support of community strengthening for its success. Still, these supporting elements do not occur in reality, so technology optimization cannot be said to have achieved its reasonable goals. Instead, it has become a new problem in society. The nature of technology that facilitates many things in the

dimensions of human life, if good ethics and digital culture do not follow it, will give birth to problems and polemics that should be anticipated.

The regulation of public services through the Electronic-Based Government System (SPBE) by optimizing digitalization is managed by many institutions in Indonesia. At least there is the Ministry of Communication and Information (Kominfo), the Ministry of Home Affairs, the Presidential Staff Office, Bappenas, and the Ministry of State Apparatus Empowerment (PAN-RB). The biggest challenge under these conditions is coordination and integration. The sectoral ego problem is something that must be eliminated. In its implementation, with the vast territory of Indonesia and the many parties involved in the effort to realize Indonesia's digital transition and transformation, SPBE is not easy. Collaboration and synergy are the keys to success, which is still a record that needs to be broken through.

Covid-19 pandemic can be seen as a trigger for strengthening the digital transformation. Still, at the same time, it shows the low readiness of Indonesia's digital literacy and becomes a severe problem for realizing justice and blocking inclusivity. This pandemic has made those who do not have direct access even more thrown and fall into the category of poverty. Public service spaces that are highly developed can be seen in the ministry of education, the ministry of health, and at the same time, the government's official website with some notes. It can only be said that the handling of the crisis during the pandemic also shows some serious problems that must be addressed related to digital ethics and digital culture. The high number of hoaxes and hate speech in many cases shows that systematic intervention is very much needed in developing an Indonesia Digital Nation.

Digital literacy is needed to achieve the big vision that has been set. The quality of existence of various dimensions and pillars still has a record that needs to be improved. Injustice and problems with inclusiveness must be fought for so that Indonesia's transition to digital can involve all levels of society throughout Indonesia.

Thus, to reach the Indonesia Digital Nation that it aspires to, it still requires both vertical and horizontal encouragement. Vertically, it is necessary to strengthen the integrated and comprehensive digital vision and mission of the policymakers. While horizontally, efforts are still needed to stimulate the involvement of all elements of society in this transition process. The challenges of the large community and the region's vastness

require specific strategies for Indonesian policymakers to strengthen the achievement of national ideals in 2045/2050. Indonesia's digital transition with all the strengths of Generation Z and the many problems surrounding it, are a huge challenge for Indonesia.

The world and Indonesia in particular face the real challenge of exclusivity which has the potential to become a real threat in the digital transformation process. Inclusivity towards a digital society requires a comprehensive approach at the upstream and downstream levels. Unresolved problems upstream will result in downstream problems. Therefore, the transformation can start with the development and strengthening of infrastructure, but further than that, strengthening the ecosystem is very important.

The community ecosystem must be grown through the vibrant strengthening of digital literacy, and the political ecosystem needs to be strengthened towards a robust national vision and continue to be grown so that a firm policy is formed, as well as the business sector that provides hope for a better future by utilizing digital technology. Digital transformation is a broad landscape that has extra dimensions and very complex intra-relationships in its ecosystem. The world nations need to work and comprehensively unravel the problems they have because if they don't, the digital divide and digital inequality will get deeper and wider. The G20 is a forum for exchanging knowledge and energy among member countries. The process of learning from each other and strengthening energy to strengthen inclusiveness is very needed. There is no ready-made recipe, only serious efforts to achieve a shared vision that can realize grand agenda in the future.

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## CHAPTER-10

# DIGITAL TRANSFORMATION IN THE GLOBAL TOURISM: RESILIENCE AFTER PANDEMIC COVID AND CRISIS

Muhammad Baiquni

### 10.1 INTRODUCTION

**T**ourism in many countries in the world, also in G20 countries, has significant contribution to national economy by increasing international tourist visitation, stay, and spend. Tourism creates job opportunities especially in small medium enterprises, attract investment from private sectors both local and international, encourage cultural creative activities, preserve and conserve natural resources, as well as ensure responsible, inclusive, and sustainable development.

Digitalization in tourism development encourage opportunities for tourism policy and planners to formulate action programs in enriching tourism ecosystems. Further digitalization in tourism also equipped enterprises to expand their market, innovated products, improved operational efficiencies, increased growth, and sharpen competitive edges. Indonesia and India governments formulated roadmap policies to improve and implement digitalization in tourism, such as Go Digital for Indonesia (Kemenparekraf, 2020) and National Digital Tourism Mission for India (GOI MT, 2022). It is believed that digital transformation in tourism can open for innovation, encourage creativity, and ensure the competitiveness of country's tourism sector.

The World Tourism Organization (UNWTO) support the 2022 G20 Indonesian Presidency, have developed a knowledge partner and in close co-ordination and consultation with the G20 Tourism Working Group, the G20 Bali Guidelines ‘Strengthening Communities and MSME as Tourism Transformation Agents—A People Centered Recovery’.

Basically, tourism is a complex ecosystem with high diversity of actors and sectors involving national and local governments, several ministries and agencies, small and big companies, communities and private sectors. Each has their roles in playing certain function in such complex ecosystem. The government has pivot point role in conducting the orchestra of sectors and actors, while tourism industries playing real action in providing tourism services.

The government has to set a policy and program to enabling tourism access like basic infrastructure, public transportation, and destination management. Tourism industries provide amenities such as travel services, accommodation, restaurant and café; while community play important role in presenting attractions such as art performance, music and dances, and other tourism services at tourism sites. Arranging tourism as a multi levels both sectors and actors involved, it needs an integrated government approach. Smart governance with digital supports will be the key to prioritize tourism transformation in new normal after pandemic and crisis.

This chapter explains the digital transformation in global tourism with special focus on recovery and resilience after pandemic Covid-19. First explanation is on the analysis of pandemic Covid-19 which smack down tourism sector and how policy strategies to recover the crisis. Second explanation is on how digital transformation alters tourism sector in the new normal. Third explanation is on the Indonesian experience in Sustainable Tourism Development and Go Digital programs. The last is a reflections and recommendations for G20 in coping with pandemic Covid-19 and crisis in tourism development.

## **10.2 COVID-19 PANDEMIC AND TOURISM RESILIENCE**

G20 responded pandemic Covid-19 and global crisis which more cooperation to support recovery in tourism with a Guidelines for the Future of Tourism, such the leader’s declaration as follow:



*“Building on the work made in 2020, we will continue to support a rapid, resilient, inclusive and sustainable recovery of the tourism sector, which is among those hardest hits by the pandemic, with a particular focus on developing countries and MSMEs. We endorse the G20 Rome Guidelines for the Future of Tourism, and commit to take action to fulfil its objectives, in particular with regard to safe mobility and seamless travel and sustainability and digitalization. We will explore collaboration in the fields of creative economy and innovation in support of tourism”.* G20 Rome Leaders Declaration.

The Covid-19 pandemic has had a broad influence on the tourism businesses and industries since the outbreak of the pandemic in Wuhan China in December 2019. In the beginning of 2020 from Wuhan the virus spread out to the world and on March 11th WHO has announced that the world is experiencing a serious global pandemic. Director General Tedros Adhanom Ghebreyesus announced that in early pandemic more than 121,000 people have contracted the virus in various parts of the world. The speed of transmission through the respiratory tract is easily infected through the medium of droplets from coughs and sneezes that can infect people around the crowd. The risk is greater for the old age group and having other diseases that can aggravate the congenital disease. WHO urged the government all over the world to immediately take steps to handle and prevent this pandemic which is easily transmitted in very high human mobility.

The global economic contribution of tourism, which amounted to USD 3.5 trillion in 2019 or 4% of world GDP, calculated in tourism direct gross domestic product was decline by more than half in 2020, dropping by USD 2.0 trillion, to 1.8% of world GDP. This correspond to about 70% of the overall decline in world’s GDP in 2020. In addition, approximately USD 1.1 trillion were lost in export revenues from international tourism in 2020, a 64% drop in real terms and a share of 42% of the total loss in international trade in 2020. UNWTO also reported that seven in ten OECD and G20 countries reported that more than 50% contraction in tourism direct gross domestic product (UNWTO, 2021 and 2022).

Due to pandemic Covid-19, millions of jobs were lost or worker laid off, and some other get part time job with limited income or supported by government employment schemes. This has impacted particularly women

and youth and the informal sector. Many other related sectors were also strongly affected including the cultural sector. According to UNESCO, more than 1.000 UNESCO World Heritage properties have impacted Covid 19 which is very hard to manage the situation during Pandemic and crises. In 2020, UNESCO conducted a survey of world heritage site managers and national authorities, have discovered that a 66% decline in site visitations and a 52% drop in revenues. The report is also mention that 13% of sites surveyed noted that staff have been laid off as a result of Covid-19, with an average of 40% of permanent staff and 53% of temporary staff made redundant (UNESCO 2021). Globally, OECD projected that the Cultural and Creative Industries (CCIs) employment was slashed from 0.8% to 5.5% due to pandemic (OECD, 2021).

The world community during Pandemic Covid-19 prefer to less travelling and more staying at home, changing the pattern of working, studying, and worshipping with family at home. UNWTO (2020) analyses the existence of a 30 years decline in tourism industry and the tourism business has fallen due to less mobility to travel. The MICE (meeting, incentive, conference, and exhibition) events which usually held by businesses, communities, governments has fallen due to the financial crisis to support the events.

The phenomenon of Pandemic Covid-19 become the “Domino Effects” the collapse of tourism activities chain which spread to social and economic problems. The Covid-19 has reduced the mobility of global tourists by reducing and changing travel patterns, which means that there are no transportation services, accommodation, food and beverage consumption, or demand for tourism services. As consequences tourism businesses and support industries have been forced to stop and even close due to Pandemic Covid-19, some of them were turning to basic sectors such as agriculture, food processing for local consumers, and trade services related to health services.

Tourism is at a nadir position or looser experiencing a very hard crisis, on the other hand there is an opportunity to improve the situation with digital transformation. According to Decoding The Economics of Covid-19 in Egypt, Information and Communication Technology (ICT) industry is part of the potential winner. There is a challenge to synergize tourism recovery and resilient with digital transformation, which is more efficient

and effective to improve a new tourism which is more quality orientation, inclusive, equitable, and in sustainable way.

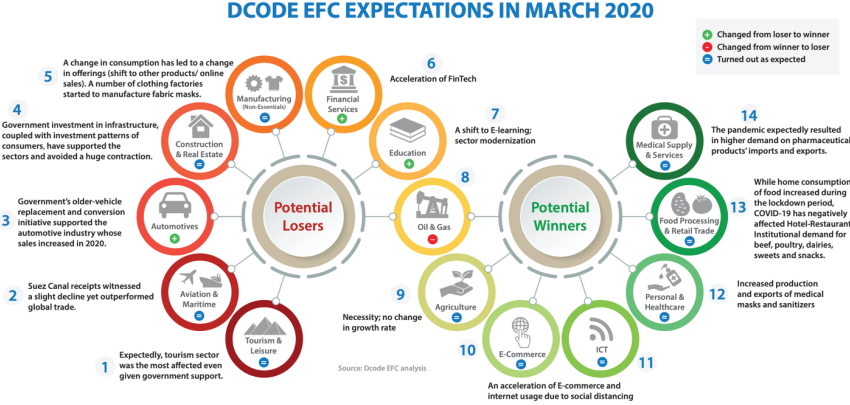


Figure 10.1 Potential Winners and Losers in Pandemic Covid-19  
 Source: Dcode EFC Analysis, 2020

During recovery period each country has to focus and prioritize on public health, which prevent spread out Covid-19 while restore economic and social crisis in many aspects of the life. The Dcode AFC analysis in 2020 exposed that the potential losers and potential winners in Figure 10.1. Potential winners are medical supply and services, food processing and retails, personal health care, ICT and e-Commerce; while potential losers related to tourism and leisure, transportation, accommodation, construction and real estates, and manufacture.

UN Secretary General urged a policy brief on pandemic Covid-19 and transforming tourism. It is a need to work hand in hand to rebuilding tourism which is opportunity to transform with emphasis on controlling its impact on destinations visited and building resilient communities and business through four pillars which are innovation, digitalization, sustainability, and partnership (UNWTO, 2020).

The pandemic Covid-19 has been the most disruptive in this century, flash back to a century ago a pandemic in 1920s which also hit hard human health and economic crisis. UNIDO (2020) published a document on “Covid 19 Implications & Responses: Digital Transformation & Industrial Recovery” have shown some implications causes by Covid-19, i.e., millions

of people infected and shorted medical equipment, industries face financial slumps from trade restrictions, global value chain disruptions, slowing down economic growth. UNIDO also exposed some responses in light of digital transformation such as innovative policy solutions and advance technologies allow businesses to repurpose their production, hygiene practices and food safety standards, increase online market places and shift toward e-Commerce activities, etc.

Tourism businesses and industries was one of the most impacted sectors by the pandemic Covid-19. UNWTO (2022) reported that in 2020, international tourist arrivals dropped by 72% amid widespread travel restrictions, bringing international tourism back to the level of 30 years ago like in 1990s. This graphic shows that international tourist has been growing very fast since the year of 2000, but some disturbances like SARS disease in 2003 spread in some part of the world and global economic crisis in 2009 have little impacts to tourism. Covid-19 is the worst pandemic hit hard tourism sector which represented in the Figure 10.2.

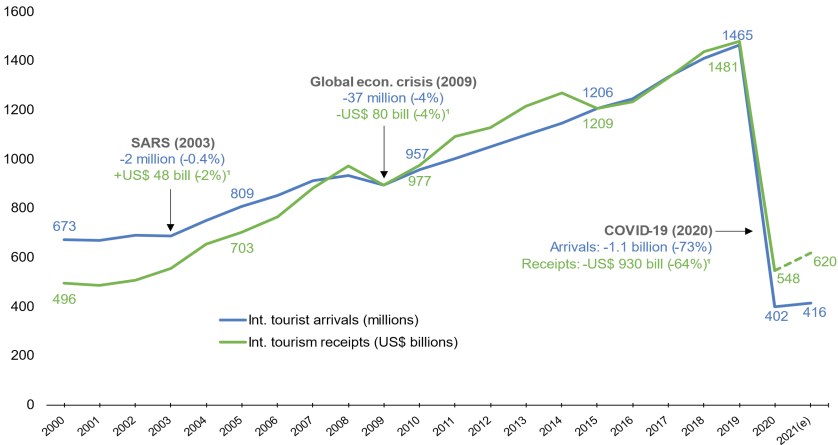


Figure 10.2 International Tourism, 2000–2021 Real Percentage Change (Local Currencies, Constant Prices)

Source: UNWTO, 2022

Since pandemic Covid-19 tourism was the most affected as represented in Figure 10.1 and 10.2, with businesses and industries as well as community economic activities around the world severely impacted. This phenomenon

is particularly true for many developing countries, as well as for youth and women, for whom tourism is a main source of jobs and income opportunity.

By 2021, two years after pandemic Covid-19, World Health Organization (WHO) declare that various vaccines were approved, and more than 50% of the world's population had covered at least one dose. Percentage of the population have covered by vaccine depend on the government and stakeholder efforts in prioritizing health care and services. Some countries have implemented health policy in strong way, others rather careless or puerile due to lack of financial and medical infrastructure supports. While vaccine equity remained far away, the progress of coordination and cooperation among countries has been made, has lead to a significant easing of travel restrictions and rising consumer confidence. International traveler mobility especially tourist arrivals grew by 4% as compared to 2020 as a whole. Slowly in 2021 travel and tourism industries rise up and recover again (see Figure 10.2).

UNWTO (2021) conducting a policy paper for the 24th General Assembly entitled "Tourism: From Crisis to Transformation" stated three main priorities: crisis management, restart tourism, and accelerating tourism. The first is crisis management to support the combat against the pandemic and sustain tourism jobs and companies. The second is restart tourism, to restore mobility, to promote save travel, and to enrich coordination and consumer confidence while encouraging the survival of the sector. The third is accelerating tourism in order to accelerate the transformation of the sector towards a more resilient, inclusive and sustainable future maximizing the opportunities of innovation and digitalization. The policy direction can be figure out as follow:

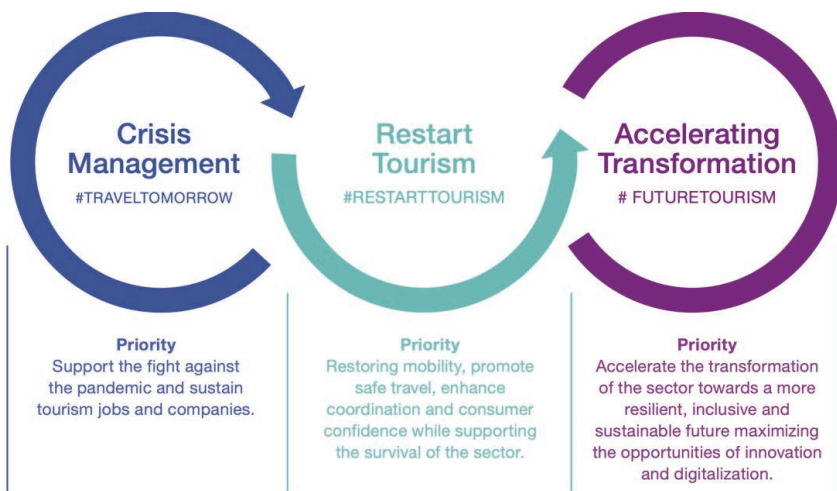


Figure 10.3 Three Focus of Tourism from Crisis to Transformation

Source: UNWTO, 2021

In case of Indonesia, three focus of main priority as UNWTO framework have also been practiced through the government policies and programs on quick respond to pandemic Covid-19. In respond to pandemic Covid-19 and impacts in tourism sector, the Ministry of Tourism and Creative Economy (MTCE) of Indonesia has launched The Tourism Incentive Assistance (TIA) Policy for businesses and industries to overcome difficulties during crisis. The Tourism Incentive Assistance ranging from a basic package of foods and medical supports to financial supports to survive and to maintain their business.

In tourism sector the financial support to help homestay in village tourism and other 13 types of tourism entrepreneurs. For creative economy, the TIA which is financial support can be applied for 6 types, ranging from digital application, games, crafts, culinary, fashion and film. Most of the TIA basically to support micro and small entrepreneur to survive or to shift to new business opportunity. Since pandemic Covid-19, many huge hotels were laid down their staffs, they have to create alternative jobs in their own capacity.

The MTCE also launched the “Indonesia Care” or in short “I Do Care” campaign and the CHSE (Cleanliness, Health, Safety, and Environment) on July 10, 2020 in line with medical treatment such as vaccine for people who work in tourism sector. The CHSE implementation guidelines has been spread out to destinations, hotels and accommodations, café and restaurants, travels

and public transportations, and performance venues. They have to follow the guidelines and get certification of CHSE to open and operate their business.

In order to accelerate tourism to more resilient, inclusive, and sustainable; the MTCE promote Go Digital Tourism and innovations. Go Digital Tourism strives to connect and regulate destination governance with tourist markets in various parts of the world, so that complex and complicated information and communication can be arranged systematically. Innovation and digital transformation create new business ecosystems and allow entrepreneurs to restart with new behaviors smart and speed in tourism resilient.

### **10.3 DIGITAL TRANSFORMATION TO SUPPORT ENTERPRISES IN TOURISM**

In 2018, UNWTO celebrate World Tourism Day on 27 September with theme on “Tourism and Digital Transformation” which put opportunities of technological advances such as digital platform, artificial intelligent, and big data, on the map of sustainable tourism.

World Tourism Day, celebrated every 27 September around the world, is a unique opportunity to raise awareness on tourism’s actual and potential contribution to sustainable development. Digital transformation in tourism sees as a solution to synergize reminded growth with more quality, responsible, and sustainable tourism sector.

*“Harnessing innovation and digital advances provides tourism with opportunities to improve inclusiveness, local community empowerment and efficient resource management, amongst other objectives within the wider sustainable development agenda”,* said UNWTO Secretary-General Zurab Pololikashvili.

Tourism industry, due to outbreak pandemic Covid-19, need a smart and speed digital transformation in order to recover and to create stronger with new normal. Digital transformation in tourism is not just an accessory, but as essential in business in digital globalized world (Skift and Amazon Web Services, 2020; Baiquni, 2020).

*“This crisis is an opportunity to rethink the tourism sector and its contribution to the people and planet; an opportunity*

*to build back better towards a more sustainable, inclusive and resilient tourism sector that ensure the benefits of tourism are enjoyed widely and fairly”, UNWTO Secretary-General, Zurab Pololikashvili*

Digital transformation is a process of integration of digital tools and systems into a company’s business cultures and processes which creates many numbers of benefits (Skift and Amazon Web Services, 2020). Digital transformation is rapidly growing and changing in many aspects of business and industry including tourism sector over the world. Digitalization is the cause of disruptions in business ecosystem, connecting people in many places and scale up network of the works which providing opportunities for value creation and capture, while creating a major source of risk. Some keys successes of digital transformation are strong leadership and sponsorship from the top of the organization, among others such as corporate culture, clear communications to courage everybody working in the organization and stakeholders in the business ecosystem (WEF, 2017).

UNIDO (2020) is addressing megatrends in digital transformation due to the pandemic Covid-19 and promote a strategic framework in recovery, resilient, and realignment in achieving 2030 Agenda for Sustainable Development. The keys areas for supporting the digital transformation and industrial recovery are:

1. Innovation and digitalization of MSMEs using promotion of digital transformation and strengthening innovation ecosystems for institutional capacity building, partnership, and networking.
2. Investment and technology promotion of multi-stakeholder partnerships to enhance the knowledge-policy interface, which is fundamental to stimulating the appropriate investment for technology acquisition, upgrading and transfer in developing countries.
3. Quality infrastructure and smart production in order to strengthen the competitiveness and resilience of the business sectors and actors through improved quality, standards, and smart production.

The digital transformation leads to the changing of global economy especially in tourism which made possible by the advances in information and communication technology. Tourism businesses and industries have been



influenced sharply by the changes in term of the type of business developed and the service offered (Tajeddini et al., 2019).

Digital transformation in tourism is altering how travel and tourist mobility in selecting destination and enjoying tourism activities and services. It creates new opportunities for tourism businesses and industries in global tourism markets. Integration of big data and digital management create new tourism business ecosystem which allow young smart generation and new entrepreneurs play important role in new start up digital businesses. New business models based on digital platform have emerged in tourism business landscape, such as Airbnb in accommodation, Uber and Grab in transportation, Shopee and Gojek in food and other services.

The challenge in digital transformation is related to equal access on digital devices and infrastructure supports, especially for users in remote areas and archipelagos. The challenge is also related to new behaviours in utilizing digital devices for communication in social media and other digital platforms. Different expectations among tourists and service providers may create disappointed and disputes. So, digital transformation needs mutual understandings to get mutual benefits in optimizing tourism experiences. Digital literacy is very important in doing tourism businesses to more inclusive, resilient, equitable, and sustainable.

Human resource capacity building has strategic transformation in utilizing digital technology. Trainings and educations for children and youth are important to improve quality of knowledges and skills of human resource capacity. More specific readiness of young entrepreneurs in tourism businesses should be encourage in digital utility in tourism systems, i.e. destination management, promotion and marketing, market analysis include tourism packages, and travelling and tourist mobility.

Regarding human resource capacity in many levels and chains of tourism system, it is important to promote training and technical assistance, particularly in developing countries (DiMaggio et al., 2004). For example, Indonesia focuses on some priorities as follow: (1) digital transformation training and technical assistance for tourism in rural destinations and in remote areas of the archipelago which have prime and unique attraction, both natural and cultural; (2) business reactivation through incentives and technical assistance; (3) business development assistance like reskilling and upskilling; (4) market recovery and expansion utilizing digitalization; and

(5) intellectual property protection such IP registration especially for design and products of creative economy.

Digital transformation in tourism can support tourism destination management in improving their quality of services and competitiveness. The new opportunities emerge for youth and women in remote areas to access markets, financial supports, and partnerships. But they have to aware and to mitigate the risks in new landscape of digital business platforms. Partnerships among tourism businesses and industries are needed in utilizing digital tourism platforms, especially in negotiating with government international agencies which put the business on the table.

The use of digital technologies has led to changes and transformation in tourism business operations and hospitality industry. As a consequence, tourism businesses have become more sensitive to the demands of their customers. They need team works who are adaptive, flexible, and smart to adjust in the changing requirements and expectations of their customers. Training and education of the digital knowledge and skills used in this sector to university students can be a part of preparing human resource in this new tourism sector. Therefore, tourism education and training should be innovative and creative in the digital transformation.

#### **10.4 A JOURNEY TO INDONESIA SUSTAINABLE TOURISM DEVELOPMENT**

Indonesia is the largest archipelagic state in the tropical world, which has many and diverse natural and cultural uniqueness. Indonesia has an area of 5,193,250 km<sup>2</sup> consisting of 63% ocean and 37% land area with number of five big islands and 30 smaller archipelagos in total of 18,110 islands and islets which around 6,000 islands are inhabited. The 2020 population census, the population reached 270 million, the fourth largest in the world. There are 1,340 ethnic groups with 718 regional languages with one Indonesian national language (BPS, 2021). This diversity is important for the basic strategy for sustainable development in archipelagic approach.

The case also explains Indonesia sustainable tourism development and the current issues in integrated with digital transformation. The sustainable tourism in the archipelago context has to be well-defined to prevent problematic issues from arising debates due to diversity of nature and culture of development in each island. Therefore, a sustainable tourism model and

praxis that fits and appropriate to the archipelago country's tourism planning and development is necessary. The ultimate goal should focus on justice and welfare of people involved, which reflected in the activities related to the current and future of economic, social, and environmental impacts, and at the parallel outcome is also fulfil the needs of tourists, the industry, the environment, and the host community.

The concept, model, and praxis of sustainable tourism have been well known in Indonesia for more than 35 years in line with a commitment to Our Common Futures of the Brundtland Report in 1987. The Sustainable Development is manifested in the Chapter II of Laws of The Republic of Indonesia Number 9 of 1990 covering the principles and objectives of Indonesia Tourism Development. This conception is addressed in international academic meetings and taught in tourism management courses and programs in universities and tourism training centers. However, a supportive national policy stayed on unclear until the Regulation of the Ministry of Tourism of The Republic of Indonesia No. 14 (2016) was announced and followed by implemented programs. The regulation consists of guidelines to build sustainable tourism destinations. Through introducing this regulation, Indonesia is moving in the direction of optimally developing tourism to sustainable way. Following the latest world tourism trends, the regulation is now has been updated and revised by the issuance of a Regulation of the Minister of Tourism and Creative Economy No. 9 of 2021 on Guidelines for Sustainable Tourism Destination.

In line with the Sustainable Development Goals, sustainable tourism also adopts criteria and indicators, which are implemented in the Regulation or the Guidelines for Sustainable Tourism Destination. The guideline has also covered issues as follows: (1) pillar one on human capital: jobs, skills, entrepreneurship and education; (2) pillar two on innovation, digitalization and the creative economy; (3) pillar three on women and youth empowerment; (4) pillar four on climate action, biodiversity conservation and circular economy; and (5) pillar five on policy, governance, and investment scheme.

Indonesia was launched a strategy called Sustainable Tourism Development (ST-Dev) strategy which consists of five components, which are: Sustainable Tourism Destination (STD), Sustainable Tourism Observatory (STO), Sustainable Tourism Industry (STI), Sustainable Tourism Marketing (STM), and Sustainable Tourism Certification (STC).

Indonesia Sustainable Tourism Award (ISTA) was launched to promote sustainable paradigm to the tourism businesses and communities. The first International Conference of Sustainable Tourism was conducted in Yogyakarta in October 2017. The conference resulted some recommendations and new ideas and initiatives which are: the establishment of the National Sustainable Tourism Management Forum and Wonderful Indonesia Tourism Observatory Forum. The two forums encourage and facilitate destinations including tourism businesses, industries, universities, and research centers to share their experience and knowledge, as well as problems solving in harnessing sustainable tourism.

Indonesia Sustainable Tourism Council (ISTC) was formed in order to facilitate and to assist tourism stakeholders to implement sustainable tourism concepts into praxis. ISTC also promotes as certification body to provide Sustainable Tourism Certification to tourism destinations, tourism industries, and tourism professionals.

The latest initiatives in implementing sustainable tourism practices in Indonesia is the commitment to apply Carbon Footprints Calculators and Offsetting (CFCO) in tourism destinations across Indonesia. Knowledge sharing and skills trainings related to the CFCO in tourism have conducted in various events.

## **10.5 CONCLUSION**

The Covid-19 pandemic has accelerated the needs of digitalization that has been underway for decades as the response of customer experience and seamless interaction of businesses in global tourism. Customers with digital internet access began seeing information and shopping remotely, many employees began working from home, and many businesses adopted digital business models to keep operations running and create competitive markets. Tourism globally changes their business landscape and tourist mobility also change their behaviors in selecting destinations and attractions as well as purchasing products.

The challenge in digital transformation mostly concerns with equal access to digital devices and infrastructure supports. There are some challenges in digital transformation which are gaps of access to digital technology, lack of knowledge and skills, misconduct in using social media, and misbehave due to misunderstanding of digital utilizations.

Sustainable tourism needs innovation not only in hardware digital technology, but also software and brainware of human capacity and behaviours. Digital transformation gives benefits to tourism stakeholders and the local community, in improving the value of the tourism experience and the core competencies and hence expanding tourism competitiveness toward resilient and sustainability. Innovation in tourism related to the focuses and priorities of tourism destinations management, tourism business models, tourism promotion and marketing, as well as in travelling and mobility of tourists to and in destinations. Innovation may create integration of systems and information, strengthen tourism linkages with other sectors, added value products, reduce costs of productions and marketing, support the implementation of planning and management solutions that contribute to the economic, social, and environmental sustainability of the sector.

Digital transformation in global tourism may create disruptions and risks. On the other side, it also create new opportunity to work more inclusive and equitable to produce more quality and sustainability of tourism. In order to bridge the gap, digital transformation in tourism should integrate scientific research in development policies and planning, education and skills development, technology innovation and information technology (IT) investments, taxation, trade, investment, and regulatory policies in an integrated system.

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# CHAPTER-11

## DIGITAL TRANSFORMATION IN INDONESIAN EDUCATION SECTOR

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### 11.1 INTRODUCTION

The 21st century is characterized by transition and transformation from the industrial age to knowledge age. In this period, most alternative efforts to meet the needs of life in various contexts are more knowledge-based. Efforts to fulfil the need for knowledge-based education the development of a knowledge-based economy, development and knowledge-based social empowerment, and development in the field of industry is also knowledge-based (knowledge-based industry) (Mukhadis, 2013). As the value chain progresses in the industrial age, extracting, manufacturing, assembling, marketing, and sales products is the chain in the knowledge age of data, information, knowledge, expertise, and marketing to services (Trilling and Fadel, 2009). This change in the economy has necessitated the acquisition of many new skills or the alteration of existing skills that individuals need to possess.

Although the economic order is the main area of change, of changes that the new century brings with it are not limited to this. Next to the requirements for jobs, intensive and simple handling of the digital media tools and platforms such as smartphones and social media informed decision-making, which is possible through the acquisition of new knowledge and skills that are essential and not desirable (Hobbs, 2010).

Due to the characteristics of the new century, students need new skills to live a complex and ever-evolving future life. These skills are mostly referred to as 21st-century skills. The 21st-century skills are based on assumption that the new century requires different skills for an individual to work effectively at every level of society (Ananiadou and Claro, 2009). Over the centuries, only a small number of people needed to have skills like creativity, critical thinking, and problem-solving, but in the new century, every citizen needs to have these skills to survive (Akgündüz et al., 2015). One of the reasons for the difference between 20th-century skills and the 21st century is a major advance in information and communication technology, because this type of work is in progress shifts, in parallel (Dunleavy et al., 2009).

## **11.2 EDUCATION IN THE 21ST CENTURY**

It is becoming increasingly important for students to ensure that they acquire skills to learn and innovate. Information technology and media skills, and the ability to survive in collaboration with them. Use life skills. It was shaped by many in the 21st century (1) Information that can be used anywhere and can be accessed anytime, (2) Faster computation, (3) Automation instead of daily work, (4) Possibility of communication.

There is a need for major changes in national education to meet the educational needs of the 21st century. The Indonesian education system is one of the largest education systems in the world, with approximately 30 million students, 200 thousand educational institutions, and 4 million educators spread throughout Indonesia. The Ministry of Education and Culture formulates a 21st-century learning paradigm which is the ability of students to learn from various sources, formulate problems, think analytically, work together and work together to solve problems (Anonymous, 2020).

The explanation of the 21st century learning framework according to (Anonymous, 2010) is as follows: (1) Critical-thinking and problem-solving skills, able to think critically, laterally, and systemically, especially in the context of problem solving; (2) Ability to communicate and collaborate (communication and collaboration skills), able to communicate and collaborate effectively with various parties; (3) Critical-thinking and problem-solving skills, able to think critically, laterally, and systemically, especially in the context of problem solving; (4) Ability to communicate and collaborate (communication and collaboration skills), able to



communicate and collaborate effectively with various parties; (5) Ability to create and renew (creativity and innovation skills), able to develop their creativity to produce various innovative breakthroughs; (6) Information and communication technology literacy, able to utilize information and communication technology to improve performance and daily activities; (7) Contextual learning skills, able to carry out contextual independent learning activities as part of personal development; and (8) Information and social media literacy skills, able to understand and use various communication media to convey various ideas and carry out activities collaboration and interaction with various parties.

To face learning in the 21st century, everyone must have critical thinking skills, knowledge and skills of digital literacy, information literacy, media literacy, and mastering information and communication technology (Frydenberg and Andone, 2011). These are all the requirements to survive in the next decades to come.

### **11.3 DIGITAL TRANSFORMATION IN EDUCATION**

Digital transformation is a change related to the application of digital technology in all aspects of life in society (Wikipedia). According to Westermen et al. (2011), digital transformation is a process of organizational change that involves people, strategies, and structures through the use of digital technology and business models that adapt to improve organizational performance.

The definition of digital transformation according to Fitzgerald (2013) is the radical use of digital technology to improve performance or to achieve company goals. Digital transformation provides a lot of paradigm shifts in various activities in society in various sectors of human life. Starting from business, education, health, and lifestyle to entertainment, all of them cannot be separated from digitalization. These changes are caused by: Industrial Revolution 4.0 (Cyberspace system), IoT (everything is connected), (Cloud Computing (Computing Power), Broadband (High Speed and Multimedia Communication), Sophisticated Algorithm (Artificial Intelligent), etc.

With the shift in the 21st-century learning paradigm, digital transformation in the education sector is a necessity. In general, digital transformation in education means digitizing educational service processes and products to improve the learning experience for all parties involved.

Digital transformation means improving the core business operations of educational institutions to meet the needs of all relevant parties, especially students, lecturers, staff, and alumni, efficiently by utilizing data and technology. The digitization of the education sector will benefit students and lecturers. Learners and educators benefit from digitizing their education system.

The digital transformation of the education sector today needs to prioritize three things (Dilmegani, 2022). First, accessibility. Digital technology makes it easy for students to access learning resources. Today, people of different socioeconomic positions of all ages in all parts of the world have access to classroom learning and learning resources via the internet. Second, is interactive learning. The learning format is becoming more interactive, due to technology and the availability of various applications. For example, language learning can be done interactively on various application platforms to reach more participants. The third is adaptive learning. Computer technology and artificial intelligence (AI) allow students to adapt their teaching methods according to their needs. Digital transformation in education not only enhances the learner experience, but also focuses on improving the campus environment, teaching, and learning methods.

## **11.4 DIGITAL TRANSFORMATION IN EDUCATION: LEARNING ENVIRONMENT**

A sophisticated interaction between the learner and the environment, mediated by technology, and quick adaptation of the entire learning process characterizes a smart learning environment. An smart learning environment responds to the individual needs of learners: guidance, feedback, instructions or tools. With analyze their learning behavior, performance, and online and real-world contexts can determine learning success. There are several things to consider when designing a smart learning environment, including: (1) an smart learning environment and contextual awareness, (2) an intelligent learning environment that provides the following support from several angles: learning performance, learning behavior, profile, and personal factors, (3) the overall ability of an intelligent learning environment to adapt to the user interface, taking into account personal factors: learning styles and preferences, and learning

status: learning performance, quality, and individual learning outcomes (García-Tudela et al., 2021)

Of all the points mentioned above, it will enable students to interact with the learning environment using all the above skills with digital devices such as smartphones, tablets, computers, and even computer systems are ubiquitous. In addition to those mentioned above, the overall purpose of smart learning environment should include and facilitate learner according to an all-in-one learning experience, regardless of place, and immediate availability.

From the perspective of the all-in-one learning experience, the intelligent learning environment should be understood, both in the framework of formal and informal learning. Personalized smart learning should contain several learning analyzes with high accuracy and precision to support the big data framework (Gros, 2016). In addition, technical characteristics that can make it easier to decipher an intelligent learning environment in its entirety must also be carefully considered. For instance, in a previous work, quoted from Zhu et al. (2016), the ten key characteristics that define an smart learning environment:

1. Location-aware: in smart learning the location in real time is important data that the systems need in order to adapt the content and situation to the learner.
2. Context-aware: exploring different activity scenarios and information.
3. Socially-aware: sensing social relationships.
4. Interoperable: setting standards for different resources, services, and platforms.
5. Seamless connection: providing continuous service when any device connects.
6. Adaptable: pushing learning resources according to access, preference, and demand.
7. Ubiquitous: predicting learner demands until clearly expressed, providing visual and transparent access to learning resources and services.
8. Whole record: recording learning path data to mine and analyse in depth, then providing reasonable assessment, suggestions, and pushing on-demand service.

9. Natural interaction: transferring the senses of multimodal interaction, including position and facial expression recognition.
10. High engagement: immersion in multidirectional interactive learning experiences in technology-enriched environments.

## **11.5 DIGITAL TRANSFORMATION IN EDUCATION: SMART EDUCATION—SMART CAMPUS**

Why does digital transformation matter to educators? Gone are the days when students sat in class and learned just by listening to lectures. Today, education must be collaborative and interactive. Teachers are making drastic changes to the way they approach instruction, with technology in the classroom playing a major role. Digital transformation has a positive impact on student learning by opening up a world of endless possibilities and collaboration. This digital transformation is not a basic hardware or software upgrade (though it can play a role). The digital transformation of education is a physical and philosophical change designed to meet the ever-increasing demands of your students, faculty and campus to create a learning environment where everything is connected. It is an ecosystem that combines technology, services and security to bridge the digital divide to create collaborative, interactive, and personalized learning experiences.

With this digital transformation in the education sector, the conventional education system has changed into a smart education system by utilizing technology, AI, cloud and big data analysis, which is generally referred to smart education.

Some definitions of smart education that have a high similarity of meaning include: Smart education environment incorporates different information and communication technologies to activate learning process and adjust to the requirements of different students (Abdel-Basseta et al., 2018). Smart education is about delivering personalized learning, anytime and anywhere (Bajaja and Sharmab, 2018). Smart education is the conception to describe the brand-new learning process in the information era (Lin et al., 2018). Smart education requires innovative pedagogy methods and tools in order to maximize opportunities of active learning and exploit and enhance the creativity of students (Lytras et al., 2010). An educational paradigm in which students acquire knowledge and skills during which factors like career relevance and development, societal relevance and potential impact,

sound pedagogy, and classrooms equipped with appropriate technologies and devices that enable good instruction and facilitate the ease of rapid acquisition and synthesis of knowledge are considered (Hollins, 2020).

Smart education is now a typical feature in education emerging from information communications technologies and the constant introduction of new technologies into institutional learning. The aim of the smart education is that users develop skills, adapt, and use technologies in a learning context that produces elevated learning outcomes. Technologies, such as cloud computing, learning analytics, big data, Internet of Things (IoT), wearable technology etc., promote the emergence of smart education. The IoT is a new paradigm in which objects equipped with sensors, actuators, and processors communicate with each other to serve a meaningful purpose. IoT influences education in many ways that enable institutions to make decisions that are more informed in an effort to improve student learning experiences, operational efficiency and campus security and many more.

A smart campus is a subset of smart education embedded with sensors and intelligent terminals on the concepts of cloud, internet of things technology and related technologies synthesis. The idea is for administrators, teachers, and students through a more sophisticated environment smartly communicate to enhance learning, share experiences and effectively communicate (Jianqing et al., 2014). The development of the smart campus would not be possible without the innovation in technology. In the literature, the main technologies supporting the smart campus revolution include cloud computing, IoT, AR, and AI.

A cloud based learning platform in the smart campus is being used by virtual learning materials could be created and seamlessly shared, which expands time and space dimension of teaching and learning and facilitates collaborative learning process among instructors and student. On the other hand, the prospective benefits of implementing IoT technology in smart campus mainly lie in three aspects. First, IoT provides the information platform for instructors to track students' learning progress and take informed actions. Second, IoT automates the smart campus operation and smooth's the teaching/learning process. Such convenience means that the stakeholders can put more focus on the learning activities rather than the routine management/administration tasks. Third, emotion or psychological recognition based on the IoT technology, if adopted in a smart campus, can

track students' cognitivity in their learning activities and correspondingly redirect students' attention based on their mental conditions.

Augmented reality (AR) is an emergent form of experience in which the real world is augmented by the virtual content from a computer, which allows seamless overlay and mix between computer-generated content and our real-world perceptions (Aguilar, 2016). Serving as a next-generation interface, AR provides a different way of interaction and gain experience to reinforce the teaching/learning environment. In a smart campus with AR technology, the students tend to gain better knowledge and understanding of what is going on around them, which elevates their learning experiences.

Artificial intelligence is a computation science of making machines or systems to learn from experience, adapt to new inputs, and perform humanlike tasks, which would be a suitable technique to solve problems where solution can be hardly generated through analytical analysis.

Based on the perceived environment, the applied AI algorithm should be able to maximise the chance of the agent to successfully achieve its goal through interaction with the environment or extracting critical information from statistical data. AI has recently gained significant success in many real-world applications, such as pattern recognition, forecasting, translation, control, games, etc.

A smart campus, as cloud computing and IoT has provided the platform for intelligent solutions, AI is then the technique that adds intelligence attributes to the devices and systems. To nominate a few, AI brings the following benefits to smart campus.

## **11.6 LESSONS LEARNED FROM INDONESIA EDUCATIONAL DIGITAL TRANSFORMATION**

Indonesia is an archipelagic country, the government records the number of islands in Indonesia until 2021 is 17,000. Previously, the Republic of Indonesia recorded as many as 16,771 islands, with a land area of 7.81 million km<sup>2</sup>. With the number of provinces in Indonesia in 2022 as many as 37 provinces. The number of public and private elementary schools (SD) in Indonesia in the 2020/2021 school year reached 148,743 schools or 131,058 schools of which are state elementary schools, equivalent to 88.11% of the total elementary schools in the country. The number of public and private junior high schools (SMP) in Indonesia in the 2020/2021 school year reached

40,597 schools. As many as 58.30% of them came from public schools or as many as 23,670 schools. Meanwhile, the number of public and private high schools (SMA) reached 13,865 schools. Among them are private schools, which are 6,966 schools or 50.24% of the total high schools in Indonesia.

Based on statistics Indonesia 2022, there are 3,115 universities spread throughout Indonesia in 2021. This number includes both public and private universities under the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek). The number of campuses is also dominated by the private sector. Of the 3,115 existing tertiary institutions, 2,990 of them are private. Meanwhile, the other 125 are state universities. In addition, there are several universities managed by the Ministry of Religion.

The diversity of geographical locations, social, economic, political, cultural conditions, environmental conditions allow for gaps in educational facilities and infrastructure in urban and rural areas, unequal support from the government, the existence of ancient mindsets in society, low quality of resources, and weak learning evaluation standards make education quality factors not evenly distributed in Indonesia. So that the level of use of digital transformation in the education sector varies from one school to another, as well as in universities.

#### **a. Realization of Educational Digital Transformation in Schools**

In general, digital transformation in education means digitizing educational service processes and products to improve the learning experience for all parties involved. According to Cem Dilmegani (2022), digital transformation in education today focuses on three things, namely accessibility, interactive learning, and adaptive learning. Digital technology allows students to access learning resources more easily and cheaper. Today, students across Indonesia, of all ages, with different socioeconomic statuses have access to classroom learning and learning resources via the internet. With the development of technology and the availability of various applications, learning formats have become more interactive. For example, language learning is carried out interactively through various application platforms and is able to reach more participants. Computer technology and artificial intelligence (AI) allow educational methods to be adapted to the wishes of the students.

Digital transformation in the world of education, especially in schools, is supported by the Ministry of Education and Culture through the link *belajar.id*, account, a system prepared to accelerate the quality of education. In the link *belajar.id*, account, there is a learning house facility for teachers to obtain learning materials, inspiration, and even various experiences and good practices with fellow teachers throughout Indonesia.

During the Covid 19 pandemic, this digital-based learning for students turned out to be very stressful for their psychological soul due to being at home all the time and very limited interaction with their friends to play together. The lessons given by the teacher online do not only give assignments through WhatsApp Groups (WAG) but also explain digital-based materials. Digital-based learning processes are widely used, ranging from paid to free, such as Sevima Edlink, Moodle, Google Class, Etmodo, to Schology.

This digital-based learning, of course, also costs a lot of money to access the internet, so many parents complain about internet packages that run out quickly, which their children use to do assignments for hours, not to mention the internet provider when Covid-19 attacked did not lower the price or make it free as is the case in some countries. Internet speed is also a complaint, so many parents switch to faster internet providers even though they are more expensive. For parents who work at home, there are not a few complaints because their children are always at home so that their work activities are disrupted by the presence of children at home, unlike when children are at school. Not infrequently children also complain that they do not get pocket money from their parents due to school holidays. However, behind these various complaints, it turns out that there is a hidden wisdom for parents who supervise their children for 24 hours, this closeness that parents must take advantage of for their children.

Facing with the reality, during the Covid-19 contagion many teachers turned out to give a lot of assignments through digital media, showing that to implement Permendikbud No. 22 of 2016 concerning Standards for Primary and Secondary Education Processes, one of the points related to the concept of digital-based learning, has not been well understood by teachers in Indonesia.

Even though implementing these regulations is in accordance with digital pedagogy (e-pedagogy), where content is no longer important because



with the internet, anyone can get content, most of which is provided for free, this should be put to good use by teachers in the midst of the global pandemic. The necessity in this 4.0 revolution era is not what one learns but how to learn it, and this should be emphasized for all teachers. So the teacher's position as an educator is very important to understand this to guide students about using the internet for the learning process.

Several leading schools in several big cities in Indonesia have implemented smart schools. Smart school is a system created to digitize all aspects that exist in schools, including learning, management of school facilities and infrastructure, with the aim of facilitating teaching and learning activities in schools. The application of smart school shows that the level of student involvement in the learning process increases, and provides benefits for schools, among others. Some characteristics are:

1. Easy and practical. Students do not need to buy products such as notebooks or lessons every semester. Because all it takes is a laptop, internet network and other gadgets that can be used for more than a year.
2. Expand access to information. As we know that technology provides unlimited access to find various information. Teachers and students can access information anywhere and anytime regarding subject-related knowledge. It even provides more in-depth knowledge information that is not discussed in the curriculum but is related to the curriculum of the subject.
3. Interactive learning experience. Another benefit of the smart school concept is a learning environment that is more interactive and involved in understanding lessons comfortably and close to the teacher, such as giving quizzes or online exams.
4. Involving parents is not only teacher and student communication, smart schools also provide parental involvement to communicate with teachers efficiently such as through class management applications.
5. Environmental friendly. It is certain that by reducing the use of paper as a learning medium, smart schools have supported the environmentally friendly movement.

From the reality of the digital transformation of the education sector in most schools, especially in urban areas, it has shown that the education that is being carried out from Education 3.0 leading to Education 4.0

which is characterized by the teacher as a guide for the use of knowledge resources, learning can be done anywhere, students begin to determine for themselves what they want to know, share, and decide, students learn contextualization and innovation. Learning activities share on social media, and play an active role in shaping knowledge. The teacher can be anyone and anywhere. Student-centered learning. Internet technology is the main tool.

In line with technological developments, the digital transformation program in the education sector in schools, the Directorate General of Informatics Applications encourages capacity building of teachers and education personnel in the use of ICT. In 2022, it will adopt digital technology IoT, Big Data, Cloud Computing, Video Based Learning, Virtual Reality, and Augmented Reality. Teachers and educators will be trained to create creative content to support student learning materials.

#### **b. Realization of Digital Transformation in Higher Education**

Digital transformation in higher education refers to the process and strategy of using digital technology to rapidly change the way institutions operate and serve students, faculty, employees, industry, parents, and government. Digital transformation in universities is to produce the best and easy services for students and partners.

The use of digital transformation in higher education institutions in Indonesia is very diverse, and for high-class universities, it is currently at a quite encouraging stage. There are already quite a number of universities that have carried out digital transformation for education which includes:

1. Learning innovations using information and communication technology, including UT, UI, ITS, UGM, ITB, IPB and many others. In addition, the development of open online courses is also increasingly visible with the Ministry of Research, Technology and Higher Education's Online Learning System (SPADA).
2. Use of facilities in Learning Management Systems (LMS) for the learning process. Although some institutions already have an e-learning system, its use is still limited to a repository of learning materials and has not made much use of the interaction features between lecturers and students. The use of online learning systems in Indonesia has moved from just the use of LMS and other ICT-based tools, to a process of in-depth study (research) to see the extent of the impact of the use of

online learning systems on student learning achievement and teaching effectiveness by the lecturer.

3. Applying blended learning. One of the well-known blended learning methods is the flipped classroom. If the traditional learning method teaches material in class and students do assignments at home, then in the flipped classroom, this learning sequence is reversed. Students learn new material independently and do assignments in class with the guidance of lecturers. The role of technology in this approach allows students to have control over the pace, time and place of learning. Students can pause or rewind the learning video material, so that the material can be absorbed according to their abilities. Students who also ask questions about the material will be more helpful in developing a critical attitude. The delivery of the material has been done by the students independently, so the class becomes a discussion room so that students can ask questions about the parts of the material that are difficult for them to understand. Lecturers become student mentors personally according to the abilities of each student. Assignments can be done in class, students are conditioned to learn to collaborate and communicate.
4. Applying a project based learning method that packs all materials and assignments in group projects based on scenarios released in the community. This method can be assisted by software delivery, for example to provide interactive scenario explanations or as a task collection platform. The goal is to train students' problem solving creatively.
5. Running smart campus at a certain level according to the ability of resources in each campus. A smart campus uses advanced network infrastructure and internet-connected devices to provide supportive and engaging experiences. It joins people, devices, and applications and allows universities to make insight-driven decisions to improve security and maximize resources. In the smart campus concept, all elements related to the campus are interconnected with one another. Everything is interconnected, starting from lecturers, employees, students, parents/guardians of students and also operators to facilitate activities related to campus. An example of implementing smart campus is the use of the Integrated Academic System. By using the Integrated Academic System on smart campus, employees can use student lecture data to be used for

other system purposes. For example in the financial system (finance), library, smart cafe, smart parking, scholarships, and other interests.

6. Some universities use smart campuses in terms of equipment capabilities and smart classrooms. The classroom's equipment is linked to the internet via the Internet of Things (IoT) devices, which can be controlled remotely via applications. Remote systems, for example, can turn on room lights, AC, and LCD from other locations; attendance systems use various sensors; and room security systems use biometric authentication such as fingerprint, face recognition, or smart card authentication.

Based on the foregoing explanations, it is possible to conclude that some of the features or capabilities of a smart campus system include integrated campus information system, which includes academic information systems, e-offices, and new student admission systems, a learning management system that is integrated, a classroom automation system based on IoT, and system of blended learning. These capabilities have been implemented in several campuses in Indonesia, specially campuses that are categorized as world class universities. World-class campuses in general have implemented Education 4.0 which is characterized by a focus on creation and innovation, applying flipped classrooms anytime and anywhere as a practical application of face-to-face interaction. Learning takes place at home or outside of school, while at school students develop skills. Use free and/or easily accessible technology, increasing use of virtual reality, develop personalized teaching and learning, and replace lesson plans with creativity plans.

Lessons learned from digital transformation in education in Indonesia are as follows:

1. Leadership: because there is no obligation to apply the smart school/campus concept in every school/campus, considering that school/campus conditions vary greatly in the ability of human resources and facilities and infrastructure, then if the principal does not care about smart schools, the development of smart schools will run slowly. The replacement of school/campus leader whose term of office has ended, does not always show that the leadership and care for the development of smart schools/campus.
2. Resources: although the digital transformation of the education sector and its benefits are inevitable at this time, the obstacles still faced are

internet access, electricity supply, and also human resources (HR). Internet access in Indonesia is not yet fully evenly distributed. Digital transformation in the education sector can only run smoothly if internet access evenly reaches all corners of Indonesia

3. Institutional: according to the current policy, there is no implementation of smart school/campus development nationally. Smart school development is only handled by a special team or by local companies at their respective schools or campuses, so smart campus capabilities differ from one campus to another. Ideally, to develop a smart school/campus, it is also necessary to reorganize the business processes of the school/campus, so as to enable easy sharing of resources, utilizing AI, cloud, big data, and virtual reality technologies.
4. Planning: smart school/campus planning needs to be part of a smart city master plan; because this concerns one of the characteristics of a smart city, namely smart living. What is still less clear is where the funding for the implementation of the smart campus plan will come from. The smart school program can be part of a government program that can be attached to the RPJMD (medium regional development plan) and its derivatives so that it can receive funds from the APBD (annual regional development budget). The smart school program can be part of the city government's innovation as stated in Law (UU) No. 23 of 2014 concerning local government and the attributes of innovation that are used as a measure of the implementation of local government innovation, Law UU No. 17 of 2007 concerning the National Long-Term Development Plan (Rencana Pembangunan Jangka Panjang Nasional, RPJN) and UU No. 18 of 2002 concerning the National System of Research, Development, and Application of Science and Technology.
5. Operations and control: in the construction of smart schools/campus, usually every school/campus innovates, so that many applications are produced and vary greatly from one school/campus to another. However, there are still many applications that are not integrated with each other at school/campus, let alone integrated with other schools/campus, so that the ability to share resources and collaboration becomes less effective. So that the development of smart school/campus applications (as a form of innovation) needs to be well planned, coordinated by all related parties so that they are operational, and also integrated so that

all aspects of school/campus life or campus activities can be handled by the system.

6. Innovation development: is every school/campus charged for innovation development? Or, there is a special government agency that conducts research and development, innovates smart school/smart campus applications into prototypes, and conducts large-scale testing in several schools/campus for operational innovation. On the other hand, there is still a need to streamline the role of R&D institutions in schools and campuses, in addition to revitalizing the role of R&D institutions (the R&D function of large companies). Smart school/campus development requires the cooperation of government, campus, and industry.
7. Collaboration/involvement/participation: smart school/campus requires collaboration of all stakeholders, but if smart schools/campus is only promoted by local governments or as local government programs, there may not be enough socialization and promotion to invite all parties to work together in developing smart school/smart campus. Is this because there is no government unit dedicated to the development of an integrated smart school/campus?
8. Development of human resources: smart schools/campuses require intelligent human resources, including human resources who master smart technology (such as big data analytics, artificial intelligence, sensors), as well as cyber security, cloud computing, data science, digital information management, and so on. Courses related to smart technology need to be taught in all study programs to educate and train the human resources needed to be more technology literate.
9. Development of digital society and digital culture: the development of digital transformation of the education sector must be comprehensive, therefore it is necessary to implement programs to improve digital society and digital culture in the community, through schools/campus so that the community can participate in the implementation and development of digital transformation in general, and in particular in educational sector.
10. Change management: change needs to be monitored and not only by regulations and orders, but also through systematic change management efforts. Therefore, a team that is responsible for long-term

change management is needed to unite the ability to carry out digital transformation according to the roadmap that has been prepared.

**c. Digital Transformation: Challenges and Recommendations for Improving Education in Indonesia**

Industry 4.0 refers to the growing technological trend towards automation and data exchange in technology and processes in the manufacturing industry. Some of the supporting technologies are the Internet of Things (IoT), Industrial Internet of Things (IIoT), cyber physical systems (CPS), artificial intelligence (AI), smart factories, cloud and edge computing, and so on. This technology allows the process of changing the use of conventional technology to digital so as to increase collaboration, be able to improve work processes more effectively and efficiently, increase business productivity in all lines, including in the field of education.

In line with that, in August 2020, Indonesian President Joko Widodo stated that digital transformation in the pandemic and post-pandemic period will change the way previously offline contact, consumption, study and trade with physical things and structurally go online.

Although the digital transformation of the education sector is a necessity for now, which has been accelerated by the emergence of the Covid-19 pandemic, causing the government to issue a new regulation that during the pandemic period everything is done through digital media/online, so like it or not, everyone must follow these regulations. With the invitation to carry out digital transformation continuously, some of the challenges faced and their recommendations for the digital transformation of the education sector, including:

1. Internet access is not yet fully distributed. Digital transformation in the education sector can only run smoothly if internet access reaches all corners of the country evenly. Based on data from the Indonesian Ministry of Education and Culture's Pusdatin, currently there are still around 42,159 schools that do not have internet access. Likewise for the power supply. Data from the 2020 Dapodik Ministry of Education and Culture of the Republic of Indonesia noted that there were 8,522 schools that had not been electrified. Therefore, it is necessary to develop adequate infrastructure so that internet access can be well guaranteed throughout Indonesia.

2. Increasing human resources is also absolutely necessary. There are still many school teachers who lack the ability to use technology or applications for education. For this reason, training and courses in the use of digital technology to support the learning process for teachers need to be intensified and sustainable.
3. The number of schools and universities in Indonesia is very large and very varied in terms of quality, infrastructure, and human resource capabilities, making it difficult to start the development and implementation of an equivalent smart school/smart campus, including the type of technology used. There is a need for an accelerated program for equal distribution of education quality.
4. There are still many universities that find it difficult to implement the smart campus system, because they do not have strong capabilities in the field of technology. Therefore, it is necessary to support the strengthening of technology in schools/campuses which are still weak.
5. There are still many schools/campuses using the internet to support campus operational activities, but have not utilized the intelligence dimension, including: open data, AI, big data, and IoT. This can be implemented at the tactical/operational level, strategic/policy level, or both for school/campus purposes.
6. The benefits of AI, Big Data Analytic, VR applications for educational purposes are not widely understood by educators. Artificial intelligence application can undertake simple but time-consuming tasks in education to ease the workload of educators or school staff. Voice-to-text technologies transforming classes to notes are helpful to students with hearing impairment.
  - (a) Text-to-voice technologies help students with dyslexia listed instead of read so they can learn effectively.
  - (b) Personalized learning can involve a diverse set of technologies including AI to elicit how a student learns best and tailor the education accordingly. Digital technologies enable schools to collect and analyze a wealth of data about their students to monitor and enhance their performance. They can determine where students struggle and succeed, develop new methods, and test whether these methods yield expected results.



- (c) Augmented reality and virtual reality (AR/VR) technologies can enable virtual field trips to historical locations or facilitate learning-by-doing for applied sciences and medicine. The distance learning experience can also be improved with AR/VR technologies and Internet of Things (IoT). The increasing use of smartphones and other edge devices improves the connectivity between students and their educational institutions by enabling real-time communication and data transfer.
7. The culture of resource sharing and collaboration between schools/campus is still not growing well. This culture needs to be developed, supported by smart school/campus technology, aimed at realizing the maximum utilization rate of higher education resources through sharing resources, increasing educational efficiency, and accelerating the improvement of the quality of higher education while expanding the scale of higher education. Thus, it will be easier to achieve equal distribution of the quality of education, which is still a problem in the world of education in Indonesia.
  8. A large institutional culture helps the small, the strong helps the weak, in the bond of cooperation, has not been done much, still needs to be cultivated. With the variety of quality, the quality of human resources, infrastructure and school/campus locations in Indonesia, the implementation and development of smart schools/campuses in accordance with established standards will be difficult to achieve. Therefore, it is necessary to develop, for example, the sister school/campus program which focuses on capacity building and improving the overall performance of smart schools/campus, with the aim of increasing the management and leadership capacity of weak schools/campus, improving the quality of school/campus education services of the weak campus, at least according to national standards. In its implementation, strong schools/campuses provide direct and remote assistance, provide internships to increase the capacity of human resources in managing education in a smart way. All of these activities are supported by the use of digital transformation technology.
  9. Development of smart schools/campuses that are suitable to be applied to all schools/campuses in Indonesia which vary greatly in quality and condition, which supports resource sharing and collaboration, to realize

an equitable and high-quality education quality, in order to create an intelligent nation. It needs to formulate the smart school/campus concept together, keeping in mind the 21st century learning concept and the Society 5.0 concept.

In addition, in general we need to develop a digital education sector transformation model that is in accordance with the situation and conditions in Indonesia. One of the models that can be adopted is cloud-based big data enabled smart education system. Cloud-based framework to provide more economical, stable and economical education services, cloud computing has become the choice of the education sector. This framework provides e-learning content services deliver and distribute and enhance different types of academic content. The framework consists of six main options required to implement cloud-based academic content services (1) a cloud platform providing a cloud-based educational media service environment infrastructure, (2) compatible file formats that allow media content to be distributed across different types of devices, (3) authoring tools that allow teachers to build various types of media content, (4) content viewer that displays different types of media across multiple channels, (5) an inference engine that offers individualized learning content to students, and (6) protection mechanisms for safe educational content services that handle privileged user access and data encryption in the cloud (Jeong and Kim, 2016).

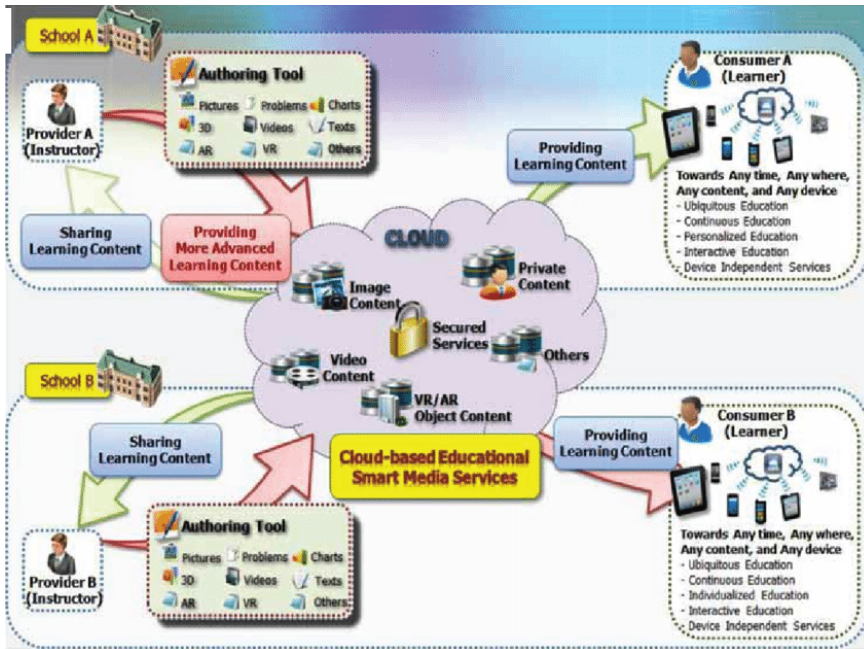


Figure 11.1 Cloud-based Big Data Enabled Smart Education System  
 Source: Suresh et al., 2021

The framework also includes a content viewer to read/check and display learning content, and inference engine based on their interests and experiences to support content individually for each student. To provide student-specific learning content by analyzing interests, learning styles, and content usage patterns use an inference engine. In addition, it controls data access and encryption security framework provided in the cloud. It provides the infrastructure for the implementation of cloud-based big data-enabled educational media services environment applying many IT and cloud computing technologies, such as data synchronization, virtualization, service provisioning, and multi-sharing services.

Other models can also be developed by studying the digital education transformation that is developing in the world. The role that will be carried out by the government in transforming digital education as a driving force for the transformation of the digital education sector needs to be improved, including increasing technological support for schools/campuses and

awareness of the needs and interests of schools/campuses towards the transformation of the education sector.

Regarding the digital transformation of the education sector in Indonesia, Universitas Gadjah Mada has a graduate school (Master and Doctoral) programs to prepare its human resources, namely the Computer Science Study Program which was established in 1998, and has produced more than 1000 graduates who are ready to support promotion of digital transformation in Indonesia. In addition, since the 2022/2023 academic year, the Master of Artificial Intelligence study program has been opened. These three study programs are managed by the Department of Computer Science and Electronics, under the Faculty of Mathematics and Sciences.

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**PART-3**  
**SUSTAINABLE ENERGY TRANSITION**





## CHAPTER-12

# PATHWAYS TO ENERGY TRANSITION IN INDONESIA

Wangi Pandan Sari

### 12.1 ENERGY TRANSITION OUTLOOK

The Paris Agreement or the Paris Climate Accords is a legally binding global climate change agreement aimed to limit the global temperature increase in this century to 2°C and preferably to 1.5°C, in comparison to pre-industrial levels. The agreement was adopted at the COP21 (Paris Climate Conference) by 196 Parties in December 2015 and entered into force the following year.<sup>1</sup> As part of the commitment to tackle climate change as per The Paris Agreement, countries have agreed to submit their climate action plans in what is known as Nationally Determined Contributions (NDCs). Long term strategies (LTS) should also be formulated by the participating countries (though not mandatory unlike the NDCs) to provide clear direction on strategies that should be taken to reach the goals set in the Paris Agreement.

Energy transition from fossil based fuels to renewable energy resources is central to addressing the threat of climate change. Strategies have been put in place and actions have been implemented to phase out fossil fuels and increase the use of renewable energy resources. However, in this current condition where we face severe global challenges from Covid-19 to the crisis in Ukraine, it is questionable whether the target set in the Paris Agreement can be achieved. The progress of energy transition is far from being on track,

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<sup>1</sup> <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

pressing the needs for countries to accelerate the energy transition agenda. There is an urgency for short-term interventions to address the current energy crisis. These interventions should also be accompanied by and aligned with resolute mid and long term strategies of the energy transition as to meet the climate change goals. Accelerating energy transition is also vital to address energy trilemma, i.e. finding the balance among the three core dimensions of energy sustainability—energy security, affordability, and environmental sustainability.

The World Energy Transitions Outlook (WETO) produced by The International Renewable Energy Agency (IRENA) in 2021 outlines a pathway to attain the Paris Agreement goals, providing alternatives to limit the increase of global temperature to 1.5°C and to reach net zero emissions by 2050. The report presents the guiding framework to achieve realise the IRENA’s 1.5°C Pathway (Figure 12.1).

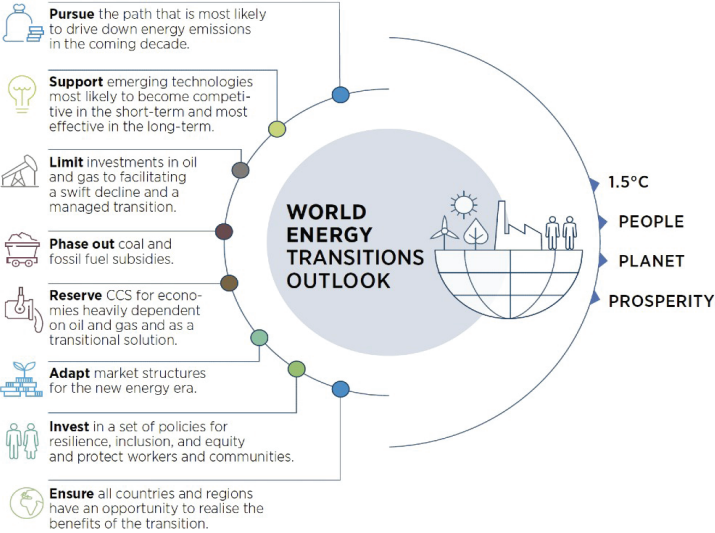


Figure 12.1 Guiding Framework of World Energy Transition Outlook Theory of Change  
Source: IRENA, 2021

The second edition of the report produced in the following year recognises electrification and efficiency as key drivers shaft of the energy transition. The outlook provides a pathway to achieve net zero emissions by 2050. This requires a transformative change from the world, particularly from

those that consume the largest energy and produce high carbon emissions. The report anticipates a decrease of nearly 37 gigatonnes of annual CO<sub>2</sub> emissions by the half century (Figure 12.2) which can be achieved through.<sup>2</sup>

1. Notable improvement in production and direct uses of renewables-based electricity.
2. Significant advancement in energy efficiency.
3. The electrification of end-use sectors (e.g. electric vehicles).
4. Clean hydrogen and its derivatives.
5. Bioenergy coupled with carbon capture and storage.
6. Last-mile use of carbon capture and storage.

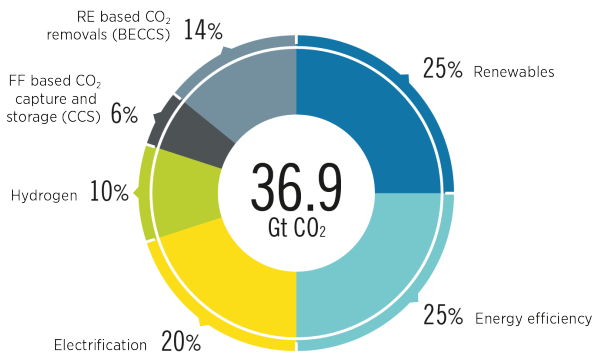


Figure 12.2 Reducing Emissions by 2050 through Six Technological Avenues  
Source: IRENA, 2021

Enabling an accelerated energy transition that is aligned with the climate goals requires unwavering commitments from governments around the globe. Countries should work together to realise successful international cooperation. A holistic framework that is implemented globally can bring countries together and provide financial assistance, technology development and transfers, and capacity building that is essential and needed to enable an accelerated energy transition.

## 12.2 NATIONALLY DETERMINED CONTRIBUTION (NDC)

Nationally Determined Contributions (NDCs) is the core of the Paris Agreement. It contains climate commitments and each country’s efforts

<sup>2</sup> IRENA (2022), World Energy Transitions Outlook 2022: 1.5°C Pathway, International Renewable Energy Agency, Abu Dhabi

to reduce national emissions and adapt to the impacts of climate change. Countries that have submitted NDC documents are required to update the NDC documents every 5 years.

Indonesia signed the Paris Agreement in 2015 and after that immediately started the preparation to produce NDC document as part of its commitment in reducing greenhouse (GHG) emissions. The first NDC document submitted by the country was in 2015, which later updated in the following year with a validity period until 2030. Indonesia has committed to reducing emission by 29% unconditionally and 41% conditionally (with international support) against the Business as Usual (BAU) scenario by the year of 2030. In the period of Joko Widodo's first presidency (2014–2019), priority actions were determined through the National Nawa Cita framework, i.e., nine development priority agendas. Its mission is aligned with the national commitment toward a low-carbon and climate-resilient development. The nine Nawacita priorities above inspired and become part of the National Medium-term Development Plan 2015–2019.

Indonesia as the largest archipelagic country in the world, consisting of more than 17,000 islands, is particularly vulnerable to climate change. The risks of climate change is especially higher at its lowland areas which cover about one-fifth of Indonesia's total area of which about half are peatlands. Contributing to its geographical location, Indonesia perceives that the key strategies in formulating the adaptation and mitigations efforts to achieve climate goals should be a comprehensive approach that integrate land and sea considerations. Indonesia strives ambitious goals to reach sustainable consumption and production related to water, energy, and food. These can be achieved through empowerment and capacity building, improving basic health and education services, innovations technology, and sustainable natural resource management in line with good governance principles.<sup>3</sup>

Indonesia has set out plans for climate change mitigation and adaptations action to achieve its climate goals. As outlined in its NDC documents, there are five sectors that will be contributing to reducing its GHG emission target by 2030, i.e. 29% unconditionally and 41% conditionally. These five sectors are: energy, waste, agriculture, forestry, industrial processes, and product use (IPPU). As illustrated in Figure 12.3, the projected emission in 2030 based on BAU scenario is estimated at 2.87 GTonnes CO<sub>2</sub>e. To achieve the

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3 Strategi implementasi NDC

target goal of reducing GHG emissions by 29% unconditionally by 2030 (CM1), forestry sector is estimated to contribute the largest CO<sub>2</sub>e emission reduction (by 17.2%), followed by energy sector (by 11%), agriculture (by 0.32%), IPPU (0.1%), and waste (by 0.38%) respectively. With the international support (CM2) to reach 41% GHG reduction by 2030, forestry sector is estimated to contribute to 22.7% reduction, followed by energy (13.9%), waste (0.9%), agriculture (0.13%), and IPPU at 0.11% reduction respectively. The actions amongst others that can be taken to realise this transformation toward low-carbon emission include reducing deforestation and forest degradation, land conservation, utilisation of degraded land for renewable energy, energy efficiency, integrated watershed management, sustainable agriculture and plantation, and improving consumption patterns.

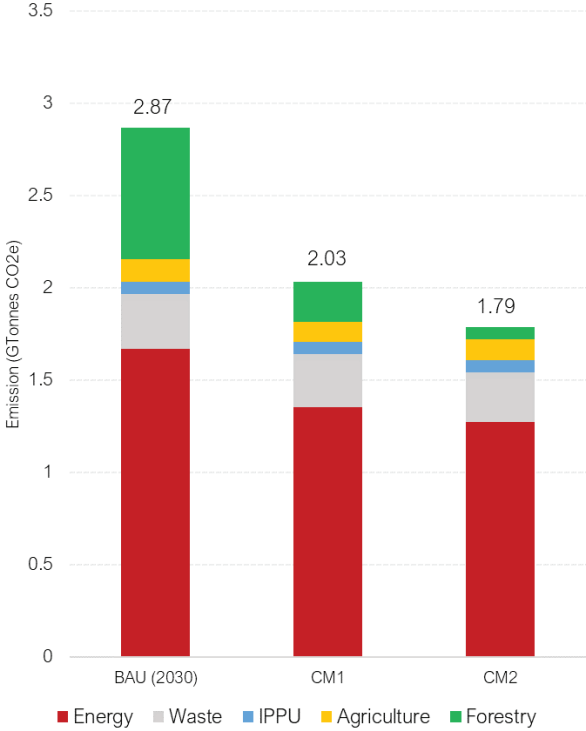


Figure 12.3 BAU Projection and GHG Emission Reduction from the Five Contributing Sectors

Source: Ministry of Energy and Mineral Resources (ESDM), 2021

Note: CM1 = unconditional targeting; CM2 = conditional targeting (with int'l support)

In the latest updated NDC document (2021), Indonesia clarified and added several points that were not included in the previous version of the NDC. The document reflects an enhanced clarity on the mitigation and adaptation strategies to tackle climate change by adopting the Paris Agreement rulebook, also known as the Katowice Climate Package, and translating it into Indonesia's context.

The updated NDC is aligned with Indonesia's national development and long-term visions. It is aligned with RPJMN 2020–2024 which focuses the development on seven agenda including:<sup>4</sup>

1. improving economic resilience for quality growth,
2. developing regions to address inequality,
3. improvement the quality and competitiveness of human resource,
4. building characters and creating a nation of cultures,
5. strengthening infrastructure to support economic development and provision of basic services,
6. building the environment and improving resilience to natural disaster and the climate change impacts,
7. improving stability in politic, law, national security and defence, and public service transformation.

The updated NDC also describes indicatives pathways toward the vision of 100 Years of Indonesia (Vision Indonesia 2045) that is based on the four pillars:

1. human resource development and advances in science and technology,
2. sustainable economic development,
3. equitable development,
4. strengthening national resilience and public governance.

The NDC in line with the national development and visions are well reflected in the Indonesia Long Term Strategy for Low Carbon and Climate Resilience (LTS-LCCR) 2050 that was formulated in 2021 along with the updated NDC. The adoption LTS-LCCR 2050 will play an important role in aligning climate goals and targets with the national and international goals including the SDGs (Sustainable Development Goals). The existence

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4 Updated NDC Republic of Indonesia, 2021

of LTS-LCCR will also strengthen Vision Indonesia 2045 in striving for prosperous Indonesia.

In the updated NDC, Indonesia is committed to adjust to energy transition that is reflected in its effort to create decent work and quality jobs. The creation of employment opportunities for an effective and inclusive transition will be followed through in synergy with the existing programmes. Indonesia also considers the importance of gender equality in addressing climate change. The country perceives that women should play a bigger role in climate change and the capacity should be strengthened. Women have been already involved in climate change agenda and will be continued to be so as part of the NDC implementation and should be regard to gender equality. It views gender issues in climate change is pivotal and policy on gender issues.

In terms of emission reduction, the target that Indonesia has previously set has not changed, i.e. 29% unconditionally and 41% unconditionally by 2030. However, there is an update on the projected GHG emissions based on BAU scenario from NDC 2016 to NDC 2021. The updates from NDC 2016 to NDC is summarised Table 12.1.

Table 12.1 Updated Changes from NDC 2016 to NDC 2021

No.	Aspect	NDC 2016	NDC 2021
1	Alignment with national strategy	Selaras dengan konsep Nawa Cita	Penyelarasan dengan RPJMN 2020–2024 dan Visi Indonesia 2045 melalui NDC
2	Projected GHG emissions in business as usual (BAU)	✓ Energy CM2: 1.271MTonnes CO <sub>2e</sub> ✓ FOLU CM2: 64 MTon CO <sub>2e</sub>  Emission reduction target: ✓ Energy CM2: 398 MTon CO <sub>2e</sub> ✓ FOLU CM2: 650 MTon CO <sub>2e</sub>	✓ Energy CM2: 1.407 Mton CO <sub>2e</sub> ✓ FOLU CM2: 68 Mton CO <sub>2e</sub>  Emission reduction target: ✓ Energy CM2: 441 MTon CO <sub>2e</sub> ✓ FOLU CM2: 692 MTon CO <sub>2e</sub>
3	Document <i>Long Term Strategy</i> (LTS)	Not available	Available, to fulfill the mandate of the Paris Agreement Article 4.19 (including the issue of gender equality and decent job)

Table 12.1 Updated Changes from NDC 2016 to NDC 2021

No.	Aspect	NDC 2016	NDC 2021
4	Assumptions description in BAU projections and targets	Not available	Available
5	Indonesia commitment in international conventions	Not available	Available
6	Translating <i>Katowice Climate Package</i> as Guidance to the implementation of the <i>Paris Agreement</i>	No	Translated

Source: <https://iesr.or.id/simak-6-perbedaan-pada-ndc-indonesia-tahun-2015-dan-ndc-hasil-pemutakhiran-2021>

## 12.3 NATIONAL ENERGY SECURITY

Energy security, as defined by the IEA (International Energy Agency), is the uninterrupted availability of energy sources at an affordable price.<sup>5</sup> According to Government Regulations No. 79 Year 2014 on national energy policy, energy security is defined as the condition when availability of energy and public access to energy at affordable prices in the long term are ensured whilst taking into account the protection of the environment. Energy security can be broken down into short-term and long-term energy security. The latter deals with timely investment to supply energy whilst the former focused on promptly reaction to the abrupt change in energy demand and supply (more discussion on energy demand and supply available in Chapter-13 of this book). In the long term aspect, the investment in energy supply must be in line with economic growth and also consider its effects on the environment. The short-term aspect of energy security focuses on the ability to balance sudden change in energy supply and demand.

National energy security can be assessed using 4A approach as illustrated in Figure 12.4.

1. **Availability:** how readily available the energy and its source, whether there is existing energy resources available domestically or if there is any existing support system available, or if there is energy to be imported.

<sup>5</sup> <https://www.iea.org/areas-of-work/ensuring-energy-security>



2. **Affordability:** how affordable the energy investment cost, which may start from the cost of exploration, to production and distribution cost of the energy, and the price at which the customers pay to use the energy.
3. **Accessibility:** the ability to access the source of energy, which include energy infrastructure, energy network and distribution, taking into account the geographic and geopolitical challenges that is faced by the country.
4. **Acceptability:** usage of energy that is environmentally friendly. This aspect also considers the acceptance of the public to use a certain kind of energy resources, for example, public perspective on using nuclear energy.

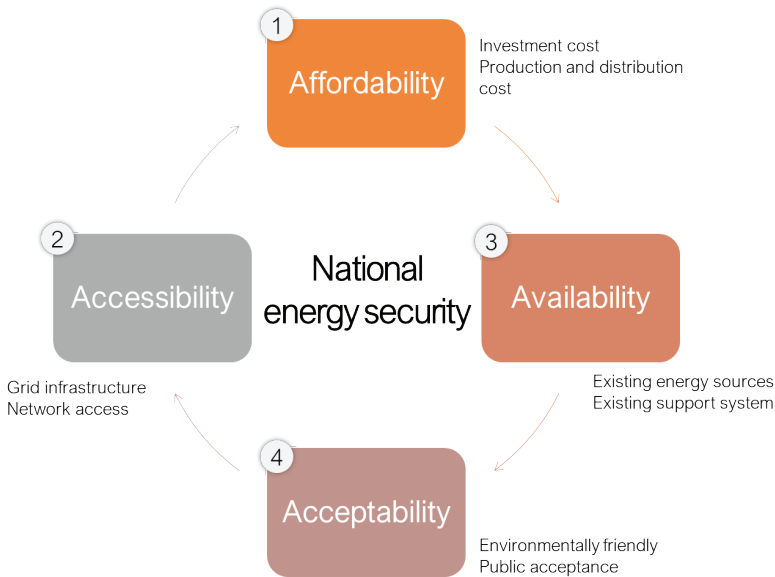


Figure 12.4 Energy Security Model  
Source: [www.iea.org](http://www.iea.org)

The 4A energy security model has been implemented since 2014. Each of the aspect has indicators that can be used as a guidance to calculate the level of national energy security. Each aspect has its own weight with the largest is on the aspect of *affordability* (46,7%), *accessibility* (27,7%), *availability* (16%), and *acceptability* (9,6%) respectively. The affordability aspect has 4 indicators, i.e. energy productivity, fuel and LPG prices,

electricity prices, and land prices. The accessibility aspect has 5 indicators which are the provision of fuel and LPG, the provision of electricity, electricity services, the provision of natural gas, and natural gas distribution services. For the availability aspect, there are 8 indicators namely of LPG fuel reserves, energy buffer reserves (CPE), imports of BBM & LPG, imports of petroleum, coal supply obligations for domestic purposes (domestic market obligation (DMO)) for gas and coal, achievement of the energy mix, oil and gas reserves and resources, and coal resource reserves. The acceptability aspect has three indicators, i.e. energy efficiency, the role of new and renewable energy (EBT), and reducing greenhouse gas emissions.

Dewan Energy Nasional (DEN) is an independent national institution that is responsible for the national energy policy. DEN produces national energy security index obtained through an assessment involving expert judgment by using a questionnaire instrument containing data on national energy conditions in the 2014–2018 period.<sup>6</sup> There were 46 respondents comprising experts and/or officials in the energy sector with the knowledge and awareness of the development of the national energy conditions to date. The results of the assessment using the 4A approach can be seen in Figure 12.5. The scale of the results of the assessment is as follows:

1. Highly resilience (8–10) shows the development energy has improved significantly within the last two years. This may include a comprehensive and integrated cross-sectoral support on technical policies and regulations, the realisation of the government programmes according to or exceeding the set target, and safe and sustainable condition in long term (>10 years).
2. Resilience (6–7.999) shows the development energy has improved within the last two years. This may include a progression toward comprehensive and integrated cross-sectoral support on technical policies and regulations, the realisation of the government programmes near the set target, and safe and sustainable condition in medium term (<10 years).
3. Less resilience (4–5.999) shows the development energy has yet to improve within the last two years. This may include cross-sectoral supports on technical policies and regulations has not been integrated nor comprehensive, the government programmes are realised but did not

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6 Ketahanan Energy Indonesia 2019, DEN

- achieve the target, and the current condition is quite safe but needs early warning to potential vulnerabilities in the medium term (<10 years).
4. Vulnerable (2–3.999) shows the development energy has not improved within the last two years. This may include cross-sectoral supports on technical policies and regulations are not integrated nor comprehensive, the government programmes are not realised according to the target, and the current condition is not safe and in urgent need for short-term countermeasures are needed (<5 years).
  5. Highly vulnerable (0–1.999) shows the development energy is not available within the last two years. This may include regulations and policies on cross sectoral energy management is not available and government programmes to support energy security are not available either.

Following the energy security assessment, the overall ('Total score') of the national energy security of Indonesia is classified as 'Resilience' with the value index generated in the 4 data collection periods (2014–2018) has increased. Similarly, the evaluation of each aspect has also seen an increase in general. The highest assessment is obtained at the affordability aspect—this is also the aspect with the highest weight. The second highest is obtained at the acceptability aspect. However, out of these four aspects, the availability aspect is still classified as 'less resilience'. This means that there are indicators on the aspect of energy availability that still need to be improved, such as national fuel and LPG reserves, oil and gas reserves and resources, imports of fuel and LPG, and imports of petroleum.

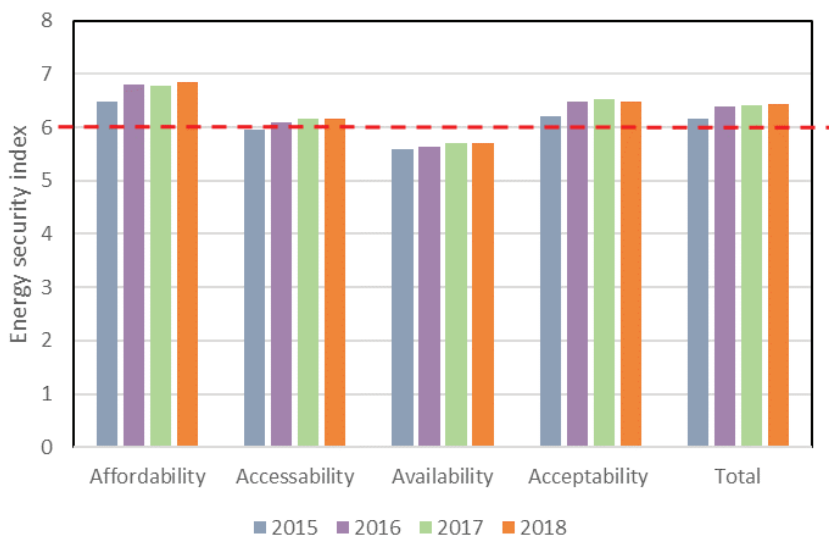


Figure 12.5 Assessment of Indonesia Energy Security 2019  
 Source: Ketahanan Energi Indonesia 2019, DEN

The assessment of the national energy security is paramount as the result can be used as an input to help identifying the root cause problems that may hinder the national energy supply. It can be also used as a reference in formulating the necessary steps that needs to be taken in the attempt to improve Indonesia energy security to higher level.

## 12.4 NATIONAL ENERGY MIX

Indonesia has set an unconditional emission reduction target of 29% from the BAU scenario by 2030. This commitment will be implemented through an inclusive and evidence-based approach, including through effective land and space use, sustainable forest management, restoration of ecosystem functions, conservation energy and clean and renewable energy source campaigns, and improved waste management. Indonesia has also set a conditional emission reduction target of 41% by 2030. This increase can be achieved if supported by international assistance, for example through technology transfer, financial support, and capacity building.

On the one hand, taking into account the challenges of national development and focusing the efforts to reduce poverty and create a better

quality of life for all Indonesians, this emission reduction target can be seen as an ambitious step. But on the other hand, the absence of changes in the emission targets from the previous version of the NDC document can be seen as a lack of urgency for Indonesia to respond to the current climate crisis. Indonesia should be able to increase its emission reduction targets to achieve the target of preventing the increase in the earth’s temperature below 2°C.

In the energy sector, Indonesia has implemented a policy on the national energy mix. In addition, the development of clean energy sources has also been determined as a national policy direction. Government Regulation No. 79/2014 on National Energy Policy, sets out the ambition to change, by 2025 and 2050, the primary energy supply mix (Figure 12.6) with the following breakdown:

- 1. new and renewable energy at least 23% in 2025 and at least 31% in 2050;
- 2. oil must be less than 25% by 2025 and less than 20% by 2050;
- 3. coal at least 30% in 2025 and at least 25% in 2050; and
- 4. gas at least 22% in 2025 and at least 24% in 2050.

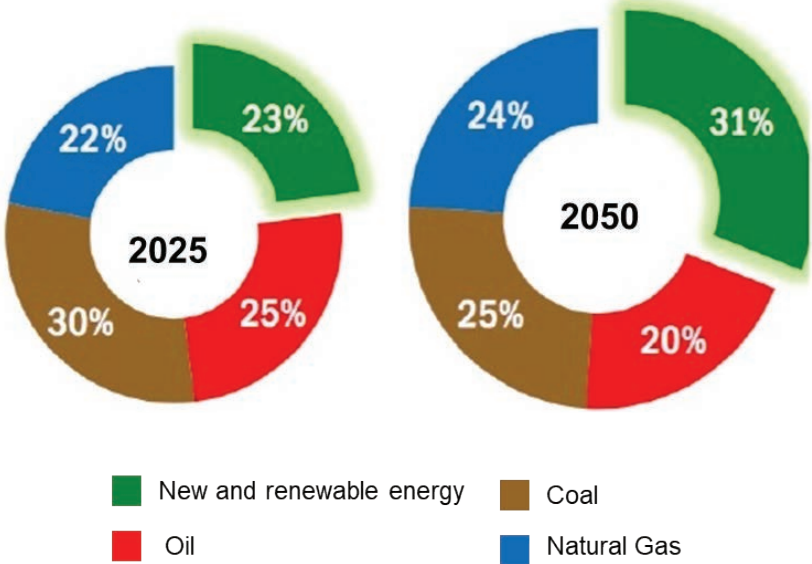


Figure 12.6 National Energy Mix Target 2025 and 2050  
Source: Tampubolon, IESR, 2020

Currently, oil and gas is still playing a vital role as a national energy source. In 2020, the realisation of the renewable energy mix reached 11.2% of the target of 13.42. As can be seen in Figure 12.7, the percentage of new and renewable energy continues to increase from year to year. However, reflecting the rate of new renewable energy growth in recent years, the target of 23% new renewable energy energy mix by 2025 is likely not to be achieved. With the current policy scenario applied, the projected primary energy mix in 2025 will only be 18%.<sup>7</sup>

To be able to achieve the renewable energy mix target in accordance with Indonesia’s commitment in the NCD, strategic steps are needed to accelerate efforts to shift to renewable energy and develop new and renewable energy.

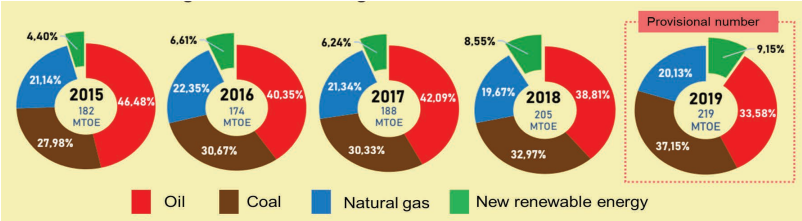


Figure 12.7 Development of the National Primary Energy Mix in 2015–2019  
 Source: <https://www.den.go.id/index.php/dinamispage/index/869-perkembangan-bauran-energi-primer-nasional-tahun-20152019.html>

**Overview of Power Generation in Indonesia**

Fossil fuels have long been the main source of electricity generation in Indonesia. However, after the oil crisis in the 1970s, Indonesia reduced its oil-based electricity production from around 56% in 1971 to around 19% in 2000 and continues to decline to around 3% in 2020.<sup>8</sup> This reduction was accompanied by an increase in coal-based electricity production, starting from 0% in 1971 to 36% in 2000, and increasing to around 64% in 2020. On the other hand, gas-based electricity production began to grow in the 1980s which later increased to 28% in 2000. However, the percentage of gas-based electricity production decreased to around 18% in 2020.

<sup>7</sup> Rencana Umum Energi Nasional (RUEN): Existing Plan, Current Policies Implication, and Energy Transition Scenario. Agus Tampubolon IESR—29 September 2020  
<sup>8</sup> [https://transisienergi.id/data\\_input/bauran-pembangkitan-listrik-di-indonesia/](https://transisienergi.id/data_input/bauran-pembangkitan-listrik-di-indonesia/)

Coal-fired power plants are still the main source of electricity generation in Indonesia. The mix of electricity generation in Indonesia in 2020 can be seen in Figure 12.8. With more than 60% of the energy mix in power plants still dominated by coal, Indonesia will find it difficult to achieve the energy mix target in accordance with its NDC commitments. The slow growth of new renewable energy in power plants also contributed to the far reaching realization of the energy mix target of 23% new renewable energy in 2025.

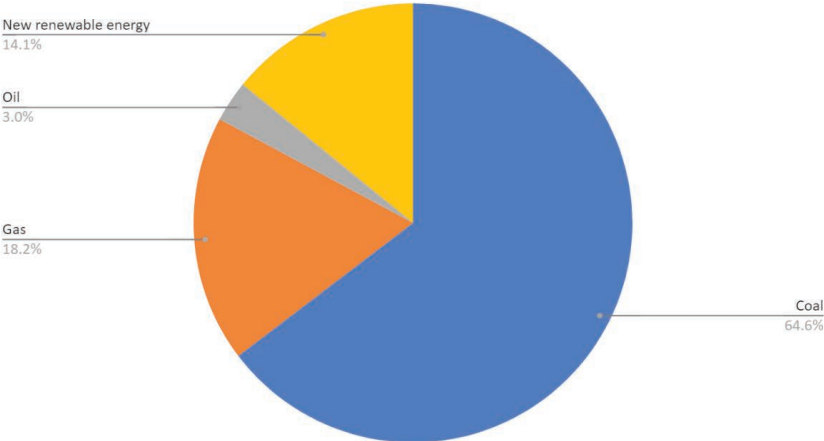


Figure 12.8 Electricity Mix in Indonesia in 2020  
Source: DEN, 2019

Actually, Indonesia has a fairly high potential for renewable energy, but its utilisation has not been carried out optimally so that the energy mix target has not been achieved as targeted in the *Kebijakan Energi Nasional* (KEN), i.e. National Energy Policy. There are several factors that hinder the achievement of this energy mix. One of them is the realisation of economic growth which is lower than the projected figure. The annual energy consumption growth rate is currently at 4%, lower than 4.7%/year in the *Rencana Umum Energy Nasional* (RUEN) 2015–2050, i.e. the National Energy General Plan. The low realization of economic, industrial and population growth will lead to less electricity consumption. Therefore, looking at the current conditions, instead of reaching >45 GW of renewable

energy in 2025, renewable energy in that year is projected to be realized at 22.62 GW.<sup>9</sup>

Because the territory of Indonesia is an archipelago, the utilisation of new and renewable energy is also constrained by the geographical gap. Energy sources and energy requirements are different from one location to another. Not to mention the investment in the technologies to bring new renewable energy into realisation. The cost is still relatively expensive, especially if it is to be implemented in remote and/or isolated areas in Indonesia. To accelerate the implementation of the use of new and renewable energy, significant efforts are needed not only from the government in making policies and regulations that can encourage the use of new and renewable energy technology, but also requires the participation of various other parties including the wider community.

## 12.5 INDONESIA NET ZERO EMISSION 2060

Net zero emissions (NZE) is a condition where the amount of carbon released into the atmosphere does not exceed the amount of emissions that can be absorbed by the earth. As part of commitment in reducing GHG emissions, many countries around the world have made a pledge to reaching NZE within the few next decades. Indonesia is one of the countries that is committed to realise its NZE target by 2060 or earlier if possible (with international support). However, at the current energy mix where the composition of energy mix (as of 2021) is 89% sourced from fossil based fuel and only 10–11% is sourced from new renewable energy, it would be a massive challenge for the country to achieve its NZE 2060 target.<sup>10</sup> It needs enormous investment, be it from the financial sectors or the human capital. Following its commitment in the NDC, Indonesia's climate funding requires around IDR 3.9 trillion (around USD 260 millions).

There were USD 100 million funds available for climate change mitigation and adaption in 2020 as confirmed at the COP26 in Glasgow, Scotland in 2020. The funds were accessible to underdeveloped and developing countries, however, these funds alone were not sufficient to support the realisation of the GHG reduction and NZE target for the countries.

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9 Rencana Umum Energi Nasional (RUEN): Existing Plan, Current Policies Implication, and Energy Transition Scenario. Agus Tampubolon IESR—29 September 2020

10 <https://www.cnbcindonesia.com/news/20210628123005-4-256458/ri-bebas-karbon-2060-cuma-mimpi-kalau-gak-lakuin-ini>



Other strategies should also be implemented, such as the carbon tax, capacity building and empowerment, and technology transfer among others.

Reflecting at the realisation and development of Indonesia energy mix, there is an urgent need for the government to act fast and act together with other stakeholders to help accelerate energy transition so that goal of NZE 2060 can be achieved.



## CHAPTER-13

### ENERGY DEMAND AND SUPPLY FROM A MULTISECTORAL PERSPECTIVE

Dwi Novitasari, Sarjiya, and Deendarlianto

This chapter will discuss Indonesia's energy demand and supply from several sectors, such as the power generation, industry, and transportation sectors. This chapter also will discuss the greenhouse gas (GHG) emissions in Indonesia. Before going into a detailed explanation, Figure 13.1 shows the final energy consumption in Indonesia from 2001 to 2021. During the last ten years, final energy consumption experienced significant growth in 2018 of 12%, from 772 million BOE (Barrel of Oil Equivalent) in 2017 to 866 million BOE in 2018. While the most significant decline occurred in 2020, from 943 million BOE in 2019 to 840 million BOE in 2020. This decline is in line with the decrease in Gross Domestic Product (GDP) in 2020, caused by the Covid-19 pandemic.

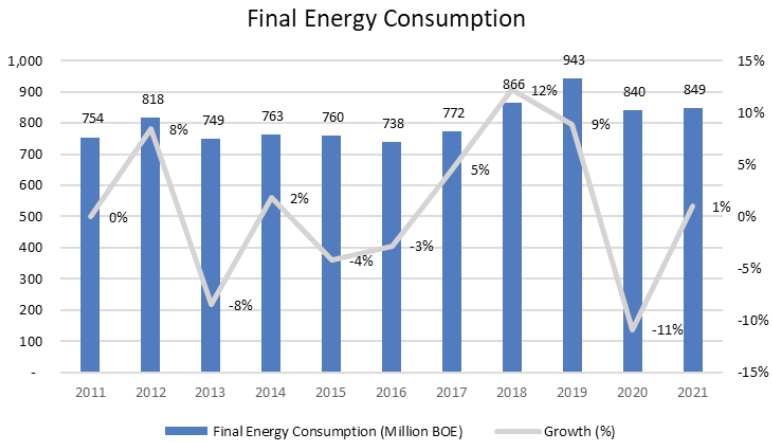


Figure 13.1 Final Energy Consumption Indonesia  
 Source: Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumber Daya Mineral), 2021

To meet the existing needs, the supply of primary energy, as shown in Figure 13.2 has a significant increase in 2016 by 13%, from 1,213 million BOE in 2015 to 1368 million BOE in 2016. The most significant decline also occurred in 2019–2020 due to the pandemic Covid-19.

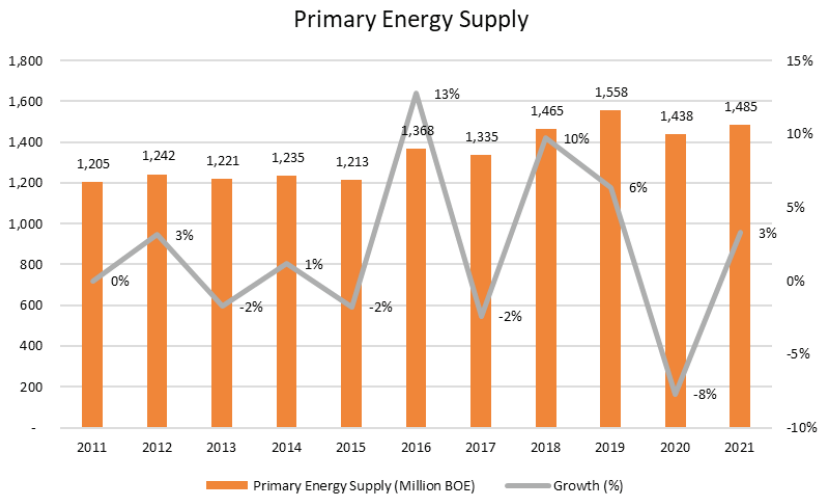


Figure 13.2 Primary Energy Supply in Indonesia  
 Source: Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumber Daya Mineral), 2021

### 13.1 ENERGY DEMAND

The National Energy Council noted that Indonesia’s final energy consumption (without biomass) in 2020 reached 809.59 million BOE. This amount is a contribution from several sectors. The transportation sector became the largest energy consumer reaching 349 million BOE, followed by the industrial sector with 375.80 million BOE, households with 136.18 million BOE, commercial with 39 million BOE, and other sectors with 9.5 million BOE. When compared in percentage terms, it is shown in Figure 13.3.

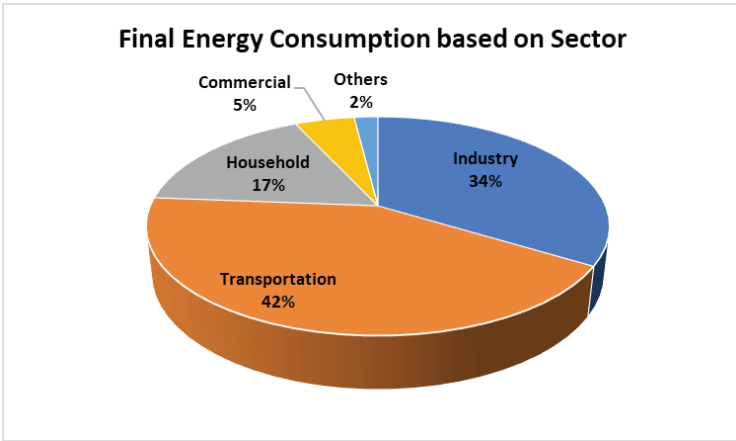


Figure 13.3 Final Energy Consumption  
Source: National Energy Council (Sekretariat Jenderal Dewan Energi Nasional), 2021

#### 13.1.1 Powerplant Sector

The total demand for electrical energy is shown in Figure 13.4. The household sector is the largest value of electricity demand, followed by industry and business. The increase that occurred in 2011 compared to 2020 was 54.3%. In 2011, the total energy demand reached 156,289 GWh. Meanwhile, in 2020, the demand reached 241.41 GWh.

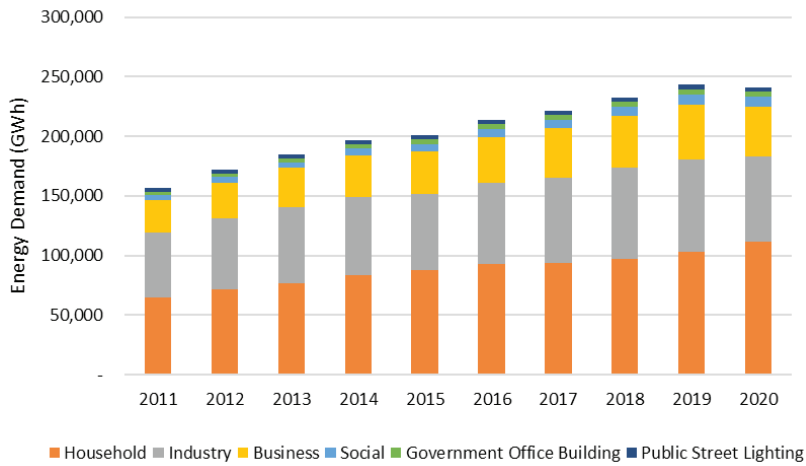


Figure 13.4 Electricity demand in Indonesia  
 Source: State Electricity Company (PT PLN (Persero)), 2021

The realization amount in 2020 is slightly lower than the projection studied by the Center for Energy Studies, UGM under the Business as Usual (BAU) BAU scenario without considering pandemic Covid-19. Based on the study’s results, in 2020, the total electricity demand is 256,940 GWh. Meanwhile, in 2030, 2040, 2050, and 2060 are 536,318 GWh, 1.19 million GWh, 2.76 million GWh, and 6.58 million GWh, respectively. The most significant growth value was in the household sector. The growth is in line with the government’s efforts to increase electricity demand with a target of 2,500 kWh/capita electricity utilization in 2025 and 7,000 kWh/capita in 2050 (Dewan Energi Nasional, 2020a). Compared to ASEAN countries’ energy needs per capita in 2014, Indonesia is still ranked 6th, after Brunei, Singapore, Malaysia, Thailand, and Vietnam. Meanwhile, based on data from the Ministry of Energy and Mineral Resources, electricity consumption in 2019 was only 1,084 kWh per capita, while the target is 1,200 kWh per capita (Wiratmini, 2020).

The study’s results also show that the demand for electricity in the industrial, business and public sectors has increased. Instead, compared to the total energy demand in one year, the quantity of industrial, business, and public sectors continues to decline. For example in 2030, the composition of the energy mix per sector is 16% business, 22% industry, 6% public,

and 56% household; while in 2060, the composition per sector will be 8% business, 8% industry, 3% public, and 81% household. MEMR also predicts that in the future, the electricity demand sector will shift to electricity needs for transportation with the presence of electric vehicles (Ministry of Environment and Forestry Indonesia, 2021).

**13.1.2 Industrial Sector**

The industrial sector in Indonesia, both (1) oil and gas and (2) non-oil and gas, is the sector with the second largest energy consumption in Indonesia (Kemenperin, 2019). In the non-oil and gas sector, several industries are considered to be the most energy-consuming, used as fuel and raw materials. Around 70% of energy in the non-oil and gas sector is used by eight industries, including steel, cement, fertilizer, ceramics and glass, pulp and paper, textiles, chemicals, and food and beverages.

In 2020, energy consumption in the industrial sector (without biomass) will reach 375.79 million BOE. The largest energy consumption in this sector is coal, with a value of 39.4%, followed by gas at 33.5%, and electricity at 18.8%. The value of each type of energy requirement in the industrial sector is shown in Figure 13.5.

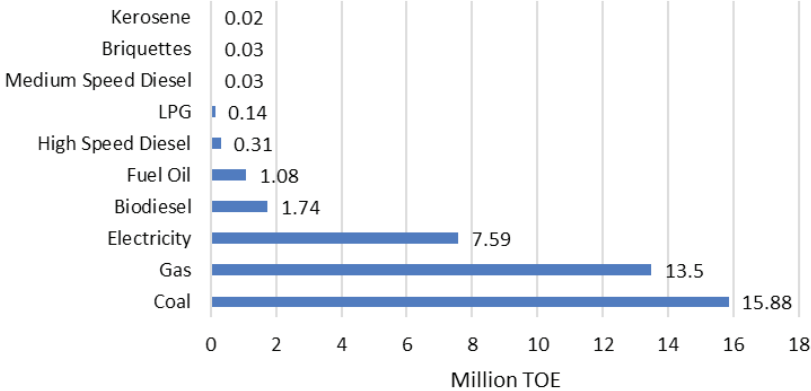


Figure 13.5 Final Energy Consumption in the Industrial Sector  
 Source: National Energy Council (Sekretariat Jenderal Dewan Energi Nasional), 2021

### 13.1.3 Transportation Sector

The most significant energy demand in the transportation sector is fuel consumption. The amount in 2013 was 77% and continues to increase to 87% in 2018. The fuel increased because the substitution program for oil to gas fuel has not been implemented due to the limitations of the gas station. On the other hand, the electric vehicle program is still being pursued to increase its penetration continuously. Meanwhile, the growth of road vehicles, including cars, buses, trucks, and motorcycles, continues to increase with an average growth of 12% per year. Still, the largest growth is motorcycles at 13% per year (Dewan Energi Nasional, 2020b). Given the dominant amount, the biggest influence on gasoline volume increase is the high number of motorbikes.

The types of gasoline sold in Indonesia are divided into four classes: RON 88, RON 90, RON 92, and RON 95. The Research Octane Number (RON) shows the performance of gasoline fuel. The lower RON, the lower prices. In Indonesia, the use of RON 88 or premium gasoline still dominates the transportation sector until 2015, considering the lower price. However, since 2015 the trend of using RON 88 gasoline has begun to decline since the availability of RON 90, which has better quality but is cheaper than RON 92 and RON 95. The use of RON 88 has shown a decline from 29 million kilo liters (KL) in 2013 to 10 million KL in 2018, and the consumption of RON 90 (known as pertalite) rose from 0.3 million KL in 2015 to 17 million KL in 2018.

In 2020, energy consumption in the transportation sector will reach around 349 million BOE. Approximately 56.4% of final energy use in the transportation sector still uses fuel, the remaining 43.6% uses biodiesel, and only 0.1% uses gas and electricity. Of the total energy consumption in the transportation sector, gasoline consumption reached 50.8%, followed by biodiesel 43.6%, avtur 4.5%, and diesel oil 1.0% (National Energy Council (Sekretariat Jenderal Dewan Energi Nasional)) (2021). Figure 13.6 shows the types of energy used in the transportation sector.



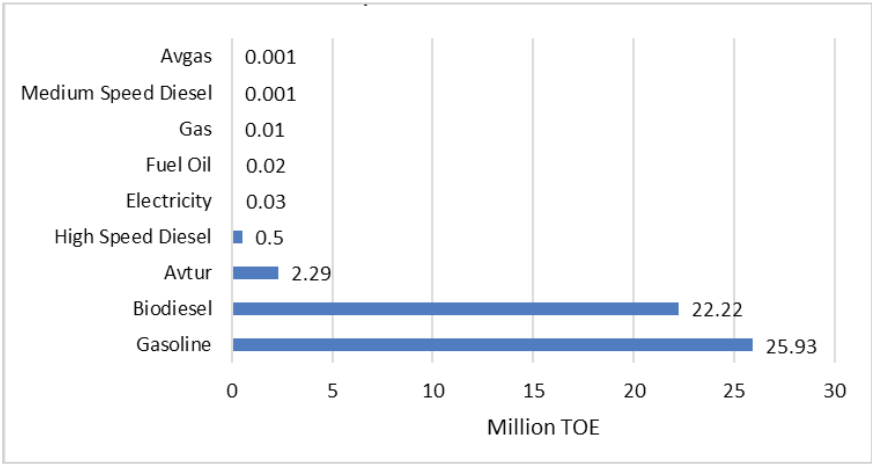


Figure 13.6 Final Energy Consumption in the Transportation Sector  
 Source: National Energy Council (Sekretariat Jenderal Dewan Energi Nasional), 2021

### 13.2 ENERGY SUPPLY

The primary energy supply shows the amount of energy available in an area. It includes the amount of energy produced, imported, exported, and stock availability. Indonesia’s total primary energy supply (without biomass) in 2020 is 1,379.7 million BOE, with the most significant supply being coal at 530.38 million BOE, followed by oil at 453 million BOE and gas at 240.9 million BOE. The remaining 155.35 million BOE is met by NRE, consisting of hydro, geothermal, solar, wind, biofuel, and biogas energy. The percentage of this number is shown in Figure 13.7.

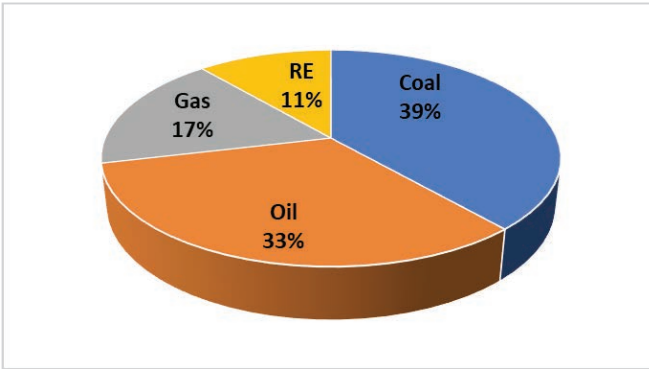


Figure 13.7 Primary Energy Supply

Source: National Energy Council (Sekretariat Jenderal Dewan Energi Nasional), 2021

### 13.2.1 Supply of Energy: Non-Renewable Energy Resources

#### a. Coal

The energy supply in Indonesia is currently dominated by fossil energy, where coal is the most widely used energy source. In December 2020, coal resources in Indonesia reached 143.7 billion tons, and coal reserves reached 38.8 billion tons. Approximately 1,400 companies supply the national coal with mining business licenses with operating or production status. National coal production in 2020 is 563.7 million tons. This amount has decreased from the previous year. Still, it exceeds the production target stated in the Strategic Plan of the Ministry of Energy and Mineral Resources (MEMR) for 2020–2024, which is 550 million tons (National Energy Council (Sekretariat Jenderal Dewan Energi Nasional), 2021).

Indonesia implements a Domestic Market Obligation (DMO) policy in which coal companies must sell part of their production for domestic consumption. This policy is based on Government Regulation 79 of 2014 concerning the National Energy Policy, in which coal is prioritized as an energy source and guarantees coal supply for domestic needs. The DMO policy is also strengthened by the MEMR Regulation Number 7/2020, which requires the holders of Mining Business Permits (IUP, Izin Usaha Pertambangan) and Special Mining Business Permits (IUPK, Izin Usaha Pertambangan Khusus) to prioritize the fulfillment of domestic mineral and coal needs. The amount of the DMO volume determination is regulated by

the Decree of the MEMR every year, where in 2020, the DMO volume is set at 25% of the total production of coal companies. If the company does not meet the DMO requirements, it will be subject to production cuts in the following year and a reduction in export quotas. This DMO policy can guarantee the availability of coal to meet domestic consumption needs.

The power generation sector is the primary consumer of coal, followed by the industrial sector. Coal consumption has increased in the last five years, with an average growth of 8.7% in 2020 (131.9 million tons) compared to 2015 (86.8 million tons). Coal consumption for power generation grew by an average of 8.4% from 2015 to 2020. Along with the increasing capacity of domestic coal-fired power plants, coal consumption for power generation in 2020 will reach 104.8 million tons.

In the future, coal utilization is predicted to continue to rise. Technology Assessment and Application Agency (BPPT, Badan Pengkajian dan Penerapan Teknologi) predicts that in 2050 coal use will be 475 million tons for the BAU scenario and 512 million tons for the scenario of an electric vehicle program. The use of coal will still be dominated by power plants (Badan Pengkajian dan Penerapan Teknologi, 2021).

## **b. Oil**

Indonesia's oil production has decreased significantly in the past two decades, from an average of 1.5 million barrels per day to around 710.3 thousand barrels per day in 2020. Meanwhile, in the last five years, from 2015 to 2020, oil production decreased from 785.8 thousand barrels per day to 710.3 thousand barrels per day due to a natural decline in reserves in old fields. Furthermore, Indonesia has only 0.1% of the world's oil reserves, with a range of 2.5 billion barrels. Indonesia's oil reserves decreased from 7.3 billion barrels in 2015 to 4.2 billion in 2020.

From 2013 to 2016, crude oil imports tended to increase, but there was a decline in 2020 to 79.7 million barrels. The decline in oil imports by 10.8% in 2020 occurred in line with the MEMR Regulation 42/2018 concerning Priority for Utilization of Petroleum to Fulfill Domestic Needs. This regulation requires Pertamina and Business Entities holding Petroleum Processing Business Permits to prioritize the supply of petroleum originating from within the country.

There was a decline in petroleum exports from 115 million barrels in 2015 to 31.4 million barrels in 2020. It was caused by a decrease in oil production and the impact of the implementation of MEMR Regulation 42/2018, where crude oil is used to fulfill domestic refinery needs. The oil export policy is implemented by considering the economic value so that exports are carried out for types of oil with high quality.

**c. Gas, Liquefied Natural Gas (LNG), and Liquefied Petroleum Gas (LPG)**

Around 17.4% of the total primary energy supply in 2020 comes from natural gas. Along with the increasing need for energy and the availability of sufficient reserves, gas has become an alternative energy use today and in the future. Gas emissions that are relatively lower than coal are an option to reduce CO<sub>2</sub> emissions in Indonesia.

Natural gas production in Indonesia comes from gas included in the oil field (associated gas) and natural gas field (non-associated gas). These two types of gas total production decreased from 3.1 million MMSCF in 2015 to 2.4 million MMSCF in 2020. This decline was caused by the closure of the Arun gas field, while the Tangguh Train 3 gas field has not yet started production. Several gas wells in Indonesia have also experienced a decline in production, but on the other hand, there are still some proven gas reserves that have not been developed (National Energy Council (Sekretariat Jenderal Dewan Energi Nasional), 2021).

At the LPG refinery, natural gas is processed at a gas refinery or LPG to extract ethane and propane content, while pentane is used as an industrial raw material. The gas input for LPG refineries in 2020 is 18,468 MMSCF. This value decreased when compared to 2015, which was 24,801 MMSCF.

Until 2020, Indonesia has three national LNG refineries, namely the Badak LNG Plant, Tangguh LNG, and Donggi Senoro LNG, with installed capacities of 21.64 million, 7.6 million, and 2 million metric tons/year, respectively. In 2020, the gas processed at the LNG plant was 818,900 MMSCF. The government will make several efforts in Indonesia to increase gas production. Some of the actions are encouraging the acceleration of exploration and development of oil and gas, applying the appropriate technology, seeking new methods for discovering gas resources and reserves,

monitoring stream field development projects on time and maintenance to improve the reliability of production facilities (National Energy Council (Sekretariat Jenderal Dewan Energi Nasional), 2021).

### 13.2.2 Supply of Energy: Renewable Energy Resources

Presidential Regulation Number 22 of 2017 concerning the General Plan of National Energy is a reference for using new and renewable energy (NRE) in the provision and national energy security. The National Energy Policy (KEN) states that NRE in the primary energy mix is at least 23% in 2025 and 31% in 2050. The use of NRE can be implemented for power generation and direct use in sectors including the transportation, industrial, household, and industrial sectors. Currently, the utilization of NRE comes from geothermal, water, solar, wind, and bioenergy (including biomass, biofuel, biogas, and waste) with a comparison of installed capacity and potential as shown in Figure 13.8.

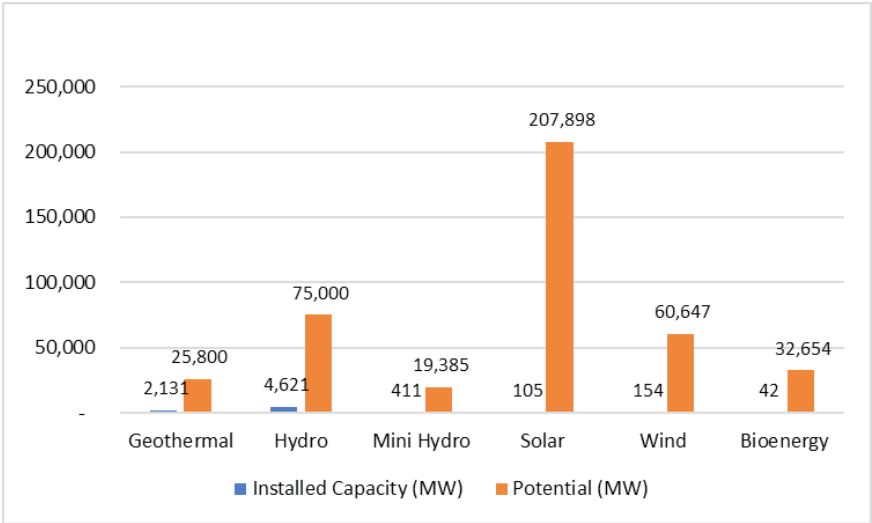


Figure 13.8 RE Installed Capacity and Potential  
Source: Badan Pengkajian dan Penerapan Teknologi, 2021

### **a. Geothermal**

To support environmentally friendly economic development and the fulfillment of the 7th Sustainable Development Goals (SDGs), the government continues to maximize the use of clean energy through the development of geothermal energy to meet the needs of the national energy supply. Based on the 2020–2040 Grand Energy Strategy, a total capacity of 7.8 GW of geothermal energy will be built until 2030. Indonesia has a geothermal potential of 25,800 MW, and only 8.3% or around 2,131 MW has been utilized, so the government targets an increase in geothermal utilization to 7,241.5 MW by 2025 (Badan Pengkajian dan Penerapan Teknologi, 2021).

The installed capacity of geothermal energy until 2020 is around 2,131 MW, divided into 16 PLTP into six Geothermal Working Areas (Wilayah Kerja Panas Bumi-WKP). The production of geothermal steam is almost entirely used for electricity generation. However, steam is used directly for the process, but the amount is still small commercially. In 2020, all WKPs will be able to produce electricity of 15,563 GWh from 110.9 million tons of geothermal steam production. In the last five years, the production of electricity generated by PLTP has increased to reach 110,917 thousand tons of geothermal steam in 2020 (National Energy Council (Sekretariat Jenderal Dewan Energi Nasional)), 2021).

### **b. Hydro**

In 2020, there was an additional capacity of the hydro-powerplant in Poso and Sion with a capacity of 66 MW and 12.1 MW, respectively. Meanwhile, hydroelectricity production in 2020 was 24,289 GWh, while microhydro was 139 GWh. From 2015 to 2020, electricity production from hydropower tends to increase where fluctuations in electricity production are influenced by the influence of weather (National Energy Council (Sekretariat Jenderal Dewan Energi Nasional), 2021).

The potential for hydropower in Indonesia reaches 75,000 MW and 19,385 MW for mini-hydro. The National Energy Plan targets hydropower development at 21.9 GW in 2030. Meanwhile, the target for hydropower development in the Grand National Energy Strategy (GSEN) is 7.7 GW until 2030. The hydropower potential is found in almost all provinces, with the greatest potential in Papua and Kalimantan, areas with low demand. Based

on the scale, the utilization of hydropower potential into electricity is divided into three, namely PLTA, PLTM, and PLTMH.

### **c. Wind**

As an archipelagic country with a long coastline, Indonesia has a large potential for wind energy. MEMR Geoportal data shows that many areas in Indonesia have wind potential with speeds of 4–6 m/s. Until now, wind energy utilization has only reached 154 MW or 0.25% of the total existing wind potential. The two newly built wind energy are the Sidrab in South Sulawesi with an installed capacity of 75 MW and the Tolo with an installed capacity of 60 MW. The Tolo has 20 wind turbines with a capacity of 3.6 MW each. The National Energy Plan (NEP) targets the development of wind turbines to reach 7 GW by 2030, and GSEN targets the development of wind energy installed capacity to reach 2.2 GW by 2030.

### **d. Solar**

As a tropical country, Indonesia has great potential for developing PV mini-grid. The average potential of solar energy in Indonesia is 4.8 kWh/m<sup>2</sup>. Until now, the utilization of solar energy has only reached 105 MW or about 0.05% of the total potential of solar energy. The utilization of solar energy is channeled to supply electricity to rural areas on a small scale, namely using the Solar Home System (SHS) with a capacity of between 150–300 Wp. The number of large-scale solar energy is still limited. However, the Project Kick-Off Ceremony of the Cirata Floating solar powerplant with a capacity of 145 MW was carried out on December 17, 2020, which will become the largest floating solar powerplant in ASEAN. As stated in the NEP, the solar powerplant development target will reach 11.2 GW by 2030.

## **13.2.3 Energy Supply in Powerplant Sector**

Over the past ten years, the installed capacity of power plants in Indonesia has continued to increase. It was recorded that in 2010, the installed capacity reached 33.98 GW until, by 2020, it more than doubled to 70.06 GW. Figure 13.9 shows Indonesia's installed capacity from year to year, excluding off-grid generators.

Unfortunately, this increase is also accompanied by an increase in the proportion of steam-coal powerplant from 38% in 2010 to 52% in 2020, or an increase of 14% in the last ten years. In addition to the steam-coal

powerplant, the gas power plant has also experienced an increase of 0.6% in the last ten years. The encouraging news can be seen in the portion of other NRE powerplant, which rose 0.7%. These types of generation include solar, wind, biomass, biogas, and waste.

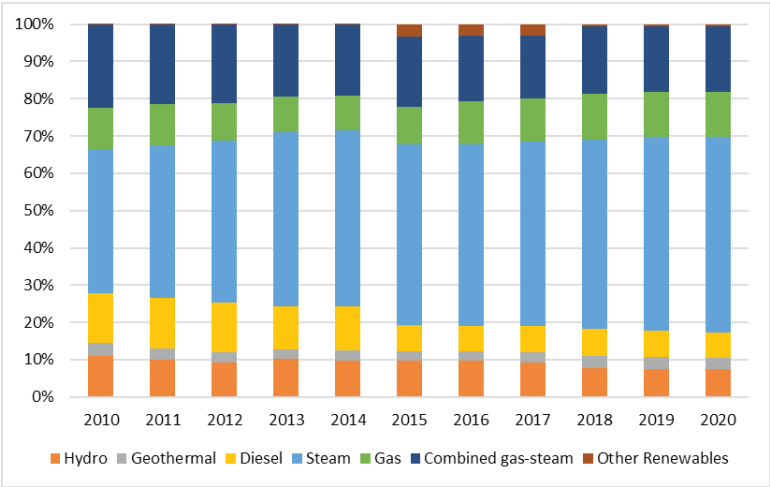


Figure 13.9 Installed Capacity of Powerplant in Indonesia  
 Source: Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumber Daya Mineral), 2021

As for the energy produced, an increase occurred by 62% in 2020 compared to conditions in 2000. In 2000, the energy produced reached 169,787 GWh, and in 2020, the energy produced reached 274,851 GWh. Although not as big as the increase in installed power generation, the value of the increase in 2020 compared to 2000 was 62%.

The composition of the energy produced is shown in Figure 13.10. The largest composition is still dominated by steam-coal powerplant, amounting to 248,403 GWh in 2020. Looking at the existing data, in 2020, there will also be promotion of biomass fuel in steam-coal powerplant or what is known as coal cofiring. Wind turbines began to look capable of supplying energy in 2018, followed by the entry of electricity from biomass and biogas in 2019.



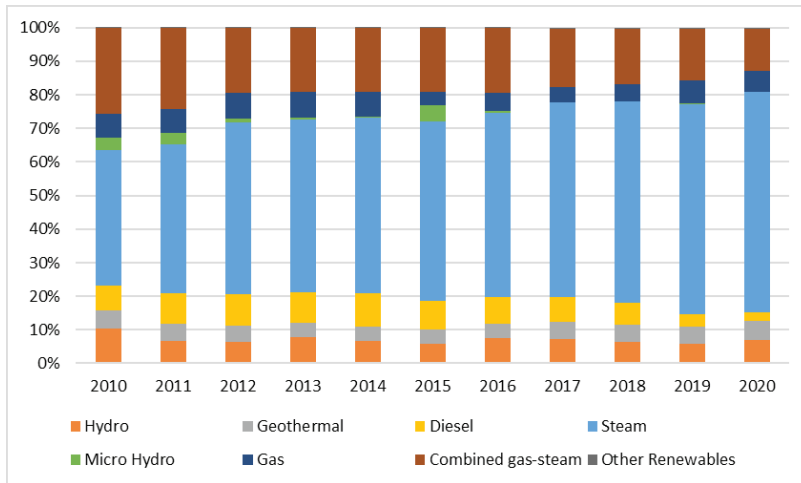


Figure 13.10 Energy Production based on Resources in Indonesia (PLN dan Non-PLN)

Source: Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumber Daya Mineral), 2021

### 13.3 GREENHOUSE GAS (GHG) EMISSION

At the 21st United Nations Framework Convention on Climate Change (UNFCCC) Conference in 2015, Indonesia stated its commitment to reduce greenhouse gas (GHG) emissions by 29% under the Business as Usual (BaU) scenario by 2030 and 41% with the assistance of international. To strengthen this commitment, Indonesia put it in Law Number 16 of 2016 concerning the Ratification of the Paris Agreement to The United Nations Framework Convention on Climate Change (Masripatin et al., 2017). The Strategy for Implementation of the Nationally Determined Contribution (NDC) in Indonesia was published in 2017 by projecting the reduction of Greenhouse Gases (GHG) in several scenarios. In addition to the BaU scenario, two other scenarios were made, namely CM1 (emission scenarios with mitigation and considering sectoral development targets) and CM2 (emissions scenarios with more ambitious targets and considering sectoral development targets with international support).

There are several approaches to calculating emissions. According to the emission source category approach, the energy sector produced 638,452

Gigagram (Gg) CO<sub>2</sub>e in 2019. This number shows an increase of 7.13% compared to the previous year. The largest emission contributor is in the energy producer category at 43.83%. Three activities fall into this category: power generation, oil refinery, solid fuel production, and other energy industries. These three subcategories consume the most energy because large amounts of fuel are needed to produce energy. Other sector categories consist of commercial and office, and residential subcategories. Meanwhile, other categories are sub-sectors that are not included in the listed categories.

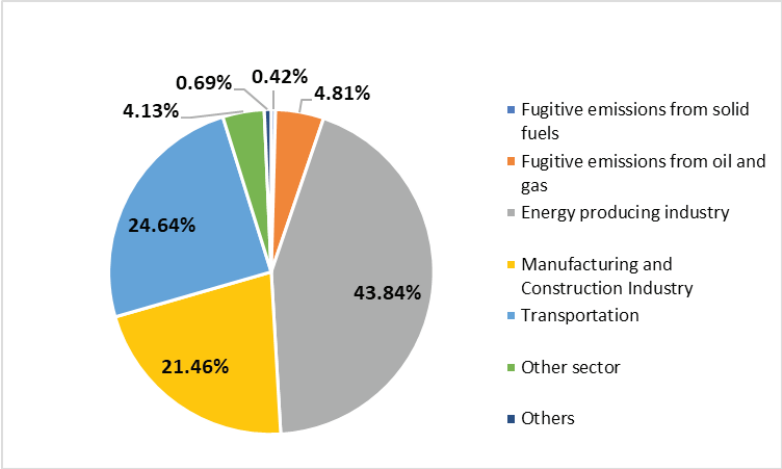


Figure 13.11 Emission Contribution in Each Sector in 2019  
 Source: Sunarti et al., 2020

Meanwhile, based on the fuel type approach—divided into solid, liquid, and gas—the GHG emissions in the energy sector amounted to 653,787 Gg CO<sub>2</sub>e in 2019. Solid fuels produced the largest emission at 50.17%, followed by liquid fuels and gases. Based on this approach, there is an average increase of 5.51% in GHG emissions per year.

Emission calculations can also be calculated using the emission source approach, divided into fuel combustion and fugitive emissions from fuel. Fuel combustion emissions from 2019 to 2019 have always been much higher than fugitive emissions from fuel. For example, in 2019, fuel emissions amounted to 95.15% of total GHG emissions.

In more detail, GHG emissions by type can be divided into various GHG contributors. GHG emissions by type in 2019 were 607,368 Gg

CO<sub>2</sub>e consisting of CH<sub>4</sub> of 27,181 Gg CO<sub>2</sub>e and N<sub>2</sub>O of 3,903 Gg CO<sub>2</sub>e. Compared to 2018, there was a significant increase of 7%. It happened due to an increase in coal consumption in the industrial sector.

### **13.3.1 Energy Producer Industry**

Emissions in this sector in 2019 reached 279,863 Gg CO<sub>2</sub>e consisting of three subcategories, power generation, oil refinery, and coal processing. If the division is carried out in more detail, the power generation sector produces the highest emissions with a percentage of 97.22%, followed by oil refineries and coal processing. The average increase in emissions per year reached 7.13%.

### **13.3.2 Manufacturing and Construction Industry**

In 2019, the manufacturing and construction industries produced 137,040 Gg CO<sub>2</sub>e. This value increased by 29.5% compared to 2018. The overall goodness of emissions in this category is 4.43% per year.

### **13.3.3 Transportation**

Transportation sector emissions contribute as much as 30% of Indonesia's total CO<sub>2</sub> emissions because this sector is still heavily dominated by fossil fuels. Land transportation accounts for the highest total greenhouse gas emissions in the transportation sector in Indonesia (IESR, 2020). In 2019 land transportation produce emissions reached 157,326 Gg CO<sub>2</sub>e, with an average increase of 7.17% per year. The transportation sector is predicted to contribute large amounts of emissions still because vehicles with fossil fuels are still being produced (Sunarti et al., 2020)

### **13.3.4 Other Sector**

Other sector categories consist of commercial and office, and residential subcategories. This sector contributed 26,382 Gg CO<sub>2</sub>e in 2019. The housing subcategory was the largest contributor, with a value of 94.29%. The average annual increase in emissions in this sector is 0.02%.

### **13.3.5 Fugitive Emissions from Solid Fuels**

Fugitive emissions from solid fuels account for the smallest emissions of the total GHG emissions of the energy sector. In 2019, this category contributed 2,688 Gg CO<sub>2</sub>e. However, this category's annual emission growth is the largest at 8.51%.

### 13.3.6 Fugitive Emissions from Petroleum and Natural Gas

In 2019, emissions in this category reached 30,733 Gg CO<sub>2</sub>e. The average increase in emissions is 3.71% per year. The petroleum subsector accounts for 64.63% of the total emissions.

### 13.3.7 Others

Other categories are the smallest emitters. Various subcategories that do not fall into the previous six categories can be included in the miscellaneous category. In 2019, this category resulted in 4,420 Gg CO<sub>2</sub>e with an average annual reduction of 1.27%.

This chapter has discussed all factors that are related to the greenhouse gas (GHG) emissions in the Indonesia. It is expected to give a clear idea about what should be considered by the government, the private companies, and the community at large. Although the country has an abundance supply of renewable energy, the demand is still on the fossil and mostly polluting sources of energy. It is evidently due to lack of commitment and the tendency to take an easy path of policies among the decision makers. Citizen participation is also crucial in using the new and renewable sources of energy.

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## CHAPTER-14

# TECHNOLOGY AND RESOURCES TO ACCELERATE ENERGY TRANSITION

Deendarlianto, Samsul Kamal, Tumiran, Sarjiya, and Ekrar Winata

### 14.1 INTRODUCTION

**S**ustainable energy transition is the priority issue from two other topics, including the global health system and economic and digital transformation in the Presidency G20 in the year 2022. Indonesia has the opportunity to increase the readiness of numerous G20 countries to implement global energy transition through the G20 meeting. As part of its action plan, the Indonesian Government has committed to achieving the energy transition by formulating a target of 23 percent energy mix by 2025 and committing to achieving Net Zero Emission (NZE) by 2060 or sooner.<sup>1</sup>

According to the situation, the availability of renewable energy resources and technological innovation will have an impact on reaching the renewable energy target and achieving Net Zero Emissions (NZE). This chapter will use a GIS (Geographic Information System) to examine the availability and accessibility of new and renewable energy resources (hydro, solar, wind, and biomass energy) and the development of environmentally friendly technology for the electrical and household sectors in Indonesia (clean cooking stoves).

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1 <https://www.esdm.go.id/id/media-center/arsip-berita/urgensi-transisi-energi-dalam-presidensi-g20-indonesia> (accessed in June, 11th, 2022)

## 14.2 HYDROENERGY

### 14.2.1 Technology Trends

Hydropower is a type of renewable energy that is widely used and plays a significant role in power generation in Indonesia and around the world. In general, hydropower plants are divided into three categories based on their operation processes and flow types, including:

#### a. Run of River (RoR)

The run-of-river mechanism provides electricity to the power plant from the river flow. This plant is typically used as a base-load power plant that is accompanied by an electrical storage facility to accommodate demand fluctuations.

#### b. Reservoir

The hydropower plant from the reservoir has a hydrostorage (reservoir) facility, such as a dam, that can store a lot of water. Aside from that, the plant has control over how much water enters the generator. As a result, the power plant's flexibility can be changed and connected with another renewable energy system, such as solar energy. Water can be kept in reservoirs while the sun is shining brightly and generating electricity. Meanwhile, water can be used to create electricity at night or in severe weather.

#### c. Pumped Storage

The hydropower pump storage plant works as an energy storage rather than a producer of energy. Pumped storage is a type of energy storage that stores potential energy from off-peak conditions. During off-peak hours, energy is utilized to pump water from a shallow river or reservoir to a higher reservoir. For energy generation, water is released from the high reservoir to the shallow reservoir.

### 14.2.2 Hydroenergy Resources

The potential for hydropower in Indonesia according to the Hydro Power Potential Study (HPPS) report in 1983 was 75,000 MW, and this data was repeated in the hydropower inventory study in 1993. However, in the report of the Master Plan Study for Hydro Power Development in Indonesia by Nippon Koei in 2011, the potential for hydropower after the further screening is 26,321 MW. Figure 14.1 shows the distribution of potential



which is collected by MEMR of Indonesia in One Map of Indonesia whose system was developed by the Geospatial Information Agency (BIG).

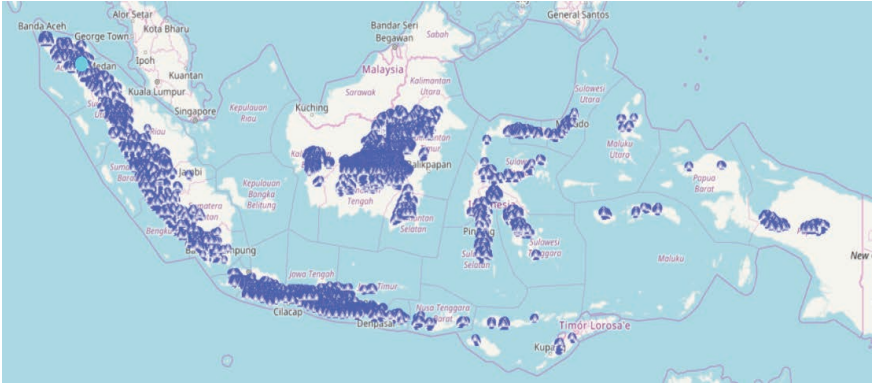


Figure 14.1 The Map of Hydroenergy Potential in Indonesia  
Source: [www.iopscience.iop.org](http://www.iopscience.iop.org)

Table 14.1 shows the differences in the calculation of the potential for hydroenergy in Indonesia, which is collected from several sources such as JICA, and RUPTL 2019–2028.

Table 14.1 The Comparison of Potential Calculations and Existing Power Plants in Indonesia

No.	Province	Hydropower from JICA (kW)	Hydropower in RUPTL 2019-2028	Hydro-PP (MW)	Hydropower from MEMR (kW)	Hydropower (kW)
1	Aceh	1204.30		Sumbagut	5062.00	5052.40
2	Bali	7.00			624.00	624.00
3	Bangka Belitung	0.00			0.00	-0.40
4	Banten	17.50			17.50	17.50
5	Bengkulu	212.60	233.60	Sumbagselteng	3102.00	703.00
6	Gorontalo	20.40		Gorontalo	14.20	1.80
7	Irian Jaya Barat	0.00			0.00	0.00
8	Jakarta Raya	0.00			0.00	0.00
9	Jambi	182.00			3102.00	3102.00
10	Jawa Barat	24.40	992.40	Jawa Bali	2861.00	-65925.25
11	Jawa Tengah	19.60	379.60	Jawa Bali	813.00	-6829.50
12	Jawa Timur	16.70	153.70	Jawa Bali	525.00	-6347.50
13	Kalimantan Barat	590.40		Khatulistiwa	4737.00	4507.00
14	Kalimantan Selatan	0.00		Barito	16844.00	16754.00
15	Kalimantan Tengah	140.70			140.70	140.70
16	Kalimantan Timur	4724.40			4724.40	4724.40
17	Kalimantan Utara	0.00			0.00	0.00
18	Kepulauan Riau	0.00			0.00	0.00
19	Lampung	45.20	34.00	Sumbagselteng	3102.00	2571.60
20	Maluku	132.40			430.00	430.00

Table 14.1 The Comparison of Potential Calculations and Existing Power Plants in Indonesia

No.	Province	Hydropower from JICA (kW)	Hydropower in RUPTL 2019-2028	Hydro-PP (MW)	Hydropower from MEMR (kW)	Hydropower (kW)
21	Maluku Utara	0.00		0.00	0.00	0.00
22	Nusa Tenggara Barat	43.40		Sumbawa	624.00	624.00
23	Nusa Tenggara Timur	0.00	15.00	Flores, Sumba	624.00	624.00
24	Papua	425.40		Jayapura	22371.00	22371.00
25	Riau	114.00			3607.00	3265.00
26	Sulawesi Barat	1962.50			1962.50	1962.50
27	Sulawesi Selatan	0.00		Sulbagsel	145.46	19.46
28	Sulawesi Tengah	1390.80		Palu, Parigi, Ampana	3967.00	3967.00
29	Sulawesi Tenggara	499.00			499.00	499.00
30	Sulawesi Utara	0.00		Minahasa, Tahuna	53.90	53.90
31	Sumatera Barat	1089.80		Sumbagselteng	3607.00	3607.00
32	Sumatera Selatan	483.90		Sumbagselteng	3102.00	3102.00
33	Sumatera Utara	964.10		Sumbagut	3808.00	3808.00
34	Yogyakarta	0.00			0.00	0.00

Source: Ministry of Energy and Mineral Resources (ESDM), 2021

The study assessed the present potential by comparing the existing hydroelectric power plants after collecting data from various sources for hydroenergy (PLTA). Figure 14.2 shows the results of the hydroenergy potential calculation in Indonesia.

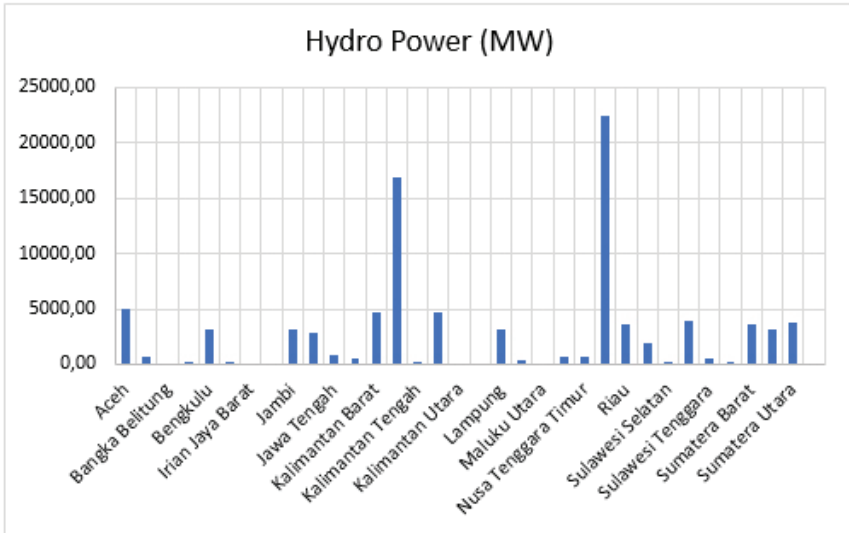


Figure 14.2 The Distribution of Hydroenergy in Indonesia  
Source: Indonesia Energy Outlook, DEN, 2019

### 14.2.3 Installed Capacity of Hydropower in Indonesia

In 2020, the existing installed capacity of hydropower plants is 5,174.04 MW, accounting for 8.28% of all power plants in Indonesia, with a total capacity of 62,449.20 MW divided between two owners, with PT PLN (Persero) owning 3,584.07 MW and an independent power producer owning 1,589.97 MW (IPP). Figure 14.3 depicts the expansion of hydropower installation in Indonesia from 2021 to 2030, according to Business Plan for Electricity Supply (RUPTL) PT PLN (persero). Between 2011 and 2020, the installed capacity increased by 2.86 percent, with the highest growth of 10.43 percent in 2017 and the lowest growth of 0.51 percent in 2012.

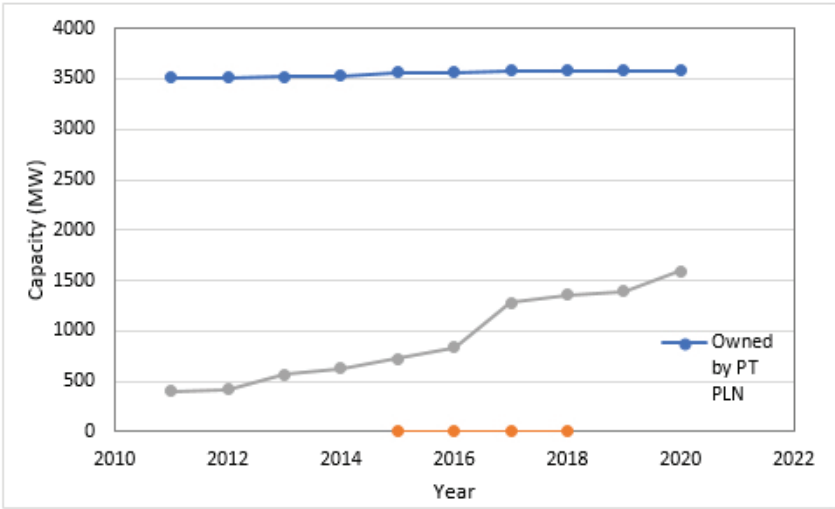


Figure 14.3 The Growth of Hydropower Installation in Indonesia<sup>2</sup>  
 Source: Indonesia Energy Outlook, DEN, 2019

#### 14.2.4 Sustained Level of Hydroenergy Use

According to the information from RUPTL PT PLN (Persero) 2021–2030 that the percentage of installed capacity of hydropower plant is 6.89% from the total of hydro-resources with a value of 75,091 MW.<sup>3</sup> It means that there are enormous resources to meet new renewable energy targets. The modelling result of renewable energy supply in energy mix 2025 shows a hydroelectric capacity of 24.9 MTOE or equivalent to 47,226 MW.<sup>4</sup> So that, it is necessary to accelerate the construction of hydroelectric power plants to achieve the target of new renewable energy supply from hydroenergy resources.

### 14.3 SOLAR ENERGY

#### 14.3.1 Technology Trends

Solar energy can be used to generate power through a photovoltaic or thermal system. The explanation of two systems is provided below:

<sup>2</sup> PT PLN (Persero), 2021, Rencana Umum Penyediaan Tenaga Listrik(RUPTL) 2021–2030

<sup>3</sup> Peraturan Presiden Nomor 22 Tahun 2017 tentang Rencana Umum Energi Nasional (RUEN)

<sup>4</sup> Ibid., hlm 61

**a. Photovoltaic System**

The photovoltaic system converts solar energy into DC electricity by using photovoltaic semiconductor components. When sunlight strikes a semiconductor material, the energy of the light is absorbed by electrons in the valence band, which are excited to produce an electric current.

**b. Thermal System**

Heat from solar radiation is used to create power in thermal systems. Pipe systems containing working fluids such as water are designed in such a way that they can collect solar energy. Sunlight is concentrated to convert the working fluid into steam in systems with only one working fluid. This steam is then directed to a steam turbine, which converts the energy into electricity.

**14.3.2 Solar Energy Resources**

The utilization of solar energy as a power plant in Indonesia has great potential as the electricity solutions for Indonesia. Because Indonesia's territory is stretched around the equator, so the sun's lighting tends to be high. In addition, solar power plants are very suitable to be developed to face the electricity roadmap for people in rural areas, outer islands, and border areas.

The map of GHI's distribution value shown in Figure 14.4 is also attached with the uncertainty level of this database, which is around 6–9%. In detail, Indonesia has several areas with potential solar energy resources that receives very high radiation energy per m<sup>2</sup>. This data is available in a GIS format that can be processed comprehensively to produce the accurate potential values for each region.

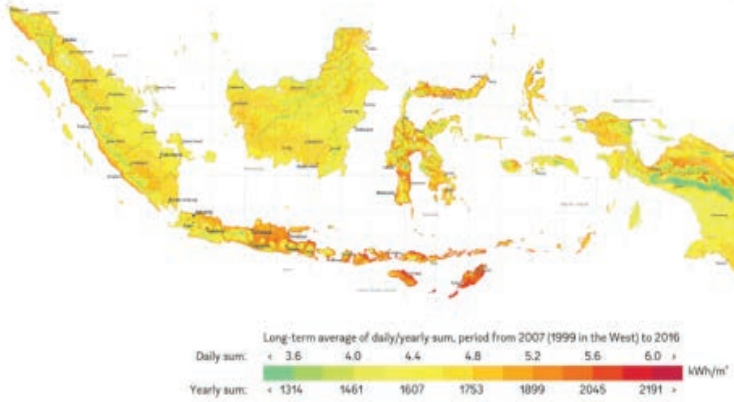


Figure 14.4 The Map of Global Horizontal Irradiation (GHI) in Indonesia

Source: W. Bank, "Solargis Software." Global Solar Atlas 2.0, 2019

In this study, each point per area is digitized to extract its potential magnitude. The value of 4.5 kWh/m<sup>2</sup> per day is used as the threshold value in determining the location of potential solar energy that can be converted as a solar power generator for every province in Indonesia.<sup>5</sup>

Based on the data above, it can be accumulated the potential magnitude of solar energy for every region in Indonesia. Figure 14.5 shows us the solar energy potential of Indonesia by province in units of Megawatts (MW) with the assumption that the supply area is 0.1% of potential area (economically scale 1 Ha equals 1 MW), the equation below describes this quantity:

$$P = \text{irradiation value (kW/m}^2\text{)} * \text{the potential area (m}^2\text{)}$$

With P, the solar energy power (kW)

5 RUPTL, Rencana usaha penyediaan tenaga listrik. Jakarta: PT PLN Persero, 2019

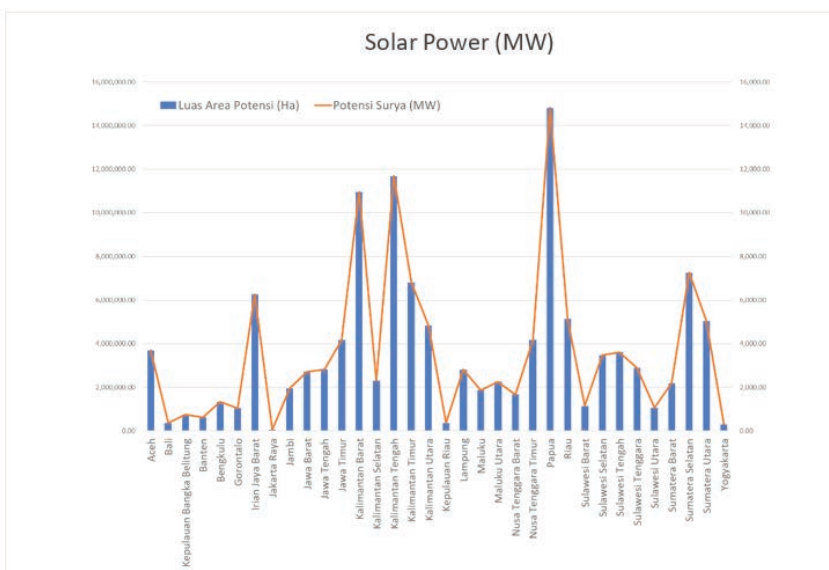


Figure 14.5 The Magnitude of Solar Energy in Indonesia

Source: Indonesia Energy Outlook, DEN, 2019

Table 14.2 The Details of the Solar Energy Magnitude in Indonesia

Province	GHI >= 4.5 MW	Province	GHI >= 4.5 MW
Aceh	3,687.39	Kepulauan Riau	357.87
Bali	359.84	Lampung	2,810.35
Kepulauan Bangka Belitung	751.15	Maluku	1,869.95
Banten	624.69	Maluku Utara	2,253.19
Bengkulu	1,338.08	Nusa Tenggara Barat	1,663.98
Gorontalo	1,043.50	Nusa Tenggara Timur	4,177.94
Irian Jaya Barat	6,258.63	Papua	14,815.10
Jakarta Raya	54.38	Riau	5,127.96
Jambi	1,947.96	Sulawesi Barat	1,149.61
Jawa Barat	2,708.30	Sulawesi Selatan	3,466.74
Jawa Tengah	2,825.64	Sulawesi Tengah	3,611.46
Jawa Timur	4,175.25	Sulawesi Tenggara	2,898.52
Kalimantan Barat	10,954.54	Sulawesi Utara	1,058.87
Kalimantan Selatan	2,303.99	Sumatera Barat	2,189.62
Kalimantan Tengah	11,684.74	Sumatera Selatan	7,262.62



Table 14.2 The Details of the Solar Energy Magnitude in Indonesia

Province	GHI >= 4.5 MW	Province	GHI >= 4.5 MW
Kalimantan Timur	6,802.87	Sumatera Utara	5,046.15
Kalimantan Utara	4,836.99	Yogyakarta	308.86

Source: Indonesia Energy Outlook, DEN, 2019

From the table above, we can see that the province with the largest potential for solar energy (14,815.10 MW) is Papua, followed by Central Kalimantan Province (11,684.74 MW). Both have the potential to be exposed to solar energy which tends to be larger compared to other provinces. Meanwhile, the total potential for solar energy in Indonesia is 122,426.73 MW or 122.43 GW.

### 14.3.3 Installed Capacity of the Solar Power in Indonesia

In 2020, the installed capacity of the solar power plants is 79.02 MW, accounting for 0.13% of all power plants in Indonesia, with a total capacity of 62,449.20 MW divided between three owners, with PT PLN (Persero) owning 16.71 MW, the capacity of 0.75 MW is the rental power plant and an independent power producer owning 1,589.97 MW (IPP). Figure 14.6 depicts the expansion of solar power installation in Indonesia from 2021 to 2030, according to Business Plan for Electricity Supply (RUPTL) PT PLN (persero). Between 2011 and 2020, the installed capacity increased by 85.60%, range from the highest growth of 100% in 2012 and the lowest growth of 0% in 2015.

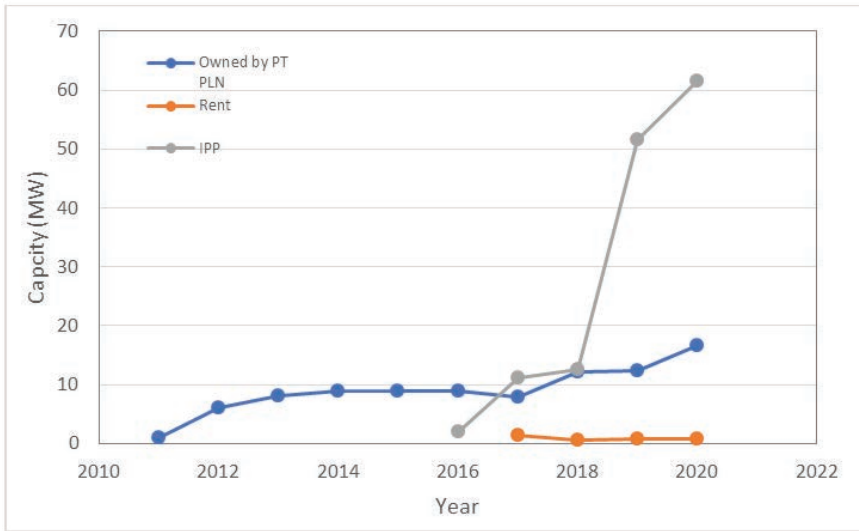


Figure 14.6 The Growth of Solar Power Installation in Indonesia  
 Source: Indonesia Energy Outlook, DEN, 2019

### 14.3.4 Sustained Level of Solar Energy Use

According to the information from RUPTL PT PLN (Persero) 2021–2030 that the percentage of installed capacity of solar power plant is 0.04% from the total of solar resources with a value of 207.898 MW. It means that there are enormous resources to meet new renewable energy targets. The modelling result of renewable energy supply in energy mix 2025 shows a solar electric capacity of 4.3 MTOE or equivalent to 8,155.41 MW. Therefore, it is necessary to accelerate the construction of solar electric power plants to achieve the target of new renewable energy supply from solar energy resources.

## 14.4 WIND ENERGY

### 14.4.1 Technology Trends

There are so many wind turbine, but the collection of wind turbine in two group according to the orientation of the rotation axis: model of

horizontal axis wind turbine (HAWT) and model of vertical axis wind turbine (VAWT).

**a. Vertical Axis Wind Turbine (VAWT)**

The vertical axis wind turbine (VAWT) has the advantages comparing with the horizontal axis wind turbine and not influenced by the wind orientation. Besides that, the weight components such as generator can be located on the ground and it has the complex aerodynamic problems. There are two types of VAWT, including Darrieus turbine dan Savonius turbine. Darrieus turbine works with airfoil is oriented by horizontal. Savonius turbine is the a drag-driven turbine that utilizes the wind direction. Drag driven turbine is easier in construction and has the low efficient due to the turbine velocity can not be fast than the wind velocity.

**b. Horizontal Axis Wind Turbine (HAWT)**

The modern horizontal axis wind turbines (HAWT) generally have an airfoil rotor blade. The airflow in the airfoil creates lift that rotates the rotor. An upwind rotor faces the wind while a downwind rotor faces back the wind. The downwind design has the some advantages, including auto turn by following the wind direction. The downwind design has the advantage that it can change automatically according to the wind direction. However, if a change in wind direction occurs, the turbine against the wind direction will still not be able to adapt. Upwind turbines are currently more extensively utilized since their dynamics and dependability are lower than downwind turbines.

**14.4.2 Wind Energy Resources**

To calculate the wind potential in Indonesia, we have extracted the wind speed from the Indonesia Wind Prospecting source. We use a wind speed of more than 5 m/s as threshold value. This value is an economically scale reference for wind energy development in Indonesia.<sup>6</sup> However, the first thing to do is a cutting process of provincial boundaries based on administrative boundaries in the shapefile (\*.shp) format as shown in Figure 14.7.

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<sup>6</sup> "Penyusunan Roadmap EBT di Indonesia," Yogyakarta, 2019.

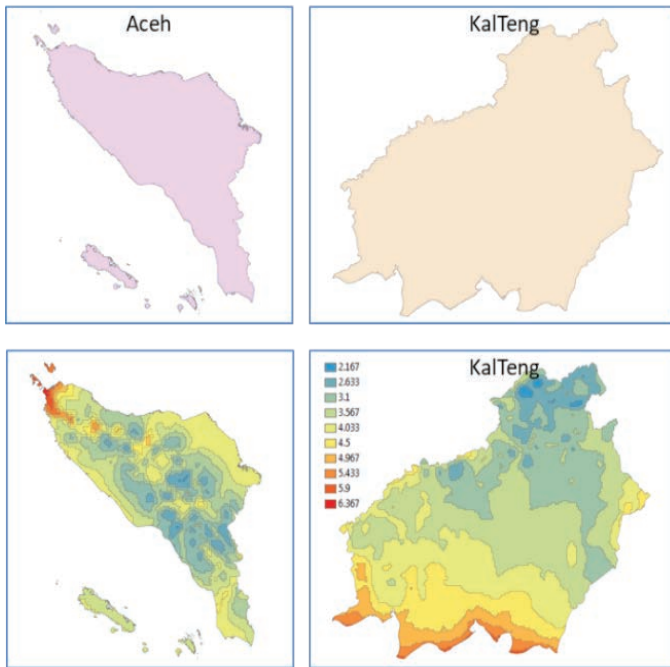


Figure 14.7 The Cutting Provincial Boundaries Process as an Input for GIS Analysis based on Administrative Boundaries

Source: BIG, 2019

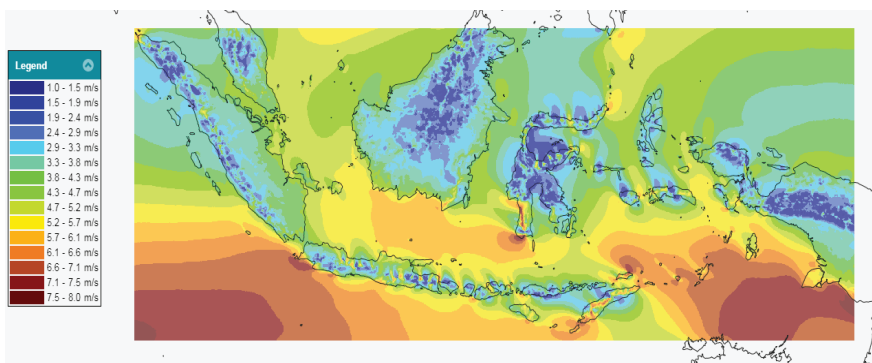


Figure 14.8 The Map of the Wind Velocity for All Regions of Indonesia

Source: E. I. A. Denmark, "Wind Energy Resources of Indonesia." The Ministry of Energy and Mineral Resources, Indonesia, and ESP3, 2020

Figure 14.8 is a map of wind energy potential for every province in Indonesia. In general, this map shows the mean annual wind speed at an altitude of 75 m with a resolution of at least 5 km. In this study, each point per area is digitized to extract its potential magnitude. The value  $\geq 5$  m/s per day is used as the threshold value in determining wind energy that can be used as a reference for the development of wind power plants.

Based on the data above, it can be accumulated the potential magnitude of wind energy for every region in Indonesia. With the equation below, and the assumption of Rho is air density ( $1.2 \text{ kg/m}^3$ ), rotor diameter (60 m), the turbine distance ( $4 \times$  rotor diameter, and generator efficiency 0.85) we can compute the wind power.

$$P = \frac{1}{2} * V^3 * rho * turbine\ number * turbine\ area * generator\ efficiency$$

$$turbine\ area = \frac{1}{4} * diameter\ rotor^2$$

$$turbine\ number = \frac{area}{spacing\ asumption * rotor\ diameter}$$

Figure 14.9 shows the wind energy potential of Indonesia for every province in units of Megawatts (MW) with the assumption that the supply area is 100% of potential area available and extracted by the area with cut off 5 m/s.

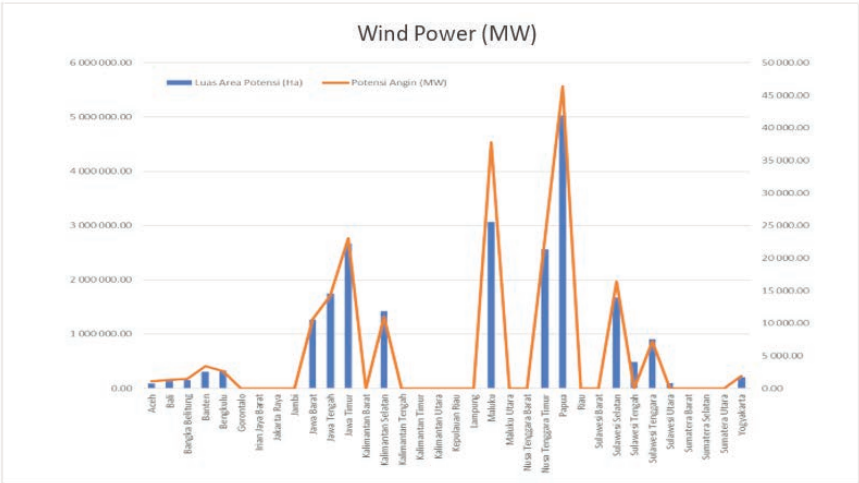


Figure 14.9 The Magnitude of Wind Energy in Indonesia  
 Source: Martosaputro and Murti, 2014; DEN, 2019

Table 14.3 The Details of the Wind Energy Magnitude in Indonesia

Province	Wind Velocity $\geq 5$ MW	Province	Wind Velocity $\geq 5$ MW
Aceh	1 083.68	Kepulauan Riau	0.00
Bali	1 299.78	Lampung	0.00
Bangka Belitung	1 475.74	Maluku	37 749.43
Banten	3 438.98	Maluku Utara	0.00
Bengkulu	2 643.40	Nusa Tenggara Barat	0.00
Gorontalo	0.00	Nusa Tenggara Timur	23 263.94
Irian Jaya Barat	0.00	Papua	46 371.84
Jakarta Raya	0.00	Riau	0.00
Jambi	0.00	Sulawesi Barat	0.00
Jawa Barat	10 630.51	Sulawesi Selatan	16 405.33
Jawa Tengah	14 200.47	Sulawesi Tengah	0.00
Jawa Timur	23 054.16	Sulawesi Tenggara	7 256.59
Kalimantan Barat	0.00	Sulawesi Utara	0.00
Kalimantan Selatan	11 022.43	Sumatera Barat	0.00
Kalimantan Tengah	0.00	Sumatera Selatan	0.00
Kalimantan Timur	0.00	Sumatera Utara	0.00
Kalimantan Utara	0.00	Yogyakarta	1 926.11

Source: DEN, 2019

From Table 14.3, we can see that the province with the largest potential for wind energy (46,371.84 MW) is Papua, followed by Maluku Province (37,749.43 MW). Both have the potential to be exposed to wind energy tends to be larger compared to other provinces. Meanwhile, the total potential for wind energy in Indonesia is 3,850,791.00 MW or 3,850.79 GW.

#### 14.4.3 Installed Capacity of Wind Power in Indonesia

In 2020, the installed capacity of wind power plants is 131.07 MW, accounting for 0.21% of all power plants in Indonesia, with a total capacity of 62,449.20 MW divided between two owners, with PT PLN (Persero) owning 0.47 MW and an independent power producer owning 130.6 MW (IPP). Figure 14.10 depicts the expansion of wind power installation in Indonesia from 2021 to 2030, according to Business Plan for Electricity Supply (RUPTL) PT PLN (persero). Between 2011 and 2020, the installed

capacity increased by 130.60 MW, with the highest growth of 131.07 MW in 2019 and the lowest growth of 1 MW in 2011.

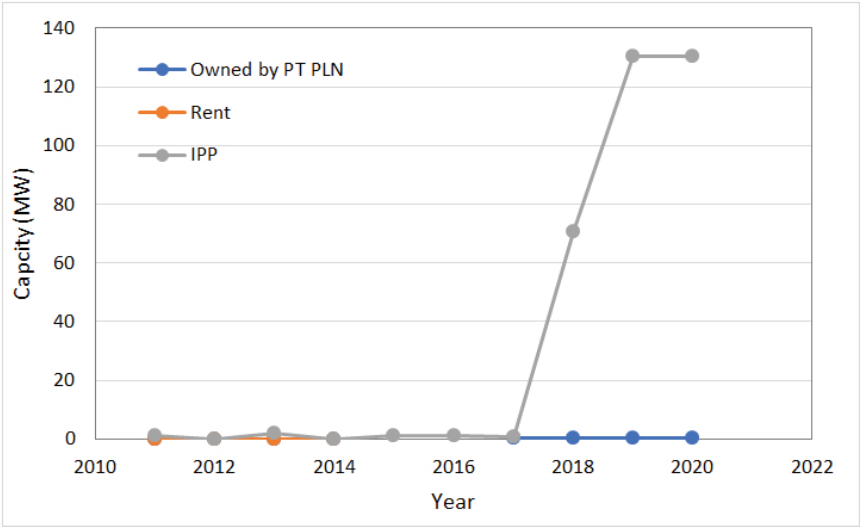


Figure 14.10 The Growth of Wind Power Installation in Indonesia<sup>7</sup>  
 Source: PT PLN (Persero), 2021

**14.4.4 Sustained Level of Wind Energy Use**

According to the information from RUPTL PT PLN (Persero) 2021–2030 that the percentage of installed capacity of wind power plant is 0.22% from the total of wind resources with a value of 60.647 MW . It means that there are enormous resources to meet new renewable energy targets. The modelling result of renewable energy supply in energy mix 2025 shows a wind electric capacity of 1.8 MTOE or equivalent to 3,413.89 MW . So that, it is necessary to accelerate the construction of wind electric power plants to achieve the target of new renewable energy supply from wind energy resources.

**14.5 BIOMASS ENERGY**

**14.5.1 Technology Trends**

To convert biomass into energy, every form of biomass requires a different processing method. In solid form, palm oil raw materials can be

<sup>7</sup> PT PLN (Persero), 2021, Rencana Umum Penyediaan Tenaga Listrik(RUPTL) 2021–2030

used totally to generate energy. Meanwhile, agricultural products can be used for energy as the initial product of biomass extraction in the form of biofuel. Meanwhile, forest products such as wood waste can be used to generate energy in the solid-state. And household/urban waste produces energy in the form of biogas.

### 14.5.2 Biomass Energy Resources

The Indonesian Government has encouraged the development of biomass and biogas with the issuance of the Minister of Energy and Mineral Resources Regulation No. 27/2014 about the purchase of electricity from Biomass Power Plants and Biogas Power Plants by PT Perusahaan Listrik Negara (Persero). Meanwhile, the development of biomass power plant for waste from several sources is supported by the Minister of Energy and Mineral Resources Regulation No. 44/2015 concerning the Purchase of Electricity by PT Perusahaan Listrik Negara (Persero) from Municipal Solid Waste Power Plants.

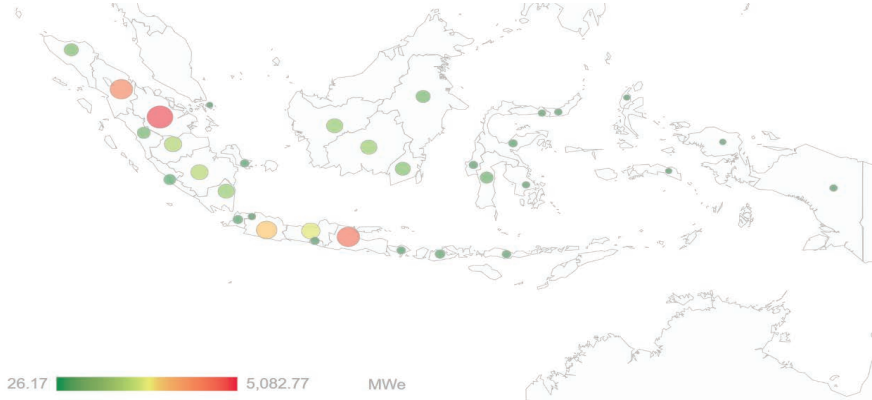


Figure 14.11 The Map of Biomass Potential in Indonesia  
Source: Ministry of Energy and Mineral Resources (ESDM), 2021

Based on Figure 14.11 the various biomass potentials were separated as summarized in Table 14.4.



Table 14.4 Biomass Potential from Several Sources

Province	Corn Farming	Paddy Farming	Palm Oil Plantation	Coconut Farming	Cow Liquid Waste	Rubber Plantation	Cassava Cultivated	Municipal Solid Waste
Aceh	24.74	245.07	548.88	3.74	16.82	243.85	0.94	20.68
Bali	14.99	125.92	0	3.89	23.13	0.01	1.65	21.66
Bangka Belitung	0.73	3.59	180.9	0.29	0.29	2.35	0.33	5.39
Banten	4.76	287.89	0	3.06	1.7	1.66	1.94	116.54
Bengkulu	19.52	83.55	293.75	0.49	3.64	114.04	1.38	7.78
Gorontalo	92.24	32.1	0	3.32	6.66	0	0.16	4.45
Jakarta Raya	0.01	1.87	0	0	0.06	0	0.01	126.11
Jambi	11.39	92.75	624.66	6.28	4.35	723.06	0.64	14.85
Jawa Barat	128.47	1,772.37	0	9.37	15.35	5.86	27.99	559.31
Jawa Tengah	423.41	1,344.79	0	10.66	70.32	2.54	38.47	278.43
Jawa Timur	756.55	1,464.80	0	17.12	171.53	2.3	40.4	397.59
Kalimantan Barat	28.41	209.43	723.11	4.13	5.56	311.47	3.01	22.87
Kalimantan Selatan	15.38	253.03	405.39	1.71	5.04	397.56	1.27	18.57
Kalimantan Tengah	2.23	84.71	943.53	4.02	1.99	169.89	1.6	10.22
Kalimantan Timur	2.88	50.4	848.31	1.2	3.33	45.47	1.29	14.71
Kepulauan Riau	0.22	0.1	8.04	0.77	0.62	2.52	0.09	3.31
Lampung	270.03	374.86	159.66	6.21	26.95	122.18	83.95	56.22
Maluku	2.09	7.83	0	4.59	2.69	0	0.87	5.29
Maluku Utara	3.22	7.95	0	14.58	2.2	0	1.29	4.54

Table 14.4 Biomass Potential from Several Sources

Province	Corn Farming	Paddy Farming	Palm Oil Plantation	Coconut Farming	Cow Liquid Waste	Rubber Plantation	Cassava Cultivated	Municipal Solid Waste
Nusa Tenggara Barat	60.67	253.3	0	6.48	24.87	0	1.3	27.8
Nusa Tenggara Timur	112.4	79.95	0	3.68	28.24	0	16.82	20.42
Papua	1.59	14.1	0	13.4	2.96	0	0.89	12.14
Papua Barat	0.52	4	0	1.01	1.5	0	0.37	2.07
Riau	9.87	74.48	1,954.64	26.05	5.8	471.61	0.91	31.71
Sulawesi Barat	10.89	48.99	0	2.48	2.64	0	0.53	5.1
Sulawesi Selatan	209.73	587.67	0	4.83	35.72	0	6.55	33.15
Sulawesi Tengah	28.36	156.97	0	11.18	8.39	0	1.15	11.49
Sulawesi Tenggara	15.41	63.65	0	2.32	7.73	0	3.1	9.76
Sulawesi Utara	65.34	81.62	0	19.92	3.82	0	0.96	9.85
Sumatera Barat	59.52	308.49	350.67	5.03	11.86	66.23	2.22	22.69
Sumatera Selatan	15.04	355.87	827.97	3.27	8.93	132.41	3.58	61.53
Sumatera Utara	176.88	626.68	1,398.84	6.84	16.38	268.66	10.55	99.49
Yogyakarta	43.22	110.6	0	3.15	13.63	0	9.18	27.1

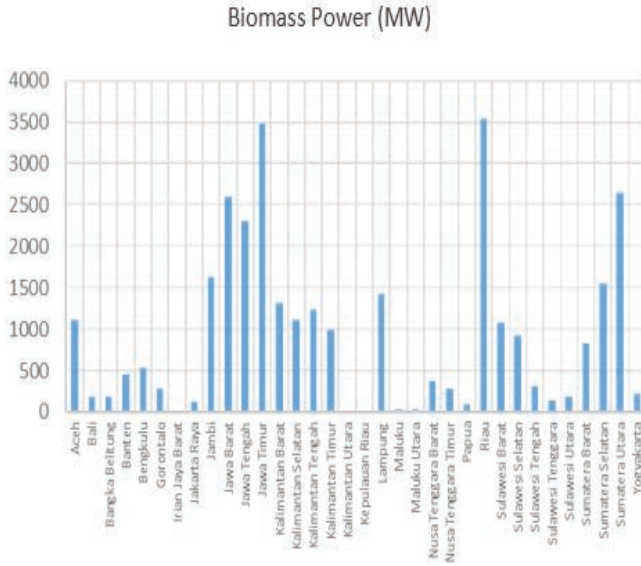


Figure 14.12 The Distribution of Biomass Potential in Indonesia  
 Source: ADB, 2020

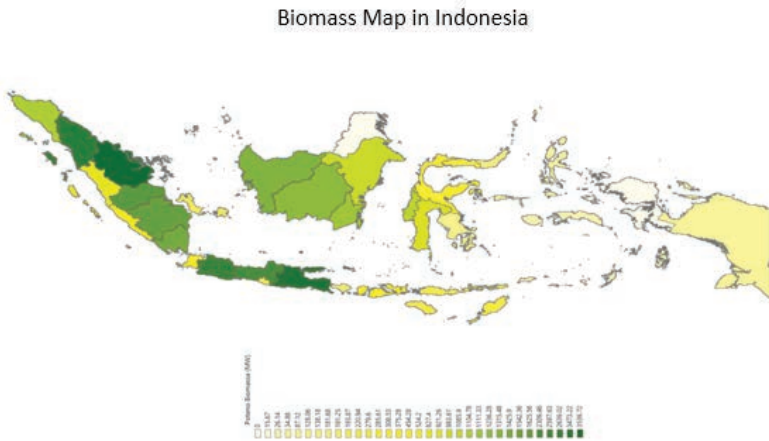


Figure 14.13 The Map of Biomass Power (MW) in Indonesia  
 Source: ADB, 2020

Therefore, the biomass potential can be found out in Figure 14.12 and Figure 14.13. From this map, Riau Province has the largest potential of 3500 MW for biomass energy. Then followed by East Java Province with energy of 3300 MW.

In the development of biomass energy, two things that must be considered are the crop cycle and land use in the supply of raw materials of biomass energy. For example, a biomass power plant using rice husks. This system has been settled at Lamlukka Cooperative Rice Mill & Paddy Center Market Co., Ltd for evidence and testing for over 360 hours. With a gas flow rate of 240 m<sup>3</sup>/hour (calorific value 4.5 MJ/m<sup>3</sup>) and a rice husk consumption of 85 kg/hour, the efficiency of the gasification system was 92%. In other words, 1.25 kg hour of rice husk consumption generates 1 kW of electricity.

As another example, the cassava plant is one of the raw materials in the manufacture of bioethanol. Cassava can be planted by cutting wood and placed on the ground in a vertical or sloping position. Cassava with powdery roots can be harvested by hand no later than 12 months after planting.

### **14.5.3 Installed Capacity of Biomass Power in Indonesia**

In 2020, the installed capacity of biomass power plants is 119.07 MW, accounting for 0.19% of all power plants in Indonesia, with a total capacity of 62,449.20 MW divided between two owners, with PT PLN (Persero) owning 0.5 MW and an independent power producer owning 119.7 MW (IPP). Figure 14.14 depicts the expansion of biomass power installation in Indonesia from 2021 to 2030, according to Business Plan for Electricity Supply (RUPTL) PT PLN (persero). Between 2011 and 2020, the installed capacity increased by 36.52%, with the highest growth of 171.24 MW in 2019 and the lowest growth of 1 MW in 2015.

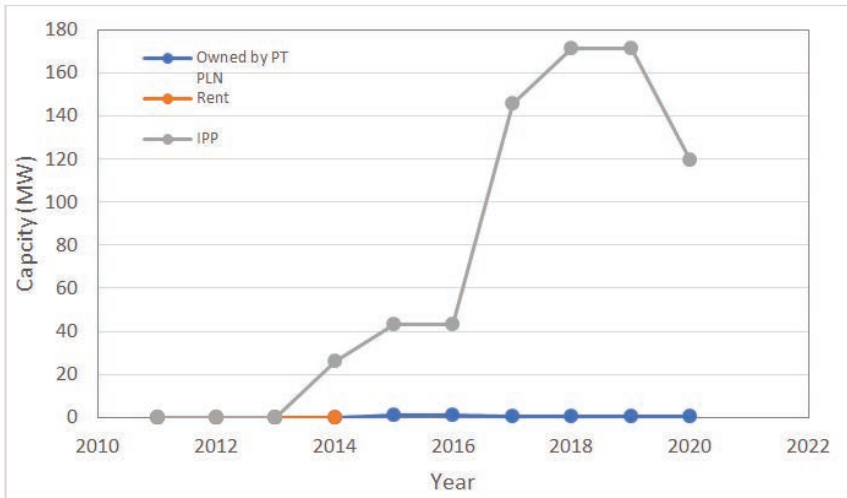


Figure 14.14 The Growth of Biomass Power Installation in Indonesia

Source: PT PLN (Persero), 2021, Rencana Umum Penyediaan Tenaga Listrik(RUPTL) 2021–2030

#### 14.5.4 Sustained Level of Biomass Energy Use

According to the information from RUPTL PT PLN (Persero) 2021–2030 that the percentage of installed capacity of biomass power plant is 0.37% from the total of biomass resources with a value of 32.654 MW. It means that there are enormous resources to meet new renewable energy targets. The modelling result of renewable energy supply in energy mix 2025 shows a biomass electric capacity of 33.8 MTOE or equivalent to 64,105.27 MW. So that, it is necessary to fast-track the construction of biomass electric power plants to achieve the target of new renewable energy supply from biomass energy resources.

### 14.6 CLEAN COOKING

#### 14.6.1 Technology Trends

The technology trends have shown that in 1990 the global population mainly or 53% of used polluting cooking fuels, dropping to 36% in 2020. In urban areas, gaseous fuels currently dominate with a growing reliance on electricity; while in rural populations, high levels of biomass use persist along with increasing use of gaseous fuels.

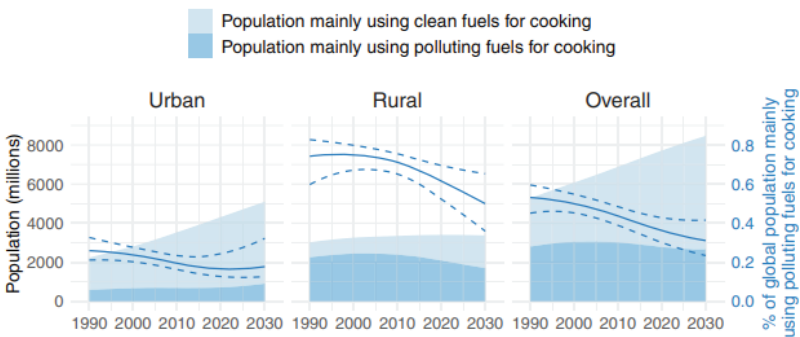
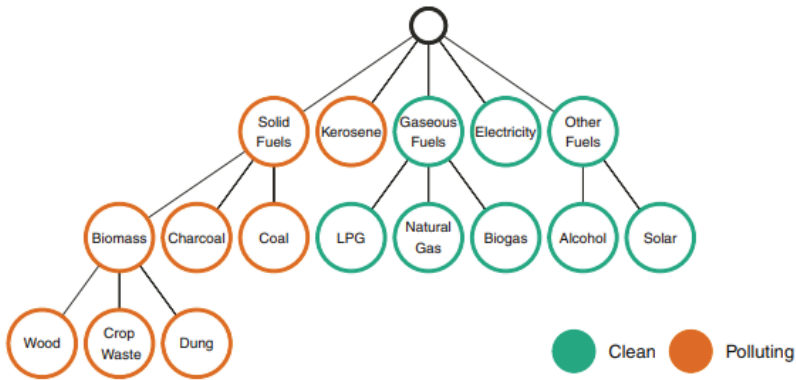


Figure 14.15 The Growth of Clean Fuels and Polluting Fuels for Cooking  
Source: DEN, 2019

The global populations mainly estimated (posterior median) using clean and polluting fuels for cooking (shaded area), have shown along with the estimated (posterior median) percentage of the global population mainly cooking with polluting fuels (solid line), with 95% posterior uncertainty intervals (dotted lines).

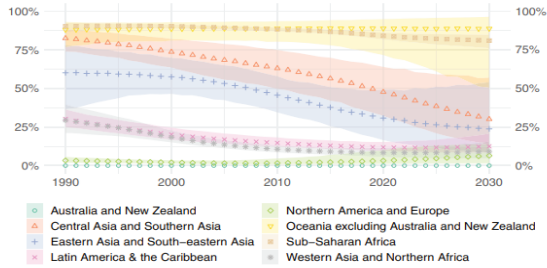


Figure 14.16 Regional Use of Polluting Fuels as the Main Fuel for Cooking  
Source: DEN, 2019

Around 40% of Indonesian households, particularly in rural regions, still depend on conventional biomass energy (firewood) as their primary source of cooking fuel. In urban areas, the government’s initiative to convert kerosene to LPG has proven successful. However, because LPG access to remote villages is limited in rural areas, the program does not work optimally. In remote areas, the use of modern fuels is not widespread, and fuel will be replaced by biomass fuels.

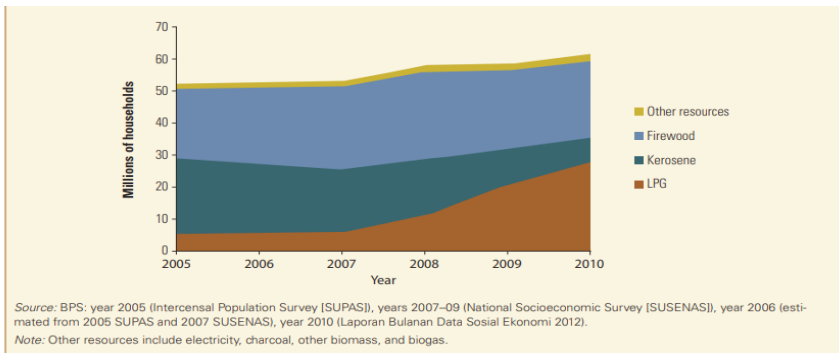


Figure 14.17 National Trend in Household Cooking Fuel Use 2005–2010  
Source: DEN, 2019

### 14.6.2 Biofuel (Biodiesel, Bioethanol, Biogas) Resources or Electric Stoves

Biodiesel is produced from raw materials such as jatropha, soybean, and palm oil. Plants like soybeans and palm oil have become important plantation commodities in Indonesia, with the objective of using them

as the primary raw material to supply biodiesel demand. Meanwhile, the acidity content of *Jatropha curcas* causes an issue in its use, which needs to be investigated further.

Palm oil has a better potential for usage as a biodiesel feedstock than soybean, associated with land area and biodiesel production potential.

Table 14.5 Biofuels Potential in Indonesia

Region	Soybean		Palm Oil	
	Area (Ha)	Biodiesel (kl)	Area (Ha)	Biodiesel (kl)
Sumatera	67,201	302,404	3,028,000	18,470,800
Jawa	588,234	2,647,052	19,000	115,900
Bali & Nusa Tenggara	123,594	556,171	0	0
Kalimantan	10,988	49,445	509,000	3,104,900
Sulawesi	41,761	187,924	100,000	610,000
Maluku dan Papua	247,832	1,115,245	38,000	231,800
Total Indonesia	1,079,609	4,858,242	3,694,000	22,533,400

Source: Statistik Perkebunan Kelapa Sawit, 2004. Ditjen Bina Produksi Perkebunan. Buku Statistik Indonesia 2004. BPS.

Bioethanol is produced from starch-containing plant raw materials such corn, cassava, sweet potato, sago, and molasses. Cassava, sweet potato, and corn are the most common raw ingredients. Based on the size of the area and possibilities for ethanol production in every Indonesian region.

Table 14.6 Ethanol Resources in Indonesia According to the Area and the Production

Region	Cassava		Sweet Potato		Corn	
	Area (Ha)	Ethanol (kl)	Area (Ha)	Ethanol (kl)	Area(Ha)	Ethanol (kl)
Sumatera	350385	612581	36012	40279	710201	383367
Jawa	663585	1348506	61984	83780	1859891	1028184
Bali & Nusa Tenggara	103309	159922	23405	28259	322306	136787
Kalimantan	37392	68531	8957	8923	59196	18493
Sulawesi	59260	98782	17454	17844	382393	194256
Total Luar Jawa	23645	40302	39614	43155	12514	6249
Total Indonesia	1237575	2335209	187426	227770	3346501	1774984

Source: \* Processed according to BPS, 2004 dan BBTP–BPPT, 2005

Note: The needs of raw material produces the ethanol, including corn 5 kg/litre, sweet potato 8 kg/litre, and cassava 6.5 kg/litre.



### **14.6.3 Successful Program Experience in Indonesia**

1. Conversion program from kerosene to LPG has been successfully implemented in 2007–2012 highly increase the LPG users mainly in urban areas. More than one-third of households switched to LPG during the first of four years program. More than three-quarters of the households that use LPG (21 million households) live on the Island of Java. In 2010, during the program, 48.2 million LPG start-up packages (including 3 kg LPG cylinder, stove, tube, and regulator) had been distributed for free to 48.2 million households and small and medium-sized enterprises. In 2011–2012, an additional 8.5 million start-up packages were allocated. The program has been especially effective in the province of East, West, and Central Java. In 2013, LPG is the dominant cooking fuel in 10 provinces replacing kerosene as the primary cooking fuel.
2. In collaboration with Indonesia’s Directorate of Bioenergy, Ministry of Energy, and Mineral Resources, the World Bank initiated the Indonesia Clean Stove Initiative in 2012. The Clean Stove Initiative is an effort to Support Universal Access to clean cooking by 2030. The aim is to expand access to clean cooking solutions for families who will likely continue using solid fuels beyond 2030. The World Bank signed an agreement for supporting the implementation of the Clean Stove Initiative until December 2015. The program includes the market development agenda, framework, design, and preparation of clean cook stoves. While preparing for the production of better cook stoves is ongoing, the government is also drafting standards for future cook stoves. According to data from the estimated growth of biodiesel and bioethanol production in 2004–2025, biodiesel and bioethanol production amounts for only 1.55 percent of total projected cooking fuel demand in 2025. To reach the objective, clean energy requirements for cooking, land expansion, and the acceleration of biodiesel and bioethanol production technology are required.



## CHAPTER-15

# ACCELERATING ENERGY TRANSITION FROM AN ECONOMIC PERSPECTIVE

Ardyanto Fitriady

### 15.1 INTRODUCTION

The energy transition requires support from many parties and is multidimensional. Sovacool and Geels (2016) say that energy transition requires changing the behavior of actors or agents of the economy as well as markets and regulations. If the power sector is the main focus in the energy transition, there are four main economic principles that must be observed (Blazquez et al., 2020):

1. The energy transition is driven more by policy than technology. This means that the outcomes of the energy transition—especially with regard to electricity prices and production—will be linked to the policies chosen so that each country will have a different path in implementing energy transition. In Indonesia, as is the case in other countries, existing green technology does not necessarily change the electricity generation; the shift from fossil energy to renewable energy (RE) is not guaranteed. There must be sufficient incentives to encourage such a shift.
2. The energy transition disrupts the liberalization of the electricity market. This second principle is an important point in many electricity markets in the world but is irrelevant to the case of Indonesia where electricity sales are monopolized by PLN. However, a different company vision—toward a *green company*—are needed to make sure that PLN's business strategy will go hand-in-hand to achieve the goal of energy transition.

3. The current technology will make the energy transition to be incomplete for, at least, the next few decades. Technically, a perfect transition is possible with available technology but it will not be easy to accomplish, both economically and politically. The importance of maintaining the economic growth will be considered in accordance with the existing industrial structure in the economy.
4. Consumers' preferences for green electricity will change and will lead to changes in current demand and business models. Looking at the experiences of developed countries, consumers tend to become more aware of the importance of green energy over time. This means that the old business model in the electricity sector must change to respond to these changes.

As mentioned in point one above, the success of the energy transition is determined by the incentives received by each economic agent involved, both producers and consumers. People respond to incentives. These incentives can be created by the market or by the government in the formula of interventions that encourage the energy transition.

The incentives that will be discussed in this chapter are:

1. Sustainable financing
2. Government intervention:
  - (a) Fiscal and non-fiscal incentives
  - (b) Carbon tax
  - (c) Cap-and-Trade
3. Price intervention

## **15.2 SUSTAINABLE FINANCING**

The energy transition requires a large amount of capital. The ability to borrow and ensure a risk-based return on investment for capital owners is critical to attract new investment and shift the allocation of capital to the renewable energy. For this reason, it is needed to manage financing costs and diversify financial sources so that the transition can occur. Based on President Jokowi's speech at the 2022 World Economic Forum, Indonesia needs around USD 50 billion (around IDR 717 trillion) to support energy transition. The existing conventional financial market is not optimal in encouraging green investment. Thus, innovations that are more business-

friendly are needed. There are several important financing initiatives to accelerate the energy transition that have been proposed in various international forums. Four of them are as follows:

1. Energy transition mechanism or ETM: ETM is a collaborative initiative developed in partnership with developing countries that will utilize a market approach to support the transition from fossil to green energy. The Indonesian Government has signed an MoU with the Asia Development Bank at COP-26 to finance the phasing down of coal-fired power plants. Public-Private Partnerships are expected to be able to acquire and retire coal-fired power plants earlier.

Through this scheme, the owners of fossil power plants exchange their assets for cash and/or equity from the ETM. ETM in a country is formed based on national emission reduction commitments (Nationally Determined Contributions, NDC) and the number of plants must be retired in a certain period. Long-term, low-interest investors then invest in ETMs supervised by multilateral banks to ensure its compliance with energy transition targets. The owner of the fossil power plant then exchanged his assets for cash and equity held by the ETM. The cash and equity are then used to make the transition to renewable energy that is more environmentally friendly, or invested in the Clean Energy Facility (CEF). The transfer of ownership of the power plant assets to the ETM uses a scheme called the Carbon Reduction Facility (CRF). In this scheme, ETM will manage the power plant and CRF will use the income from operating assets to pay the investors. On the other hand, CEF will provide funding, technological assistance and knowledge so that the host country is able to accelerate the development and investment of renewable energy. This means ETM investors will receive returns from CRF and CEF.

According to ADB (2021), ETM has the following benefits:

- (a) Accelerate climate change mitigation: countries participating in the ETM will be able to achieve emissions targets that are more ambitious than their current commitments.
- (b) Reducing energy costs: termination of coal-fired power plants will increase the demand for electricity from renewable energy sources by 2–3 times and reduce energy generation costs in the long term.

- (c) Drive investment in energy transition: ETM will help drive investment in renewable energy that is cost-effective and supports and enables technologies such as smart grids, hydrogen, electric vehicles, and other green technologies.
  - (d) Provide a measurable model: ETM has the potential to be developed in other parts of Asia and the Pacific, as well as Latin America and Africa, which could lead to significant global emission reductions.
2. Green bonds: these green bonds are issued to finance projects that support the reduction of carbon emissions, climate change and the environment whose global sales will reach USD513 billion in 2021 and are expected to reach USD1 trillion in 2022 and reach USD5 trillion in 2025 (Bloomberg, 2022).
  3. Transition bonds: these bonds are relatively new debt instruments and are often issued in sectors that do not normally qualify for green bonds, such as industries with high carbon emissions like oil and gas, iron and steel, chemicals, aviation, and shipping. This type of bond can be utilized to help finance the transition to renewable energy in the long term. The attractiveness of these bonds is not only the coupon rate but also the energy transition benefits that meet the buyers' preferences.
  4. Blended finance: this financing is a strategic development financing—usually used by the public sector—to mobilize additional finance. Blended finance usually utilizes concessional donor funds to mitigate specific investment risks. By rebalancing the risk and the reward, blended financing can attract capital to green projects and provide positive returns to the investors.

### **15.3 GOVERNMENT INTERVENTION**

In general, renewable energy technologies are relatively less attractive to investors because of the risks and its lack of competitiveness in term of prices. It is natural for new technologies whose economies of scale are still relatively small (e.g. wind and solar power plants) compared to older technologies (e.g. coal-fired power plants). Although the negative externalities of power generation are known by society, there is no sufficient incentive to internalize the costs of externalities into business or investment decisions. The existence of these negative externalities causes business decisions to be socially inefficient (sub-optimum) and create market failures.

Economic theory suggests that economic activities that create negative externalities must be taxed in order for economic agents to make decisions that cause Pareto Optimum conditions, i.e. conditions when resources are allocated efficiently and at the optimum level of welfare. One of taxes can be imposed is carbon tax which will be discussed later. On the other hand, economic activities that create positive externalities must be subsidized to reach the optimum level. In this case, the subsidy works as a negative tax. Incentives in the form of subsidies can be provided so that economic actors or businesses have sufficient incentives to invest in renewable energy.

### **15.3.1 Fiscal and Non-Fiscal Incentives**

Fiscal incentives are needed to ensure that RE investment can be more competitive than coal-fired power plants, which are currently still dominant in Indonesia. Deloitte (2011) points out that RE investment incentives need to focus on: (1) reducing management costs; (2) increasing incentive mechanisms; (3) reducing generation costs; (4) building investor confidence; (5) decreasing the price for consumers; (6) creating public awareness of renewable energy; (7) improving the market; (8) making sure it is compatible with common market structures and regulatory mechanisms; and (9) eradicating externalities.

There are several fiscal incentives provided by the Indonesian Government to RE developers. The tax relief schemes are available in the arrangement of tax allowances, import facilities, and tax holidays. Tax allowance in this context is an incentive given in the form of reduction of corporate income tax as regulated in PP No. 18 of 2015 in conjunction with PP No. 9 of 2016 and Regulation of the Minister of Energy and Mineral Resources No. 16 of 2015, and BKPM Regulation No. 6 of 2018. RE developers are eligible to get net income tax reduction of 5 percent per year for six years, or 30 percent of the investment value. Another form of incentive is import facility. This facility consists of exemption from import PPh 22 levies, exemption from import duty, and exemption from VAT for imported goods used for investment in new and renewable energy plants. In addition, the tax holiday as a tax facility provided by the government can be given to investments with a minimum value of IDR500 billion (or a minimum of IDR100 billion to obtain a mini tax holiday). This tax holiday is regulated in PMK No. 35 of 2018 and BKPM Regulation No. 1 of 2019.

Tax holiday is a facility for reducing corporate income tax collections given to companies in the form of reducing the income tax collection payable by 100 percent within a certain phase of time.

The development of new and renewable energy power plants is also supported by the government budget through the ministry and institutions for the development of infrastructure that supports RE plants. Various facilities, such as the Project Development Facility (PDF), Viability Gap Fund (VGF), and Political Guarantee Policy, can be provided by the government through the Public-Private Partnership (PPP) scheme.

The energy transition process also needs to be supported by domestic industries related to RE to make sure that Indonesia can get more benefits from the investment. Thus, in the long term, government incentives can be given to industries that support RE, especially aimed at the industries that produce RE component. However, keep in mind that these incentives cannot be provided infinitely because incentives are cost to the government and society.<sup>1</sup> If the industry is unable to become efficient or less competitive, then imports are inevitable. For this reason, the RE supporting industry must have a clear roadmap to be competitive both in terms of price and quality so that it can be a substitute for imports of RE components. In terms of investment, based on the results of UGM-Kemenkeu RI-GIZ PSE study (2018), fiscal incentives that can have a significant impact on RE investment are emission reduction incentives, interest subsidies, and tax holidays.<sup>2</sup>

### 15.3.2 Carbon Tax

Carbon emissions generate negative externalities and decrease social welfare. Although the presence of carbon in the economy cannot be avoided, the amount of carbon produced must be controlled to achieve the optimum level of carbon emissions, especially related to the issue of climate change. If production and consumption decisions that have negative externalities are left entirely to the market, the market will be inefficient. The amount of carbon emissions generated by the economy will be too large, above the

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1 Incentives have opportunity costs. Every rupiah of the budget used for incentives will reduce the budget allocation for other sectors. Reallocation of government budgets as subsidies or incentives can create deadweight loss (inefficiency) in the economy.

2 The PSE UGM-Kemenkeu RI-GIZ study (2018) shows that emission incentives can increase the IRR by approximately 6–8 percentage points, interest subsidies at 3 percent increase the IRR by 2–3 percentage points, and a 5-year tax holiday raises the IRR by 2 percentage points. Import facilities do not have a significant effect on the investment costs of PLTMH but are quite significant on the investment costs of PLTS, which is 3.6 percentage points.



socially optimum level. For this reason, an energy transition is needed to make sure that carbon emissions reach the optimum level.

In this regard, government can accelerate the energy transition by implementing carbon tax. This intervention will make investors consider additional costs (in the form of carbon taxes) in their business decisions so that the negative externalities of carbon emissions generated by fossil power plants can be internalized.

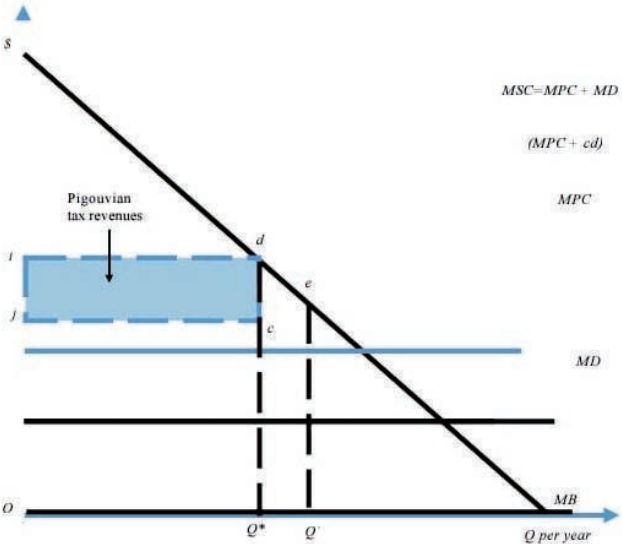


Figure 15.1 Carbon Tax  
Source: Author's Graph

Negative externalities can be illustrated by Figure 15.1. Fossil power plants have additional benefits (marginal benefit, MB) that decreases when the quantity of output increases and have additional costs (marginal cost, MC) that increases when the quantity of output increases. Without intervention, the quantity that will occur is  $Q$ . This happens because the economic agent only takes into account (marginal private cost, MPC) and ignores the damage (marginal damage, MD). The marginal damage created from this production activity is the negative externality. These negative externalities create costs for society, such as health problems, environmental pollution, and climate change. This means that the quantity  $Q$  is not a socially optimal quantity. The Pareto optimum condition will only occur if all costs

have been included in the decision making, namely at the quantity  $Q^*$  when the marginal benefit is equal to the marginal social cost (MSC). As shown in Figure 15.1, MSC is the value of the marginal cost plus the marginal damage at a certain quantity.

One way to make the market choose the optimum level ( $Q^*$ ) is to apply a carbon tax which is included in the Pigouvian tax category. In Figure 15.1 the amount of tax is  $cd$ . Taxes are applied to carbon emitters based on the damage or cost. This tax can also be seen as a cost to prevent environmental damage (or reduce an additional unit of pollution) which is called the marginal abatement cost (MAC). PSE UGM (2017) estimates that the carbon tax to achieve the emission target (29% lower than business as usual in 2030) is USD 42.75 per tonne of  $\text{CO}_2\text{e}$ . This figure is much higher than the carbon tax that has been set in Indonesia today, which is Rp30,000 per tonne of  $\text{CO}_2\text{e}$ .

Research related to the application of carbon taxes have been carried out with various perspectives. Guo et al. (2014) with a case study in China concluded that a modest carbon tax would significantly decrease carbon emissions and somewhat hinder economic growth. The implementation of a carbon tax will rise output in labour production and distribution, textile manufacturing and processing and related products, services, and agriculture. On the other hand, it will reduce output in sectors that are related to fossil fuels. They suggested that the Chinese Government need to utilize a carbon tax as soon as possible to achieve the emission reduction targets. Using the difference-in-difference method, a common method in economics, Lin and Li (2011) state that the carbon tax has a significant negative effect on per capita carbon emissions in Finland and does not have a significant effect in Sweden, the Netherlands, and Denmark because of tax exemptions for certain industries in Finland.

In principle, a carbon tax is needed to optimize social welfare level. In this case we need to internalize the externality (due to the market failure) by imposing a direct tax on the possible damage from carbon. The amount of the tax must be different for each production (or consumption) activity, depending on the carbon emissions generated.

Carbon tax will result in two kinds of benefits so-called the 'double-dividend hypothesis'. First, a carbon tax would promote an improved environment by making economic agents to consume and produce

responsible less emissions. Second, carbon taxes can inspire the economy by reducing distortions, especially in the labour market. Most of the economists agree that a carbon tax is one of the best options, even though the empirical results of this hypothesis are debatable (Fullerton and Metcalf, 1997; Bovenberg, 1999; Allan et al., 2014). A good carbon tax is an effective tool to reduce the risk or slow down climate change, reduce emission costs, encourage environmentally friendly technology innovation, and will increase government revenues (Marron and Toder, 2014). Liu and Lu (2015) found that carbon taxes are an effective tool for reducing emissions in China using dynamic computable general equilibrium model. The CGE model was also used by Allan et al. (2014) to investigate the economic and environmental impacts of a carbon tax in Scotland. They found that imposing a carbon tax of £50 per ton CO<sub>2</sub> would help the government come across its emission reduction target of 37 percent. Another result from Zhang and Cheng (2009) find that it is possible for Chinese Government to implement a carbon tax without disrupting economic growth in the long run.

It is clear to observe that political will is still a major problem to implement carbon tax. However, carbon taxes are still considered as an ideal market-based instrument compared to other approach such as command-and-control to reduce emission (Herber and Raga, 1995). Carbon taxes can be used to reduce emissions and increasing social welfare, achieving the right balance of the two, and minimizing administrative complications (Heine et al., 2012). The imposition of a carbon tax can be done via market mechanism that will affect the production side or through non-market mechanism, for example via electricity consumption behavior. Regarding the administration, Metcalf and Weisbach (2009) state we have to find the balance between reducing the target and the ease of administration. There is a trade-off between achieving emission targets and the uncomplicatedness of the administration. It is necessary to create infrastructure and institutions that are efficient and reliable in implementing the carbon tax in Indonesia.

### **15.3.3 Cap-and-Trade**

The energy transition expected at reducing carbon emissions and slowing climate change requires a right approach, both from an environmental and an economic (efficiency) perspective. Cap-and-trade is one of the best ways to answer both. By imposing a cap-and-trade, upper limit on carbon emissions

has been set and forced fossil power plants to transition. This scheme is also economically efficient. The carbon market will create a carbon price that reflects the marginal benefits and marginal costs. Cap-and-trade can be described as follows. The government determines the carbon emissions that are allowed to be produced within a country called *cap*. The right to pollute the environment is allocated or sold to the highest bidder (which reflects the marginal benefit) through an auction process. Companies that plan to produce higher and produce emissions above the emission allocation they have (Emitter A) must purchase the right to pollute the environment from a company that has allocated emissions more than required (Emitter B). The carbon market will be created with demand (from Emitter A) and supply (from Emitter B) with quantity and price determined by the market so that the outcome is efficient in term of quantity and price. Apart from ensuring that emission targets are maintained, there are incentives from each industry to reduce emissions and sell polluting rights on the carbon market. These incentives will support the achievement of a faster energy transition.

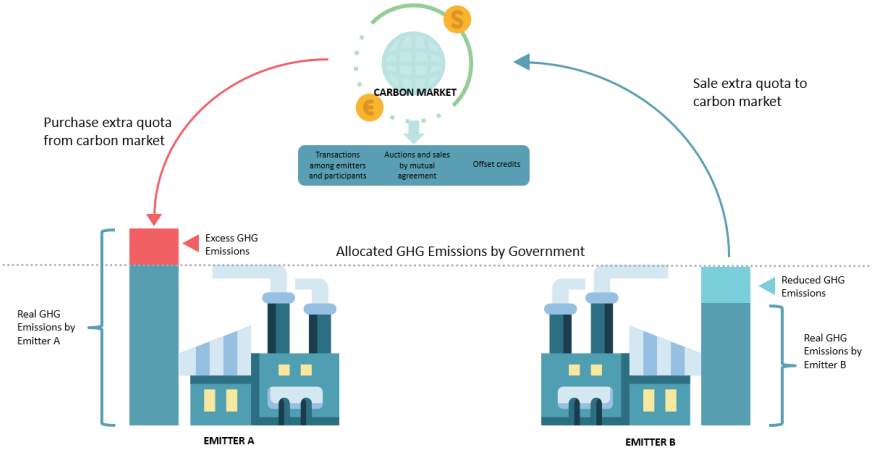


Figure 15.2 Cap-and-Trade  
 Source: Adapted from CCES, 2019; Nova Scotia, 2021

Both a carbon tax and a cap-and-trade will create a carbon price that reflects the costs of the externalities (and social costs) created by carbon emissions. In addition, both approaches will increase government revenues (from taxes or sales of emission permits) which can be used to encourage green energy investments and accelerate the transition process.

## 15.4 PRICE INTERVENTION

One of the obstacles to investment in renewable energy is the high price of electricity compared to the price of electricity from coal-fired power plants. Thus, one way to mitigate this problem is by intervening the prices. Minister of Energy and Mineral Resources Regulation No. 50 of 2017 which has been changed to Minister of Energy and Mineral Resources Regulation No. 4 of 2020 regulates the electricity purchase price scheme by PLN which is based on the unit cost (*Biaya Pokok Penyediaan, BPP*) with a maximum 85 percent if the local BPP exceeds the National BPP. This scheme creates an unequal level of competition between renewable energy and fossil energy. Assuming fossil energy is given, the renewable energy sector should receive subsidies from the government because of the positive externalities generated (in the form of reducing CO<sub>2</sub> pollution).<sup>3</sup>

For investors, purchasing electricity (by PLN) using the BPP scheme is not attractive enough to encourage new investment in the renewable energy sector. Electricity from fossil energy is cheaper from private perspective since private (market) does not take into account the cost of the negative externalities. Therefore, the role of the government is needed to increase RE's competitiveness.

One of the price interventions that can be provided is the feed-in-tariff (FiT) scheme. This scheme guarantees the selling price of electricity by the IPP which provides investment certainty. This scheme has proven to be one of the key factors in the initial success of the energy transition. Germany is one of the countries that has successfully transitioned from fossil energy to renewable energy through the FiT scheme. One of the main challenges of the FiT scheme is determining the efficient prices. Although it is a regulated price, FiT scheme can be justified to increase the competitiveness of renewable energy which creates a larger net benefit.

One of the countries that has successfully made the transition from fossil to renewable energy is Germany. In 1991, Germany implemented the Electricity Feed-in Law to increase the supply of renewable energy and at

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3 This concept is a logical consequence of the standard concept of economic theory. In economic theory, production that creates negative externalities should be burdened with taxes so that the production level is optimum (lower). If coal-fired power plants that produce negative externalities are not taxed, then RE plants are assumed to generate positive externalities by "reducing emissions" and must be subsidized for optimum (higher) production.

the same time initiated a feed-in tariff scheme. As a supporting intervention, Germany issued The German Energy Industry Act 1998 which was aimed at liberalizing the electrical energy market which succeeded in lowering the price of electrical energy through competition. The liberalization of the energy market has encouraged small and medium-sized companies to enter as electricity producers. In addition to making it easier for new actors to enter the energy market, market liberalization enable consumers to choose electricity producers at low and affordable prices and push the price of electricity to an economic level (competitive price level).

In 2000 Germany issued a policy of the EEG (Renewable Energy Act) which became the basis for providing incentives for renewable energy in the form of feed-in tariffs. This scheme provides security for investors to invest in the renewable energy sector. The FiT scheme implemented by Germany is adjusted annually based on the depression rate of each renewable energy technology. These adjustments encourage manufacturers to increase efficiency and achieve economies of scale.

The FiT scheme that has been implemented by Germany has slowly turned into an auction scheme. The auction scheme is expected to reveal the willingness to sell, based on the costs faced by renewable energy producers in producing electrical energy. The auction scheme for renewable energy is also implemented by developing countries such as India.

In the case of Indonesia, government incentives can be provided in the form of prices, reduced investment costs, and taxation. The Feed-in-Tariff (FIT) scheme which is currently being discussed is a form of price incentive. By using this scheme, the negotiation process between the developer and PLN can be accelerated. Although FIT can be gradual (decreasing), the FIT scheme is responded positively by the developers. This is a strong signal that the implementation of the FIT scheme will be a good start for an effective incentive to stimulate RE investment.

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## CHAPTER-16

# REGULATION MAPPING TO SUPPORT SUSTAINABLE ENERGY TRANSITION

Mailinda Eka Yuniza and Irine Handika

Sustainable energy transition is a noble goal that cannot be achieved solely on technical aspect readiness but also political will of a nation stipulated on its laws and regulations. Moreover, in the context of Indonesia's legal system, energy is a highly regulated sector that must operate under guidance of laws and regulations. To look at the readiness of sustainable energy transition, this chapter will explore energy transition support by the international community through international law, Indonesia commitment in sustainable energy transition and regulatory challenges and recommendations that should be addressed to ensure further sustainable energy transition.

### 16.1 ENERGY TRANSITION UNDER INTERNATIONAL LAW

#### 16.1.1 Energy Transition in UNFCCC and Kyoto Protocol

Climate change and its consequences have been a disaster for humankind. The portion of its effect has impacted societies across the globe in the environment, food, water, and health sector.<sup>1</sup> However, climate change effects have also pushed the international community to imagine solutions to create a more resilient society, one of which is by driving sustainable energy transition. The importance of energy transition has been recognized since the creation of the United Nations Framework Convention on Climate Change 1992 (UNFCCC). In the Article 4.8 Paragraph (h), it is an obligation

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<sup>1</sup> Ivanova, M., 2017, "Politics, Economics, and Society", in Klein, D., Carazo, M.P., Doelle, M., Bulmer, J, Higham, A., (Eds), *The Paris Agreement on Climate Change: Analysis and Commentary*, Oxford University Press, Oxford, p. 21.

for the parties to the UNFCCC to give full attention to what actions are required, including actions related to finance, insurance and the transfer of technology, to meet the specific needs and concerns of developing country parties arising from the adverse effects of climate change and/or the impact of the implementation of response measures, especially on countries whose economies are highly dependent on income generated from the production, processing and export, and/or on the consumption of fossil fuels and associated energy-intensive products. The energy transformation concern is also emphasized in the Kyoto Protocol, an international treaty which acts as an extension of the 1992 UNFCCC. In the Article 10 Paragraph (b) Kyoto Protocol, parties to the convention are obliged to plan, implement, publish and regularly update national and regional programs containing measures to mitigate climate change and measures to facilitate adequate adaptation to climate change including the programs in the energy sector.

### **16.1.2 Energy Transition in Paris Agreement**

In 2016, more than a decade after the Kyoto Protocol, the United Nations member country finally entered into the 2016 Paris Agreement, making it the first unilateral climate change convention. Article 2 of the Paris Agreement stated that the main objectives of the climate change convention are to prevent the increase of global average temperature below 2°C above the pre-industrial level and to pursue efforts to limit the temperature increase to 1.5°C above the pre-industrial level, increasing the adaptability to impacts of climate change and foster climate resilience and low greenhouse gas (GHG) emissions, and making finance flow consistent with a pathway towards low GHG emissions and climate-resilient development.

The Paris Agreement also sets out mitigation principles on the basis of the best available science to balance anthropogenic emissions by sources and removals of GHG, and on the basis of equity in the context of sustainable development and efforts to eradicate poverty.<sup>2</sup> The Paris Agreement has four key articles which could support the effort to its objectives including Article 7 on adaptation, Article 9 on financing, Article 10 on technology transfer and Article 11 on capacity building.<sup>3</sup> However, the above mentioned articles

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<sup>2</sup> See, Paris Agreement, Art. 4 Paragraph (1).

<sup>3</sup> Bodle, R., Donat, L., Duwe, M., 2016, "The Paris Agreement: Analysis, Assessment and Outlook", *Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)*, p. 7.

give no further detail regarding energy provision, thus the implementation of energy transition relies upon the additional mechanism of the Paris Agreement and commentaries. The explanation of the adaptation, financing, technology transfer and capacity building are as stated below:

### **a. Adaptation**

The key takeaways from the Paris Agreement Article 7 are to establish the global goal of adaptation to enrich adaptive capacity, increase resilience and reduce vulnerability to climate change. Each party intend to prepare, communicate, and maintain successive nationally determined contributions that it intends to achieve. Parties to the Paris Agreement shall follow domestic mitigation measures, with the purpose of achieving the objectives of the Paris Agreement. The implementation of adaptation conducted through Intended Nationally Determined Contributions (INDCs) which are contained in each country's national plans. The fact that adaptation requirements, priorities, and actions differ widely from nation to country is reflected in the range of adaptation goals in the INDCs.<sup>4</sup> The energy sector should ideally be included as one of the sector and sub-sector lists in INDCs. The inclusion of the energy sector and sub-sector shall undertake the adaptation in renewable energy, biomass energy, energy access, energy efficiency, and power system planning.<sup>5</sup>

### **b. Financing**

Article 9 of the Paris Agreement focuses on the mobilization of support and enhancing the implementation of climate finance. The key takeaways from this provision shall push developed country parties to afford financial resources to support developing country parties with regard to both mitigation and adaptation in continuation of their existing responsibilities, mobilizing climate finance from a wide variety of sources, instruments and channels, noting the significant role of public funds, through a variety of actions, including supporting country-driven strategies, and taking into account the needs and priorities of the developing country and provide

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4 Perez, I.S., Kallhauge, C.A., 2017, "Adaptation (Article 7)", in Klein, D., Carazo, M.P., Doelle, M., Bulmer, J., Higham, A., (Eds), *The Paris Agreement on Climate Change: Analysis and Commentary*, Oxford University Press, Oxford, p. 220.

5 The World Bank, "Intended Nationally Determined Contributions (INDCs)", <http://indc.worldbank.org>, accessed on 12 June 2022.

transparent and consistent information on support for developing country.<sup>6</sup> Article 9 also provides an additional mechanism of climate finance through the Financial Mechanism of the Convention which consists of the Global Environment Facility (GEF)<sup>7</sup> and Green Climate Fund (GCF)<sup>8</sup>. From the two mechanisms provided by the Paris Agreement, GCF acts as the climate finance institution which provides financing for the energy transition. According to Annex XXVIII in conjunction with Chapter I Annex III of the GCF Handbook, the co-financing of GCF-funded activities should be the potential programs that result in an increase in household access to low-emission energy. In 2022, over 56 energy projects worth over US\$2.8b have been financed by the GCF.<sup>9</sup>

### c. Technology Transfer

Technology transfer is recognized as one of the mechanisms to fulfill the Paris Agreement objectives. Under Article 10 of the Paris Agreement, technology transfer focuses on using the technology for mitigation and adaptation against climate change, as well as accelerating, financing, promoting, and facilitating technology development and transfer. Article 10 of the Paris Agreement also established The Technology Mechanism as the additional convention to support technology transfer. The Technology Mechanism recognizes the importance of climate technology development and transfer, which is the technology that functions to reduce greenhouse gas emissions including technology in the energy sector such as renewable energies such as wind energy, solar power and hydropower.<sup>10</sup> The Technology Mechanism is currently managed by The Climate Technology Centre and Network (CTCN) as the implementation body of the Technology Mechanism to provide technical assistance at the request of developing countries on technology issues, creating access to information and knowledge on

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6 See, 2016 Paris Agreement, Article 9.

7 See, annex A of the GEF-7 Programming Directions Documents.

8 The Green Climate Fund (GCF)—a critical element of the historic Paris Agreement—is the world’s largest climate fund, mandated to support developing countries raise and realize their Nationally Determined Contributions (NDC) ambitions towards low-emissions, climate-resilient pathways and investment across four transitions—built environment; energy & industry; human security, livelihoods and wellbeing; and land-use, forests and ecosystems, See, GCF, “Overview”, <https://www.greenclimate.fund/about>, accessed 12 June 2022.

9 GCF, “Energy Generation and Access”, <https://www.greenclimate.fund/results/energy-generation-access>, accessed 12 June 2022.

10 UNFCCC, “Technology Mechanism”, p. 1.

climate technologies, and fostering collaboration among climate technology stakeholders via its network of regional and sectoral experts.<sup>11</sup>

#### **d. Capacity Building**

Under Article 11 of the Paris Agreement, capacity building is directed to enhance the capacity and ability of developing country parties, to take effective climate change action, including, inter alia, to implement adaptation and mitigation actions, and should facilitate technology development, dissemination and deployment, access to climate finance, relevant aspects of education, training and public awareness, and the transparent, timely and accurate communication of information. The implementation of capacity building is varied, depending on each nation's institutional arrangement through bilateral, regional, and multilateral approaches.<sup>12</sup>

#### **16.1.3 COP26 and Energy Transition**

Five years after the Paris Agreement, parties to the UNFCCC, Kyoto Protocol and Paris Agreement gathered together in the 26th Convention of the Parties (COP26) in October 2021 at Glasgow, United Kingdom. The COP26 has resulted in the creation of the Glasgow Climate Pact—a COP decision that pushes commitment for the implementation of the previous climate change conventions. In the Part IV Paragraph 20 of the Glasgow Climate Pact, it is explained that the member of COP26 shall push for the acceleration of development, deployment and dissemination of technologies, and the adoption of policies, to transition toward low-emission energy systems, including by rapidly scaling up the deployment of clean power generation and energy efficiency measures, including accelerating efforts towards the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies, while providing targeted support to the poorest and most vulnerable in line with national circumstances and recognizing the need for support towards a just transition.

The COP26 has also resulted in the creation of COP26 Energy Transition Council (COP26 ETC) which was attended by 21 countries, including Indonesia. COP26 ETC stated that rapid and just transition to clean power is vital part of Paris Agreement effort to avoiding dangerous

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11 UNFCCC, "Support for Implementing Climate Technology Activities", <https://unfccc.int/ttclear/support/technology-mechanism.html>, accessed on 12 June 2022

12 See, Article 11 Para. (4) and (5)

effects of climate change and limiting global warming to 1.5°C while also conceding to the benefits such as opportunities for jobs and growth, cleaner air, improved public health, energy access, energy efficiency, and energy security.<sup>13</sup> It is further explained that the ETC has agreed to explore specific opportunities for collaboration in areas including:<sup>14</sup>

1. The preferred option is making clean power technologies for countries investing in new power generation, with the target of doubling the rate of investment in clean power by 2030.
2. In order to attract the private sector to help deliver and finance these investment needs, it is important to develop policy and regulatory frameworks.
3. Ensuring that no one is left behind, it is important to support people and communities heavily reliant on the coal economy to make a secure and just transition to clean power and other economic opportunities.
4. Supporting the delivery of SDG7, harnessing centralized and decentralized clean energy solutions to achieve universal access to sustainable, affordable, modern energy by 2030, increase energy efficiency, and maximize the wider development benefits of the energy transition.

The above mentioned COP26 ETC agreement shall become the guidelines for the parties to the COP26 as the guideline to explore and strategize domestic and international policies regarding energy transition.

## **16.2 INDONESIA COMMITMENT TO SUSTAINABLE ENERGY TRANSITION**

The energy sector is the most dominant contributor to climate change, which accounts for almost 90% of CO<sub>2</sub> emissions globally.<sup>15</sup> This then causes the sustainable energy transition to become one of the priority issues in Indonesia's G20 Presidency in 2022.<sup>16</sup> The sustainable energy transition focuses on energy security, access, efficiency, and the transition to low-

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13 See, COP26 Energy Transition Council-Summary Statement, Para. 2.

14 See, *Ibid*, Para. 6

15 Portal Informasi Indonesia, "Mendorong Transisi Energi Berkelanjutan pada Presidensi G20", <https://www.indonesia.go.id/kategori/editorial/3955/mendorong-transisi-energi-berkelanjutan-pada-presidensi-g20>, accessed on 10 June 2022.

16 *Ibid*.

carbon energy systems, including investment and innovation in cleaner and more efficient technologies.<sup>17</sup> Indonesia has the opportunity to encourage the world's collective efforts in realizing policies to accelerate the global economic recovery inclusively and show the world its full support for the global energy transition through the G20 Forum. Not only that, but the Indonesian Government has also committed to accelerating the country's transition by setting an energy mix target of new and renewable energy of 23% by 2025 and committed to fulfilling Net-Zero Emissions (NZE) by 2060 or sooner.<sup>18</sup> This target is supported by the potential of Indonesia which is estimated to have a fairly abundant New Renewable Energy (NRE) of more than 3,000 GW sourced from solar, wind, hydro, geothermal, bio-energy, and marine energy.<sup>19</sup> The potential and technology of NRE are the main capital to implement the energy transition strategy towards NZE in 2060. The energy transition is an effort to reduce the risk of global warming which has the potential to threaten a decent life in the future as well as a path to the transformation of the global energy sector into zero-carbon considering that climate change is the biggest reason behind the lack of energy transition efforts.

Climate change due to rising earth temperatures is an increasingly serious threat to humanity and planet earth, so it requires more effective cooperation between countries. Currently, Indonesia's commitment to tackling climate change is a national agenda. Therefore, to control the continuation of climate change, the Government of Indonesia together with members of the international community through the 21st Conference of the United Nations Framework Convention on Climate Change on 12 December 2015 in Paris, France, have adopted the Paris Agreement to the United Nations Framework Convention on Climate Change which was followed up by the signing of the said agreement on April 22, 2016, in New York, United States. The Paris Agreement to the United Nations Framework Convention on Climate Change hereinafter referred to as the ("Paris Agreement"), was then ratified through Law Number 16 of 2016 concerning the Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change which is hereinafter referred to as ("Law 16/2016").

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17 *Ibid.*

18 *Ibid.*

19 *Ibid.*

Given that climate change is the major reason behind the massive effort of energy transition and the energy sector is the most dominant contributor to climate change, which accounts for almost 90% of global CO<sub>2</sub> emissions, the Government of Indonesia then ratified the Paris Agreement through Law 16/2016. By ratifying the Paris Agreement, it is hoped that Indonesia will benefit to create a sustainable energy transition, including:<sup>20</sup> (1) increasing the protection of Indonesia's territory through climate change mitigation and adaptation; (2) increased recognition of national commitments in reducing emissions from various sectors, forest conservation, increasing renewable energy and the participation of local communities and indigenous peoples in controlling climate change has been fought for by Indonesia; (3) be the parties who can participate (have voting rights) in decision-making related to the Paris Agreement, including in the development of modalities, procedures, and guidelines for the implementation of the Paris Agreement; and 4) obtaining ease of access to funding sources, transfer technology, capacity building for the implementation of mitigation and adaptation actions.

One of the main content of the substance of the Paris Agreement is the obligation of each country to submit a Nationally Determined Contribution in which the emission reduction contribution must increase every period and make efforts to reduce emissions quickly through mitigation actions. The Nationally Determined Contribution (NDC) is an agreement produced by the Paris Agreement, where Indonesia's Nationally Determined Contribution (NDC Indonesia), in the first period has a target of reducing emissions by 29% with their own efforts and to 41% if there is international cooperation from conditions without there is action by 2030, which will be realized among others through the forestry, energy including transportation, waste, industrial processes and product use, and agriculture.<sup>21</sup> Indonesia's NDC commitment for the next period is determined based on a work review and must show improvement from the next period. In order to achieve the goals of the Paris Agreement, national contributions to global efforts are set forth in Nationally Determined Contributions, all state parties implement and communicate their ambitious efforts and show progress over time, related to mitigation, adaptation, financial support, and technology. Indonesia's

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20 Elucidation of Law Number 16 of 2016 concerning Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change.

21 *Ibid.*



commitment to realizing a sustainable energy transition can be seen through several national legal instruments, including:

### **16.2.1 National Energy Policy (KEN, Kebijakan Energi Nasional)**

Indonesia has established a National Energy Policy through Government Regulation Number 79 of 2014 concerning National Energy Policy (KEN).<sup>22</sup> KEN is a derivative of Law No. 30 of 2007 concerning Energy. KEN contains measurable and immeasurable goals. The measurable targets of KEN 2025 and 2050 focus on total primary energy supply, primary energy per capita, power generation capacity, electricity per capita, energy elasticity and intensity, and the primary energy mix. KEN also regulates short-term measurable targets (2015 and 2020) specifically related to the electrification ratio in 2015 and 2020, as well as the ratio of gas use for households in 2015. In addition, KEN also regulates policies that are not measurable, such as energy conservation, energy diversification, cessation of coal and natural gas exports, electric vehicles, coal gasification and liquefaction, energy infrastructure, energy economy, national energy industry, funding, greenhouse gas (GHG) emissions, hydrogen for transportation, energy reserves, and others. Important things contained in the KEN include the setting of Indonesia's energy mix targets in 2025 and 2050. This policy ultimately gave birth to the energy mix targets in Indonesia including: (1) Minimum 23% of new and renewable energy in 2025 and 31% in 2050; (2) Minimum 30% of coal use in 2025 and minimum 25% in 2050; (3) Minimum use of natural gas in 2025 and 24% in 2050; and (4) The use of petroleum is less than 25% in 2025 and less than 20% in 2050.<sup>23</sup> The KEN achievement targets can be briefly described as follows:

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22 La Ode Muhammad Abdul Wahid, "Analisis Kebijakan Energi Nasional Sebagai Produk Kebijakan Transisi Energi Indonesia", *Jurnal Energi dan Lingkungan*, Vol. 13 No. 1 Juni 2017, p. 7–16.

23 Article 30 of Government Regulation No. 79 of 2014 on National Energy Policy, LN No. 300 of 2014, TLN No. 5609.

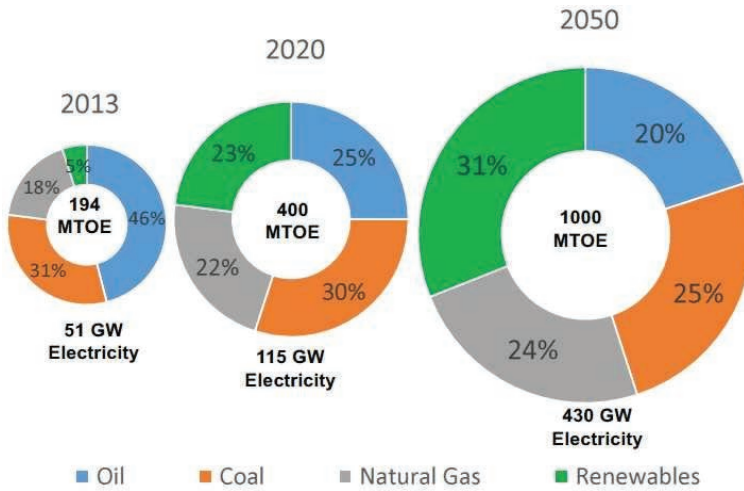


Figure 16.1 National Energy Policy Achievement Target<sup>24</sup>

### 16.2.2 National Energy General Plan (RUEN, Rencana Umum Energi Nasional)

The various targets of the KEN must be considered in the Preparation of the General National Energy Plan (RUEN) by the Government, no later than 1 (one) year after the determination of the KEN.<sup>25</sup> RUEN is a more detailed description that contains a roadmap on how to achieve the targets set in the previous KEN. This general energy plan needs to be determined at the national, provincial, and district/city scales.<sup>26</sup> Nationally, RUEN has been ratified in Presidential Regulation Number 22 of 2017 concerning the General National Energy Plan (Perpres No. 22 of 2017). In RUEN there is a Matrix in the form of 383 program activities that must be carried out by ministries/agencies and local governments to achieve KEN and RUEN targets. Of the 383 activities, the Ministry of Energy and Mineral Resources received the most responsibility for carrying out 237 activities. Furthermore, the local government with the duties and responsibilities of 102 activities. All local government activities must be accommodated in the Regional

24 Ahmad Firdaus, "National Energy Mix Based on Presidential Decree No. 79 Year 2014", [https://www.researchgate.net/figure/National-Energy-Mix-Based-on-Presidential-Decree-No-79-2014-PP-no-79-tahun-2014-4\\_fig1\\_319880138](https://www.researchgate.net/figure/National-Energy-Mix-Based-on-Presidential-Decree-No-79-2014-PP-no-79-tahun-2014-4_fig1_319880138), accessed on 14 June 2022.

25 Peraturan Presiden Republik Indonesia Nomor 1 Tahun 2014 tentang Pedoman Penyusunan Rencana Umum Energi Nasional, Kementerian Hukum dan Hak Asasi Manusia, Berita Negara Republik Indonesia Tahun 2014 Nomor 11, Jakarta, 22 Januari 2014.

26 Article 3 Presidential Regulation No. 1 of 2014 concerning Guidelines for the Preparation of a General National Energy Plan, LN No. 11 of 2014.

Energy General Plan (RUED). There are at least seven RUEN policies and programs, including increasing the added value of energy resources, aligning fiscal targets, reducing fossil energy exports, achieving maximum use of renewable energy, achieving minimum use of petroleum, and optimizing the use of natural gas. RUEN targets a 23 percent contribution of NRE in the energy mix by 2025. In addition, RUEN also plans that by 2025 Indonesia will still rely on fossil fuels with coal dominance at 30 percent, natural gas at 22 percent, and crude oil at 25 percent.<sup>27</sup> The RUEN achievement targets can be briefly described as follows:

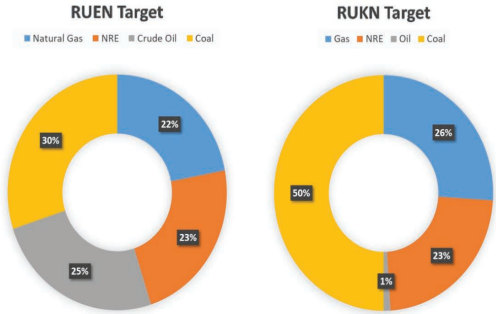


Figure 16.2 General Plan of National Energy Achievement Target<sup>28</sup>

### 16.2.3 Energy and Mineral Resources Strategic Plan

The Minister of Energy and Mineral Resources (MEMR) issues the Minister of Energy and Mineral Resources Regulation No. 16 of 2020 concerning the Strategic Plan of the Ministry of Energy and Mineral Resources for the Year 2020–2024 (Renstra MEMR). The direction of the Ministry of Energy and Mineral Resources development policy is guided by the paradigm that energy resources are not only used as export commodities, but as national development capital to realize energy security and independence. The independence and energy security referred to are as follows:

1. Energy independence is ensuring the availability of energy by utilizing as much as possible the potential of domestic sources.

<sup>27</sup> Rahmantara Trichandi, "A Brief Review on Indonesia's National Energy Policy", <https://www.purnomoyusgiantorocenter.org/a-brief-review-on-indonesias-national-energy-policy/>, accessed on 15 June 2022.

<sup>28</sup> *Ibid.*

2. National energy security is a condition of ensuring energy availability (availability), public access to energy (accessibility) at affordable prices (affordability) in the long term while still giving attention to environmental protection (acceptability).

For the 2020–2024 period, MEMR sector policies are directed on sustainable and equitable energy development to support economic growth and industrial development. The policy direction is prioritized on energy availability by maximizing the use of EBT, social justice in the energy sector which emphasizes the availability of renewable energy at affordable prices and environmentally friendly extractive activities.<sup>29</sup> In accordance with KEN which targets the contribution of renewable energy to 23% in the national energy mix by 2025, the MEMR through the Strategic Plan of Energy and Mineral Resources has set the following strategy:<sup>30</sup>

1. The addition of new and renewable energy generation capacity by 9.1 GW in the next 5 (five) years, so that the portion of the installed capacity of additional New Renewable Energy (EBT) plants to the total power plant will increase from 2020 by 15% to 20% in 2024;
2. Acceleration of development of Biofuels (BBN) through the use of biofuels for domestic use of 17.4 million kL;
3. Improving the implementation of energy conservation and efficiency with a target of primary energy intensity reaching 133.8 BOE/Rp billion (constant 2010) and decreasing final energy intensity by an average of 0.9 BOE/Rp billion per year; and
4. Develop NRE supporting industries through the use of domestic component levels in the EBT sector, with details of targets for 40% Solar Power Plants (PLTS), 40% Bioenergy Power Plants (PLTB), 70% Hydro Power Plants (PLTA), 40% bioenergy and 35% geothermal.

This strategy is also in line with the objectives of MEMR, namely increasing energy independence and security as well as optimizing sustainable energy and mineral management in order to increase added value.<sup>31</sup>

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<sup>29</sup> Ministry of Energy and Mineral Resources Strategic Plan 2020–2024, p. 64.

<sup>30</sup> *Ibid.*, p. 65.

<sup>31</sup> *Ibid.*, p. 57.

#### **16.2.4 Strategic Plan of the Ministry of Environment and Forestry**

The Minister of Environment and Forestry issued the Regulation of the Minister of Environment and Forestry No. P.16/MENLHK/SETJEN/SET.1/8/2020 concerning the Strategic Plan of the Ministry of Environment and Forestry (Renstra KLHK). The strategic target in the KLHK Strategic Plan related to energy is Strategic Target 1 (SS-1), namely the realization of a quality living environment that is responsive to climate change.<sup>32</sup> The policy directions and strategies in the KLHK Strategic Plan are briefly as follows:

1. Prevention of pollution and damage to natural resources and the environment.
2. Management of pollution and damage to Natural Resources and the Environment.
3. Recovery of pollution and damage to natural resources and the environment.
4. Improving the overall quality of the environment in every development sector and in the regions.
5. Increased resilience to climate change.
6. Deforestation rate control.
7. Improvement of conservation forest management and efforts to conserve biodiversity, species, and genetics.

The Ministry of Environment and Forestry, as the National Focal Point (NFP) at the UNFCCC, always provides support for the five sectors in the NDC, namely the energy sector, waste, industrial processes and production use (IPPU), agriculture, and forestry, can achieve emission reduction targets. The Ministry of Environment and Forestry continues to encourage the development of Industrial Plantation Forests (HTI) for bioenergy or in short, Energy Plantation Forests (HTE). The release of 6.91 million hectares (Ha) of forest area, of which 78.39 percent is oil palm which also has the potential to become a source of bioenergy. In addition, the lease-to-use forest area permit of 0.44 million ha is HTI for the energy sector. In addition, to support the creation of NRE, there are policies and regulations for the development of energy plantations, namely the Minister of Environment and Forestry Regulation Number 62 of 2019 and Number 11 of 2020. Then, the application of the agroforestry system in plantation

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<sup>32</sup> Strategic Plan of the Ministry of Environment and Forestry, p. 105.

forests is intended to support the fulfilment of food and energy needs. The Ministry of Environment and Forestry has also drawn up a memorandum of understanding with the Ministry of Energy and Mineral Resources regarding the development of EBT in forest areas.

Until now, there have been potentials related to HTI for bioenergy, including there are 14 business units with an allocation area for energy plants of 156.032 hectares with plant types in the form of Sengon, Kaliandra, Acacia, Mangrove, Gamal, Bamboo and so on. There are also 18 business units in 10 provinces that are committed to developing bioenergy, with an area of 46,600 hectares allocated for energy plants. Seeing the enormous potential of NRE in Indonesia. It is hoped that the creation and utilization of NRE in Indonesia can increase by 50 percent by 2050, so that the use of fossil fuels such as coal can be reduced by 50 percent in the same year. Moreover, Indonesia is a country that is quite good at controlling climate change. Indonesia's positive trend in controlling climate change is evidenced by the successful performance of GHG emission reductions for the 2014–2016 period with an emission reduction volume of around 20.3 million tons of CO<sub>2</sub>e. This positive result made Indonesia receive USD 103.8 million in funds from the Green Climate Fund (GCF) through the Result Based Payment (RBP) scheme. Through the same scheme, Indonesia received 56 million US Dollars from Norway for the successful reduction of GHG emissions.

#### **16.2.5 Electricity Supply Business Plan (RUPTL)**

In order to increase the electrification ratio, support the achievement of new and renewable energy mix targets, and reduce greenhouse gases emissions, Indonesia is increasing the development of electricity infrastructure, especially in terms of power plants sourced from new and renewable energy through the establishment of the Electricity Supply Business Plan (RUPTL) of PT Perusahaan Listrik Negara (Persero) which is often updated every year. Considering that the Corona Virus Disease 2019 (Covid-19) pandemic has greatly impacted the weakening of economic growth which affects the dynamics of electricity demand growth and electricity infrastructure development, the Indonesian Government through the Minister of Energy and Mineral Resources ratified the Electricity Supply Business Plan of PT Perusahaan Listrik Negara (Persero) from 2021 to

2030 which is hereinafter referred to as (“RUPTL 2021–2030”). RUPTL 2021–2030 was ratified through the Decree of the Minister of Energy and Mineral Resources of the Republic of Indonesia Number 188.K/HK.02/MEM.L/2021 (“Kepmen ESDM 188.K/HK.02/MEM. L/2021”) which has been adjusted after the Covid-19 pandemic.

The plan to develop a long-term electric power system for 10 (ten) years is deemed necessary by PT Perusahaan Listrik Negara (Persero) hereinafter referred to as (PLN) as a state-owned electricity company that plans and implements electricity projects in order to accommodate the long lead time of existing projects.<sup>33</sup> Investment decisions in the electric power industry will demand long-term benefits. This has prompted the need for PLN to develop a long-term power system in order to have an efficient investment plan and implement an electric power project based on good planning. Not only that, this electricity supply business plan is also prepared in order to comply with the provisions as stipulated in Government Regulation Number 23 of 2014 concerning Amendments to Government Regulation Number 14 of 2012 concerning Electricity Supply Business Activities, in Article 8 Paragraph (1) which states that “the business of providing electricity for the public interest is carried out in accordance with the General Electricity Plan and the Electricity Supply Business Plan”.<sup>34</sup>

The Indonesian Government’s efforts to encourage a sustainable energy transition have also spread to every province, where the provincial government is required to make a Regional General Electricity Plan (RUKD) by the mandate of Law Number 30 of 2009 concerning Electricity. Therefore, in the RUPTL 2021–2030, the electricity system planning per province is included. The RUPTL will be evaluated periodically to adjust to changes in several key parameters that form the basis for the preparation of a power system development plan so that it can always present an up-to-date system development plan and can be used as a guideline for implementing electric power projects for the realization of a sustainable energy transition in Indonesia, even the world.

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33 PT Perusahaan Listrik Negara (Persero), “Rencana Usaha Penyediaan Tenaga Listrik PT Perusahaan Listrik Negara (Persero) 2021–2030”, <https://web.pln.co.id/statics/uploads/2021/10/ruptl-2021-2030.pdf>, accessed on 10 June 2022.

34 Article 8 paragraph (1) Government Regulation Number 23 of 2014 concerning Amendments to Government Regulation Number 14 of 2012 concerning Business Activities for the Provision of Electric Power.

The trend of providing electricity generation in the last 10 (ten) years, including the existence of the RUPTL, indicates the government's commitment to providing cleaner electrical energy. The government provides power plants sourced from NRE, introduces Clean Coal Technology (CCT), and introduces Variable Renewable Energy (VRE) generators that have intermittent characteristics, with the operation of wind power plants (PLTB) and solar power plants (PLTS).<sup>35</sup> The government's objective in drafting the RUPTL is to provide guidelines and references for the development of PLN's electric power facilities in meeting the electricity demand in its business areas in a more efficient, more planned, and environmentally sound manner, so that company inefficiencies can be avoided from the planning stage.<sup>36</sup> The targets to be achieved through RUPTL are as follows:<sup>37</sup> (1) achieving the fulfillment of the need for capacity and electrical energy every year as desired at the lowest cost; (2) the achievement of a better energy mix for power generation to reduce the Cost of Supply as reflected by the reduction in the use of fuel oil, by the government's target; (3) achieving the utilization of new and renewable energy by government programs, especially geothermal, air power and other renewable energies such as solar, wind, biomass, waste and so on; (4) achieving the electrification ratio outlined in the National Electricity General Plan (RUKN, Rencana Umum Kelistrikan Nasional); (5) the achievement of better electrical performance and quality; and (6) the achievement of lower transmission and distribution network losses.

### **16.3 REGULATORY CHALLENGES IN SUSTAINABLE ENERGY TRANSITION**

Regulations concerning sustainable energy transition in Indonesia have become one of the challenges that should be addressed. Although Indonesia has shown its political will to adopt a sustainable energy transition, incomplete laws and regulations will prevent further actions taken by energy stakeholders when conducting energy transition. It is important to note that Indonesia is a state based on the rule of law, meaning that all actions that are taken, especially by the government and its institution, shall be based on existing laws and regulations.

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35 Portal Informasi Indonesia, *Op.cit.*

36 PT Perusahaan Listrik Negara (Persero), *Op.cit.*

37 *Ibid.*



### **16.3.1 The Absence of New and Renewable Energy (NRE) Law and Effects on the NRE Investment**

The new and renewable energy (NRE) is the main catalyst of the sustainable energy transition. It is estimated that Indonesia needs USD 70 billion of investment to achieve the target of 23% renewable energy by 2025.<sup>38</sup> To attain the investment target, strong laws need to be enacted to reduce project risk for the investor and other energy stakeholder. At the current level, law concerning NRE is still being discussed at the People Representative Council (DPR RI) in the form of NRE Bill. The GoI and parliament need to realize the urgency of enacting the NRE Bill into law (*undang-undang*). Below points are the challenges for NRE investment concerning the absence of NRE Law in Indonesia:

#### ***Regulatory Risk in NRE Project Management***

Regulatory risk arises when political or regulatory decisions affect an infrastructure project or asset.<sup>39</sup> According to the World Economic Forum, regulatory and political risk is considered as the 2nd highest project risk after macroeconomic volatility.<sup>40</sup> Regulatory risk in Indonesia could be associated due to the absence of NRE Law. Currently, NRE regulation is only stipulated under lower-level legal products such as the Ministry of Energy and Mineral Resources Regulation (MEMR). Regulation at the lower level can cause two things which are scattered regulation and legal volatility. Scattered regulation is caused by absence of umbrella law which contains unified rights and obligations of the NRE stakeholders. This situation also contributes to the non-differentiated treatment of NRE with other conventional energy, since they are seen as similar legal regime. For example, the basis for NRE Power Purchasing Agreement (PPA) is based on Electricity Law which might disregard the specific needs and aspects of NRE's PPA.<sup>41</sup> Lastly, current NRE regulation is prone to change due to

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38 Ministry of Foreign Affairs of the Republic of Indonesia, "Boosting Investment in the New and Renewable Energy Sector, the Ministry of Foreign Affairs and the Ministry of Energy and Mineral Resources Holds an International Webinar", <https://kemlu.go.id/portal/en/read/3204/berita/boosting-investment-in-the-new-and-renewable-energy-sector-the-ministry-of-foreign-affairs-and-the-ministry-of-energy-and-mineral-resources-holds-an-international-webinar>, accessed 15 June 2022.

39 World Economic Forum & Boston Consulting Group, "Strategic Infrastructure Mitigation of Political & Regulatory Risk in Infrastructure Projects", *World Economic Forum*, February 2015, p. 14.

40 *Ibid*, p. 13.

41 *See*, Preamble, MEMR 4/2020.

the minimum threshold of amendment approval. This situation can cause compliance difficulties when managing an NRE project in Indonesia. For example, MEMR No. 50/2017 concerning NRE for Electricity Service has been changed for at least three times in less than five years. The existence of future NRE Law could minimize regulatory risk for the NRE project as it can unify and bring clarity for the stakeholders in NRE sector.

### ***Limited Legal Innovation for NRE Project***

Ministerial regulation and/or lower regulation other than law could only regulate specific sector.<sup>42</sup> For example, MEMR do not have the capacity to regulate fiscal incentive for NRE nor the ability to create specific instrument that could attract NRE investment due to limited legal authority. Some innovation provided by the draft articles in NRE Bill would boost the NRE project investment and development. There are some points explained below:

1. **New off-taker policy:** Draft article 40 Paragraph (2) of NRE Bill proposes a new off-taker scheme for renewable energy. In the draft article, government could assign private company to buy electricity from renewable energy. This proposed article could open new PPA scheme other than relying on state electricity company as the sole off-taker. Such provision in NRE Bill could reduce market risk for renewable energy.<sup>43</sup>
2. **Fiscal incentive and NRE Fund:** incentive in draft article 52 of NRE Bill proposes incentive for the NRE company and conventional energy company that has renewable energy business portfolio. Incentive for the NRE company has been conducted through Minister of Finance Regulation No. 21/2010 concerning Tax and Customs Facility for Renewable Energy (MOFR 21/2010). However MOFR 21/2010 provides no definition on the type of renewable energy and has lower tax facility rather than MOFR No. 130/2020 concerning Corporate Income Tax Facility, which only provides 30% tax facility, while MOFR 130/2020 provides up to 50–100% tax facility. MOFR 130/2020 itself is only reserved for new investments with a high minimum investment bar of Rp100B and doesn't include the NRE sector for tax incentive. The solution to the lack of incentive is addressed by draft article 53 of NRE Bill, which is the creation of NRE Fund. NRE Fund is a fund

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42 See, Article 8 Para. 1, Law 12/2011.

43 Dentons, "A Guide to Project Finance", Dentons, 08 August 2018, p. 50.

that will be created by the GoI from various sources of funding and will be used to finance NRE's infrastructure, incentive, compensation, research and development, human resource development and subsidy for uncompetitive NRE. Both the fiscal incentive plan and NRE Fund could boost the NRE electricity project and attract NRE investment in Indonesia.

It can be concluded that the enactment of the NRE Bill into NRE Law is important to reduce regulatory risk in the NRE sector and increase legal innovation to incentivize NRE investment and operation in Indonesia.

### **16.3.2 The Need for Indonesia's NDC Renewal**

Indonesia first gave its NDC to the UNFCCC in 2016, in the same year as the signing and ratification of the Paris Agreement through Law Number 16 of 2016 concerning Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change. Previously, Indonesia had given an Intended Nationally Determined Contribution (INDC) to the UNFCCC in 2015. This shows Indonesia's efforts to increase its ambition to reduce GHG emissions, as mandated in the Paris Rulebook and provisions regarding revision and resubmission of NDCs before the implementation period in 2020 under the Paris Agreement. Indonesia through its INDC in 2015 stated that the rate of GHG emission reduction was 26 percent voluntarily, and up to 41 percent if there was international support, which is different from the post-2020 implementation period.<sup>44</sup> Indonesia's NDC increases the percentage of GHG emission reductions that must be achieved after the 2020 implementation period, namely the unconditional 29 percent target voluntarily and the conditional target 41 percent with international assistance, compared to the business as usual scenario in 2030.<sup>45</sup> In an effort to reduce GHG emissions, Indonesia has issued a National Action Plan for Reducing GHG Emissions as stated in PERPRES No. 61/2011 and GHG inventory through PERPRES No. 71/2011.<sup>46</sup> Mitigation and adaptation actions in Indonesia's NDC are very diverse, starting from the energy, waste, agriculture, forestry, and other land use (AFOLU) sectors, industry and

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44 INDC Indonesia 2015, p. 2.

45 NDC Indonesia 2016, p. 2.

46 *Ibid.*

agriculture. As a commitment to achieve global climate targets, Indonesia as a party to the Paris Agreement also submitted its climate commitments. However, Indonesia's emission reduction target commitments, as shown in Indonesia's current NDC, are not ambitious enough and do not reflect the current state of science.<sup>47</sup> Indonesia's emission reduction targets do not reflect the remaining carbon budget considerations suggested in the IPCC Special Report in 2018.<sup>48</sup> This commitment also does not reflect intergenerational justice because Indonesia's current climate commitment is not in line with the global climate commitment to maintain a target earth temperature increase of 1.5 degrees Celsius (compared to pre-industrial times) which will threaten the survival of future generations due to the adverse effects of climate change.

The important point to be criticized regarding Indonesia's NDC is that Indonesia's climate commitment in 2030 is inconsistent in restraining the rate of global warming to below 2 degrees Celsius, let alone up to 1.5 degrees Celsius as required in the Paris Agreement. In addition, a study from the Climate Action Tracker concludes that if all countries in the world follow the same approach as Indonesia's commitment to its NDC, the planet will be on a trajectory of increasing temperatures of up to 3–4 degrees Celsius compared to pre-industrial times. By using a climate justice concept approach, where non-Annex countries, including Indonesia, have more share than developed countries (Annex I), the remaining fair carbon budget that Indonesia can spend by the end of this century is 14.8 GtCO<sub>2</sub> to have a 66% chance, or 20.5 GtCO<sub>2</sub> to have a 50% chance, or about 3.5% of the rest of the world's carbon budget. Looking at the emission trajectory scenario of Indonesia's development plan reflected in Indonesia's low carbon development plan, Indonesia will spend the remainder of its carbon budget in 2027. Indonesia's low carbon development projection also reflects that Indonesia does not yet have a peak emission target. Indonesia's emissions will only decrease until 2030 and will continue to increase significantly even until 2045. The

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47 Defrio Nandi Wardhana, et al., *Analisis Kesenjangan Kebijakan Iklim Indonesia dalam Perspektif Keadilan Antargenerasi*, p. 12.

48 The Intergovernmental Panel on Climate Change (IPCC)—a panel consisting of various scientists discussing scientific developments related to climate change—has again issued an assessment report that summarizes the findings of scientists from around the world. The results of the report suggest that it is still possible to limit temperature rise to below 1.5 degrees Celsius compared to pre-industrial times but only through “rapid and broad transitions in energy, land, urban and infrastructure, as well as industrial systems”.

climate policies currently owned by Indonesia have not included the element of intergenerational justice as the main factor in the preparation of climate policies because the emission reduction measures taken by Indonesia are still far from the global emission reduction trajectory to achieve the target of limiting global temperature increase above 1.5 degrees Celsius.

### **16.3.3 The Lack of Maturity and Economic Aspects Consideration in Indonesia Carbon Tax Setting**

The policy of implementing a carbon tax as a pigouvian tax (tax on economic activities that generate negative externalities) is proof to the public and the outside world that the government is committed to using various fiscal instruments to finance climate change control as a priority development agenda as well as one of the government's efforts to overcome negative externalities that caused by carbon emissions. Indonesia is currently the first mover of carbon taxes in the world, especially from emerging economic powers.<sup>49</sup> The main objective of imposing a carbon tax is to change the behavior of economic actors to switch to low-carbon green economic activities. This is in line with the Indonesian Government's efforts to achieve the target of reducing greenhouse gas emissions by 29% on its own and 41% with international support by 2030.<sup>50</sup> As an initial stage, this carbon tax will be applied to the Coal Steam Power Plant sector on April 1, 2022, using a tax mechanism based on emission limits (cap and tax). The carbon tax is one of the Carbon Economic Value instruments that have the following objectives:<sup>51</sup> (1) changing the behavior of economic actors to switch to low-carbon green economic activities; (2) supporting GHG emission reduction targets in the medium and long term; and (3) encourage the development of carbon markets, technological innovations, and investments that are more efficient, low-carbon, and environmentally friendly. The principles for implementing a carbon tax include:<sup>52</sup> (1) fair, based on the "polluters-pay-principle" principle; (2) affordable, paying attention to the aspect of affordability for

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49 Kementerian Keuangan Republik Indonesia, "Pajak Karbon Sebagai Instrumen Pengendali Perubahan Iklim", <https://www.kemenkeu.go.id/publikasi/berita/pajak-karbon-sebagai-instrumen-pengendali-perubahan-iklim/>, accessed on 13 June 2022.

50 *Ibid.*

51 Kementerian Keuangan Republik Indonesia, "Pajak Karbon di Indonesia: Upaya Mitigasi Perubahan Iklim dan Pertumbuhan Ekonomi Berkelanjutan", [https://gatrik.esdm.go.id/assets/uploads/download\\_index/files/2bb41-bahan-bkf-kemenkeu.pdf](https://gatrik.esdm.go.id/assets/uploads/download_index/files/2bb41-bahan-bkf-kemenkeu.pdf), accessed on 13 June 2022.

52 *Ibid.*

the benefit of the wider community; and (3) gradually, paying attention to the readiness of the sector so as not to burden the community.

Law Number 7 of 2021 concerning Harmonization of Tax Regulations (“Law 7/2021”) in Article 13 regulates several main aspects of carbon tax regulation, including:

1. In the context of imposition, it is imposed on carbon emissions that have a negative impact on the environment.
2. The direction of the imposition of a carbon tax pays attention to the carbon market roadmap and/or roadmap a carbon tax that includes a carbon emission reduction strategy, priority sector targets, alignment with new and renewable energy development and alignment between various other policies.
3. The carbon tax principle emphasizes the principles of justice and affordability by taking into account the business climate and small communities.
4. The carbon tax rate is set higher or equal to the carbon price in the carbon market with a minimum rate of IDR 30,00 per kilogram of carbon dioxide equivalent (CO<sub>2</sub>e).
5. Utilization of state revenues from the carbon tax is carried out through the mechanism of the State Revenue and Expenditure Budget (APBN), which can be used, among others, for controlling climate change, providing social assistance to poor households affected by the carbon tax, subsidizing renewable energy, and others.
6. Taxpayers participating in carbon emission trading can be granted a reduction in carbon tax.
7. The implementation of the carbon tax will take effect on April 1, 2022, which is the first time it will be imposed on entities operating in the Coal Steam Power Plant (PLTU) sector with a cap and tax scheme that is in line with the implementation of the carbon market which has already started running in the coal-fired power plant sector.

The carbon tax rate will be evaluated periodically and set higher or equal to the carbon price in the carbon market. Not only that, the carbon tax roadmap is designed for energy transition, equitable transition, and sustainable transition.

In its implementation, the carbon tax also faces various challenges. In implementing the carbon tax policy, the government must pay attention to the timeliness of the implementation of the carbon tax policy. Determining the timing and momentum of the implementation of the carbon tax policy is one of the crucial things, this is because the implementation of the carbon tax can cause economic distortion.<sup>53</sup> It is undeniable that the implementation of a carbon tax will certainly have an impact on increasing the selling price of goods/services that produce carbon emissions in their production. With the increase in selling prices due to the implementation of the carbon tax, it will affect the level of public consumption of these goods/services.<sup>54</sup> Coupled with the condition of Indonesia which is in the stage of economic recovery due to the Covid-19 pandemic which has hampered Indonesia's economic growth, because the reduced level of public consumption will slow down Indonesia's economic recovery. In addition, the government must also pay attention to the impact of low-income households, because one of the common criticisms of carbon tax policies is the design of policies that do not burden low-income households proportionally.

#### **16.3.4 Government Unpreparedness in Implementing Carbon Trading in Indonesia**

The United Nations Climate Change Conference of the Parties (COP26) last November 2021 in Glasgow, Scotland, has brought a new wave of enthusiasm for the future of carbon trading, as shown in the issuance of Presidential Regulation No. 98/2021 on the Implementation of Carbon Economic Values for Achievement of Nationally Determined Contribution Targets and Control of Greenhouse Gas Emissions in National Development ("Perpres 98/2021"). The Presidential Regulation was issued because more and more countries are implementing carbon pricing instruments (carbon taxes and carbon trading) to reduce carbon emissions. In order to implement the commitment to fulfill emission reductions as regulated in Article 6 of the Paris Agreement, state parties can cooperate with each other in controlling the increase in global temperature. Cooperation between countries can be done through trade in reducing emissions between countries. The Paris Agreement does not explicitly mention market mechanisms or carbon markets in the

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53 Hilwa Nurkamila Maghfirani, Namira Hanum, dan Roidah Dzata Amani, 2022, "Analisis Tantangan Penerapan Pajak Karbon di Indonesia", *Jurnal Riset Ekonomi* 4, no. 1: 317.

54 *Ibid.*

agreement, but allows state parties to pursue “co-operative approaches” and voluntarily use International Transferred Mitigation Outcomes (ITMOs) to help meet Greenhouse Gas (GHG) emission reduction targets.

The carbon market continues to grow despite the economic recession and currently 3.76% of carbon emission reductions are made through carbon trading at a price of US\$ 40 to US\$ 80.<sup>55</sup> In order to implement an effective carbon market, it is necessary to have careful preparation from various related parties, especially the government as a regulator. The government’s role in preparing carbon trading must be mature, starting from preparing policies, carbon trading road maps in an organized market, capacity building to prepare competent and professional human resources, infrastructure in order to support the implementation of an organized carbon market, to the need to anticipate and mitigate on the impact of carbon trading involving many sectors in order to regulate activities related to carbon trading mechanisms.<sup>56</sup> The price of carbon needs to be one of the main concerns in carbon trading. Therefore, a good regulation and mechanism for carbon trading and carbon pricing is needed to achieve the Nationally Determined Contribution (NDC) target as an agreement produced by the Paris Agreement, and to ensure that the income from carbon trading is invested in sustainable emission reduction programs, so that its implementation is appropriate targeted and effective way to reduce Greenhouse Gas (GHG) emissions. Indonesia, as a party to the United Nations Framework Convention on Climate Change (UNFCCC), has made a commitment to reduce GHG emissions by 29% from the BAU GHG emission scenario (projected scenarios of current conditions, without any changes to applicable policies and other interventions that can be implemented reduce the rate of consumption), where in 2030, GHG emissions are projected to be around 2,881 GtCO<sub>2</sub>e.<sup>57</sup> With the continued opening of global carbon trading opportunities as stipulated in the Paris

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55 Otoritas Jasa Keuangan, “Masa Depan Perdagangan Karbon dan Tantangan Implementasi Untuk Indonesia”, <https://www.ojk.go.id/keuanganberkelanjutan/id/newsmedia/detailnews/3019/masa-depan-perdagangan-karbon-dan-tantangan-implementasi-untuk-indonesia>, accessed on 14 June 2022.

56 Investor Daily, “Ini Tantangan dan Peluang Perdagangan Karbon di Indonesia”, <https://investor.id/market-and-corporate/273230/ini-tantangan-dan-peluang-perdagangan-karbon-di-indonesia>, accessed on 14 June 2022.

57 Direktorat Jenderal Pengendalian Perubahan Iklim Kementerian Lingkungan Hidup dan Kehutanan Republik Indonesia, “Perdagangan Karbon: Apa Implikasinya Terhadap Pemenuhan Komitmen Indonesia Pasca 2020”, <http://ditjenppi.menlhk.go.id/berita-ppi/2682-press-release-perdagangan-karbon.html>, accessed on 14 June 2022.



Agreement, the Indonesian Government needs to examine future market opportunities and safe offsets for Indonesia to trade carbon and at the same time fulfill its commitment to contribute to global efforts to meet GHG emission reduction targets.

## **16.4 RECOMMENDATIONS**

1. In order to ensure unified rights and obligations of NRE stakeholders, reducing regulatory risk and attract investment, the GoI and parliament should fasten the enactment of NRE Bill into NRE Law.
2. Indonesia must urgently scale up and deliver new, much more ambitious NDC targets that reflect the current state of science and reflect intergenerational equity, by setting a zero emission target as soon as possible, and it must be legally bound. And to implement mitigation and adaptation actions in Indonesia's NDCs, the government also needs to issue a legal umbrella in the form of implementing regulations for NDCs so that Indonesia can further increase its efforts to reduce GHG emissions that have been targeted according to the objectives of the Paris Agreement.
3. The government must have careful consideration in preparing the implementation of carbon taxes and carbon trading in Indonesia, especially from a regulatory perspective. Currently, there are still related policies that have been set by the government on the NDC, but still not paying attention to the economic aspects.



## CHAPTER-17

# SOCIAL AND POLITICAL ASPECTS OF ENERGY TRANSITION: THE DYNAMICS OF REGIONAL-NATIONAL STAKEHOLDERS AND AREA CONSTELLATION

Derajad Sulistyو Widhyharto and Maharani Hapsari

### 17.1 INTRODUCTION

With the emergence of energy transition as a dynamic ongoing policy practice in Indonesia, it is necessary to examine its social and political dimensions more deeply. This is because energy transition as a normative project involves the aspects of power relation dynamics around knowledge production and its institutionalization at the global level. Energy transition takes place in a social and political constellation that is plural in the process of encouraging resource mobilization and overcoming root causes of problems related to inequality of access, strengthening the basis of people's livelihoods, and institutionalizing the aspects of democratic political relations.

The importance of Indonesia's energy transition is built on the rationalization of demographic pressures and changes in the global ecological constellation. Indonesia's population of approximately 270 million people has a great potential for energy consumption. The potential for consumption includes household, commercial, general public, and industrial needs. This has directly become the country's attention and responsibility to fulfill. Indonesian Government must carry out Article 33 of the 1945 Constitution of the Republic of Indonesia that mandates the country to control and utilize

all natural resources as much as possible for the interests and welfare of the people. With the constitutional reference, Indonesia conducts explorations and exploitations to utilize various available energy sources within its administrative territory, where fossil energy resources support the national social and political structure.

In its development, the exploitation and utilization of these energy resources encounter challenges when the fossil energy benefits are not in line with the government's efforts to fully implement sustainable development in Indonesia. Controversies have emerged over the exploitation of natural resources, especially fossil energy, in the face of uncertain political economy dynamics. The resources generated from these energy sources management have become a source of corrupt practices that have enriched certain groups in various periods of political leadership in Indonesia. There is a concrete need to see how these social and political dynamics impact the energy transition policy agenda onwards.

As a collective project that is often put as a strategy to advance national interests, various energy policy initiatives have linked the government's modes of regulation with the positions and roles of wider stakeholders at the national and international level. The regulatory aspect is crucial because the nature of energy as a material basis is critical to support the interaction system of human civilization. Its interdependence with social and political forces has led to a long debate divided into two viewpoints, namely economic growth and sustainability. The paradoxical nature of the relation between these two pendulums has formed a long debate in the public sphere. On one hand, economic growth represents massive exploitation, while on the other hand, sustainability represents environmental conservation. The pendulum will move following the main issues, actors, policies, and dynamic approaches. Within various periods of political leadership in Indonesia, it is quite noticeable that the pendulum tends to move in the direction of economic growth. As a result, energy as a "nexus" or basic element related to human life is caught up in a problematic position. This condition also causes energy issues to carry a greater political economy impact, especially in the intersection of actors such as the country, market, civil society, and the public in general as consumers of economic resource commodities.

This chapter discusses the social and political aspects of Indonesia's energy transition, focusing on stakeholder responses in various policy

areas. The empirical basis of the discussion is the reflection of the research conducted by the author in South Kalimantan. In addition, this chapter also interprets the latest social and political developments that have been documented by previous studies since the introduction of energy transition policy in Indonesia. Research is carried out by identifying a number of interaction aspects between multi-scale stakeholders and reflecting on their implications for the fulfillment of public aspirations in a broad and inclusive manner.

This chapter argues that the practice of energy transition in Indonesia is a response to the global energy crisis. This gives rise to various scenarios with policy consequences. Indonesia's situation corresponds with social and political factors that encourage and hinder transformation. How stakeholders position themselves in the collective agenda is influenced by the dynamics of stakeholder interactions at the domestic and regional level. To discuss the argument, this chapter is divided into four parts. The first section discusses the energy crisis as the context that drives Indonesia's energy transition policy. The second part elaborates on the dynamics of domestic interests, especially focusing on stakeholder responses and the formation of their roles and interests in central-regional relations and cross-sectoral relations (state, civil society, and energy business players). The third part elaborates the regional social and political aspects by providing an illustration of energy transition dynamics in various regions that shape each region with the interactions of domestic stakeholders. The fourth section formulates a number of reflective notes for future energy transition agenda.

## **17.2 DRIVERS AND BARRIERS FOR NATIONAL ENERGY TRANSITION**

The political economy dynamics of energy generate crises. To quote the second theory of thermodynamics, everything in the universe tends toward disorder. For example, fossil fuels will eventually become less dense, then completely lose their physical form, at least from the human eye. The shrinking, diminishing, and disappearing forms of fossil energy is part of what physicists call "entropy". Furthermore, it becomes an indicator used by humans to sense that time is moving "forward" by noticing an increase in the disorder (entropy) around us. Thus, humans tend to accelerate the

entropy of the universe. The high energy consumption trend has given rise to the social and political phenomenon of climate refugees

The crisis argument also changes the formation of issues, actors, policies, and approaches. Furthermore, the energy crisis has made new renewable energy (NRE, or *Energi Baru Terbarukan/EBT*) as the object of state regulation. As a response, the government has developed a new renewable energy power plant development plan (2016–2025 MW) as shown in Table 17.1.

Table 17.1 New Renewable Energy Plant Development Plan

Kapasitas Energi Baru dan Terbarukan (MW)	2016	2018	2020	2022	2024	2025
Tenaga Panas Bumi	1,654	1,909	2,133	2,520	3,109	7,241
Tenaga Air	5,124	4,929	5,103	5,468	5,615	17,987
Tenaga Air Mikro	162	314	520	815	1,000	3,000
Tenaga Biomassa	1,787.9	1,881	2,030	2,200	2,500	5,500
Tenaga Surya Fotovoltaik	85	225	375	550	900	6,500
Tenaga Angin	1	74	204	399	600	1,800
Lainnya (gelombang laut dan energi baru)	0	1,232	1,675	2,059	2,433	3,125
TOTAL	8,804	10,563	12,041	14,012	16,157	45,153

Source: Keputusan Presiden No. 22 Tahun 2017

The national energy mix target of 23% in 2025 is stated in the Government Regulation (PP) No. 79 of 2014 regarding the National Energy Policy. Article 8 of the government regulation states that the target for the provision and utilization of primary energy and final energy includes the generation of around 115 gigawatts (GW) or 115,000 megawatts (MW) electricity in 2025 and around 430 GW in 2050. Meanwhile, according to the Presidential Regulation No. 22 of 2017 regarding the General National Energy Plan (RUEN), the supply of NRE power plants in 2025 should be around 45.2 GW and 2050 about 167.7 GW. Unfortunately, this target is still far from reality. Based on the data from the Ministry of Energy and Mineral Resources, the NRE power plant has only reached 10,467 MW in 2020, with a 176 MW increase from 2019 which had 10,291 MW.

The 2021 target of the NRE power plant was 12,009 MW. Although it needs to reach a 1,542 MW increase this year, this is still far from the RUEN target of reaching 45.2 GW in 2025. The power plants should also

reach 26,450 MW to accomplish the 2025 national energy policy target, which is more than twice higher than the current installed capacity. This means that an additional NRE power plant capacity of around 16,000 MW is needed until 2025. Whereas, the data from the Ministry of Energy and Mineral Resources states that the total NRE potential in Indonesia reaches 417.8 GW, which consists of 17.9 GW of marine, 23.9 GW of geothermal, 32.6 GW of bioenergy, 60.6 GW of wind, 75 GW of hydro, and 207.8 GW solar potential.

NRE is hoped to fulfill the mandate of resource control for the greatest prosperity and welfare of the people, which have been deviated by actors in previous political leadership periods in Indonesia. This will implicate new changes in the ways of production, distribution, and consumption. The emergence of NRE has also created competitive dynamics in different ideological scenarios, production, processes, utilization goals, and targets as shown in Table 17.2.

Table 17.2 The Contest of Ideology, Actors, and Processes

Scenario	Who Produces the Energy?	How?	For Whom?	For What?
Today	State and Company	Global extraction of fossil fuel, Nuclear Hydro NRE (globally component source)	Industry Consumer State (including the military)	Conventional Development
Low carbon climate capitalism	State and Company	NRE Price carbon Smart Grid	Industry Consumer State	Low carbon development
Green socialist eco alternative	Community, Household, Secondary Work Unit and State	Broader Decentralization Lower scale of NRE Local source of ingredients Mini grid Reducement of demand	People Local small business	Necessity Prosperity for growth

Source: Newell, 2021

The research conducted by Newell (2021) shows that the dynamics of competition around the transition to sustainable energy are increasingly real and dynamic. This also has implications for issues, processes, goals, and changes in the formation of actors simultaneously. In addition to sharpening the political economy debate, this competition is an aspect that slows down the energy transition. This can be seen in the dominance of production issues (extraction and conversion) by the state and companies, as well as issues of supply and consumption which will ultimately create a development path towards economic growth rather than sustainability. This means that the problems faced by NRE are not much different from fossil energy, namely around production costs, policy incentives, equipment availability, technology transfer, and so on. Furthermore, the need dimension does not only require NRE hardware, but also requires software in the form of emotional bonds and the formation of a new renewable energy culture in society. Including policy innovations as mandated by Law No. 30 of 2007 on Energy, the National Energy Policy (KEN) is prepared based on the principles of justice, sustainability, and environmental insight to support the creation of energy independence and national energy security. The implication of this policy is the need for energy diversification to meet domestic energy needs, one of which is by developing new and renewable energy.

In implementing energy transition policies, Indonesia faces problems with long-term agreements and an economic design that relies heavily on fossil fuel-based production and consumption. Indonesia's fiscal structure is also closely related to the interests of the exploitation of fossil energy. Despite the global pressure to focus more on climate change agreed at the UN climate change conference in Paris (or better known as COP 21), industrialized and developing countries still continue to support fossil fuel-based industries. Exploitation, production, and massive consumption of fossil fuels still occur in many countries around the world. The level of Indonesia's oil and gas exports to other countries raises the question of which level of energy security is a concern for policymakers. Because at the same time, Indonesia has been dependent on imported energy despite the fact that the country is rich in energy sources.



Tharakan (2015) in his report mentions three main factors limiting investment in energy infrastructure development: limited funding, poorly coordinated planning and recurring problems in policy implementation. Tharakan's analysis is still very relevant to describe the reality in Indonesia today. The government's dependence on the use of fossil energy has proven to have hampered the development of new and renewable energy use in this country. Various policies and programs that support renewable energy still need to be strengthened and consolidated. Various new innovations are needed to expand the use of renewable energy, for example by establishing partnership models between the community and the private sector. It is very important to find ways that can encourage the private sector to develop business in the renewable energy sector.

### **17.3 THE RELATIONAL DYNAMICS OF DOMESTIC STAKEHOLDERS**

The interaction between stakeholders forms the social and political context for the energy transition in Indonesia. Research conducted by the author in South Kalimantan shows that there are three main stakeholder groups, namely local government, industry, and the community, all three of which interact to form political economy relations at the regional level.

Local governments are preparing regulations and local policies to open investment opportunities and give incentives. Meanwhile, industries do the exploration and production while the society becomes the object of the transition. In detail, the role of various stakeholders are shown in Table 17.3.

Table 17.3 The Dynamics of Local Stakeholder Interest on Energy Transition in South Kalimantan

Stakeholders	Experience/ Expertise	Interests	Roles
PRIMARY	Energy and Mineral Resources Office	Technical, policies, mining and energy monitoring	Energy management (+) Monitoring and evaluation of RUEN (-) Intervention in political Interests
	Investment Office	Implementation of investment policies	Increase in regional investment (+) Modernize regional industries through technology, business management and marketing (-) The target of bureaucracy and the industrial sector
	BAPPEDA	Regional development planning	Increase in regional income (+) Supports investment (-) If TUSI is done well, systematically and thoroughly
	Concession Holders and Industry	Forest management, extraction	Profit, sustainability (+) If done well (-) If not done well
SECONDARY	NGOs/CSOs	Assistance, advocacy, empowerment	(+) Support to community groups or environmental rescue (-) Personal interests of the few
	Indigenous Institution	Indigenous law, social order	(+) Support the community (-) The interests of the few
	Religious Institutions	Religious aspects	(+) B big influence in society (+) Role model (-) Personal interests of the few
TERTIARY	Community	All aspects of society	(+) As a whole (-) Personal interests of the few Increased standard of living, sustainability of their neighborhood

Source: Lessons Learnt from South Kalimantan Case Study, 2020

On the national level, the favor towards renewable energy development investment is high. The most influential and supportive towards energy transition are those who have been working related to energy issues, namely those who are actively contributing in policymaking and renewable energy projects. The Ministry of Mineral and Energy Resources, particularly EBTKE, has strong influence in the policymaking process and its implementation. The Ministry of Mineral and Energy Resources, with the Ministry of National Development Planning in the National Energy Council, is governing the renewable energy development in Indonesia to be institutionalized in Undang-Undang. This process also involves parliament participation in the formulation of the regulation.

However, there are still inconsistencies from the Ministry of Mineral and Energy Resources in advancing renewable energy resources. Indonesia is still overly dependent on fossil fuel. The usage of fossil fuel is arguably as a strategy to secure energy availability. Moreover, the demand for energy is increasing in this country. The government's arguments are implemented through policies and national energy plans, which refer to the argument that economic development will be achieved through the utilization of fossil energy.

From the South Kalimantan experience, the local government is influential in creating a conducive environment for developing renewable energy. Meanwhile, the NGOs, despite their limited influence, are still able to exercise their role in supporting the success of the renewable energy transition. A number of donor agencies also play the role in supporting renewable energy transition, such as Humanist Organization for Development Cooperation (HIVOS) Netherland, Global Environment Facility (GEF), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) German. In the wider society, various organizations and think tanks such as Yayasan Rumah Energi or Institute for Essential Service Reform (IESR) contribute to produce and disseminate knowledge to the local community. However, they are facing limited funds for energy related projects. These groups are still dependent on the funds from donor agencies and government incentives to support their programmes.

The financialization of energy transition becomes one of the crucial aspects from the authority. The Financial Service Authority (OJK) also plays an important role in supporting more investments in the renewable energy

sector, such as the Sustainable Financial Road Map. Arguably, if the role of OJK is strengthened, there will be more positive impact for the investment towards this sector, given the close relationship between OJK and other financial institutions and banking sector. Donor agencies and the private sector are showing support for advancing renewable energy yet still unable to influence the policymaking process. The proponents of renewable energy (including various society organizations and unions) will merely be able to play a limited role in the transition towards renewable energy because the utilization of fossil fuel is still high compared to renewable energy.

The Ministry of State Owned Enterprise support is still limited to the state owned enterprise (particularly PT PLN). Making energy transition become a public agenda that involves public deliberation which become an important component of organizing social and political aspiration. The Ministry of Communication and Information Technology (Kemenkominfo) is able to use its authority to influence the society's perception that may enhance the awareness and willingness of the society to support the energy transition. However, to enhance public participation effectively, the Ministry of Communication and Information Technology should synergize with other ministries and institutions and also involve society in various discussions and decision making processes.

Public participation also involves the role of the media. Specifically, the media has become an instrument that may influence and change society's perception. In this context, it is noteworthy to observe that sometimes the media in Indonesia may be utilized to defend the status quo of non-renewable energy. This, arguably, has attenuated the Indonesia renewable energy plan. Many reporters are merely focusing on covering the issues such as fossil fuel, criticize the subsidy abolishment, and focus on the high price of electricity. When the price of electricity surges, most of the national media make the issue as the headlines. The media coverage also is not representing the truth of wider aspiration. This is especially the case when delivering public debates wherein the discussion on renewable energy issues seems partial and is not giving adequate attention towards the greater potential that may drive structural transitions. Most of the media still focus on how the fate of the poor will be affected by the decreasing fuel subsidy. In the future, the structural response as previously mentioned needs to be redirected towards the bottom up agency response. Furthermore, the public

discussion of renewable energy is still focusing on the energy processing not urging to decrease the consumption. This is arguably related with the society's interest as consumers that should have to pay more to access the energy sector in the future.

#### **17.4 REGIONAL SOCIAL AND POLITICAL CONSTELLATION**

In understanding the energy transition in Indonesia, it is necessary to consider that the regional context is also mutually shaping with the domestic context. What is happening in Indonesia is not an autonomous experience with other countries' experience. The interaction between domestic and international conditions cannot be perceived as an emulation process or adaptation. There are resistant aspects towards the structural transformation as social and political dynamics. Similar to Indonesia, the other countries in the region also encounter energy issues domestically. There are problems in reconciling development normative impetus with sustainability. Which is then more dominant in the current practice of social and political relations?

Furthermore, it is intriguing to see how the dynamics of stakeholder interaction at various levels of government regulations and across sectors as happened in Indonesia are also more repetitive in the context of practices in other countries. In addition, the debate on development and environment are the areas that continue to be politicized through top-down and bottom-up policy discourses.

There are at least four social and political aspects that emerge from previous studies inside the discussions about the characteristics of the regional energy transition that are relevant to the Indonesian context, namely: knowledge production of energy transitions, government regulatory capacity, public deliberation, and the capacity of energy business actors to develop added value in commodity supply chains. A summary of the driving and constraining factors for the energy transition in these four social and political aspects can be seen in Table 17.4.

Table 17.4 Social and Political Aspects That Drives and Constrain the Energy Transition in the Regional Constellation

Social and Political Aspects	Drivers	Barriers
Knowledge production	Nation's investments in research and development sector	Inequality of access to intellectual property rights.
Regulative capacity	Government facilitation to liberalize the entry of foreign investment from investing countries	Social and environmental risk mitigation policies from energy transition programs still leave many gaps. Labor regulations from conventional production schemes to production schemes in the energy transition economic sector are still not properly institutionalized.
Public deliberation	Strengthening the internalization of gender mainstreaming norms and protection of vulnerable groups (children, the elderly, indigenous peoples; people with special needs)	Concentration of power in dominant groups in the political economy system at various levels. Social and cultural exclusion of subordinate groups in society.
Upgrading capacity of business actors	Integration of trade in energy-related goods and services The development of a community-based energy business model	Limited incentives for large industries to encourage community-based partnerships.

Source: Generated by the Author

In the aspect of knowledge production, the capability of scholars to mobilize scientific knowledge to be able to collaborate with wider stakeholders is a strategic social and political modality. Insights on energy transition are generally concentrated in the network of scientific communities in universities and think-tank institutions that have embedded relationships with investors in the energy sector (Buana et al., 2022). These scholars are also generally part of an epistemic community that has certain authoritative claims to the government policy design process. Policy consultation processes are generally based on the integration of technocratic approaches at various levels. Aspects of power relations in the knowledge production process have become a serious concern for industrialized countries. The relatively elitist knowledge production needs to be bridged with dialogue involving a wider range of stakeholders. The interest in developing a strong scientific base has become the target of policy interventions in advanced industrial countries in general because the energy transition is a policy practice that is full of technical aspects.

The strengthening of interdisciplinary aspects in the production of energy transition knowledge becomes a pillar for the dialogue of various epistemological positions which in their interactions can appear in synergistic or conflictual forms. Therefore, knowledge authorities related to energy transition need to be built by taking into account the co-production of knowledge among Indonesian scientists with best-selling researchers in developing countries in responding to inequality in access to intellectual property rights. As also noted by Akbar et al. (2020), co-citation links by Indonesian researchers across fields show significant network strengthening. Outside the scope of groups of scientists and technocrats, the production and organization of knowledge to explore initiatives at the community level is still very limited in its movement. In Latin America, local community mobilization to develop energy transition modes takes place on a communal scale, in the process also dealing with the development of extractives patterns in the NRE development sector (Parker, 2019). For the Indonesian context, the latest study notes that the advantages of knowledge production in the future can be directed at strengthening the study and development of bioenergy (Akbar et al., 2020).

In terms of government regulatory capacity, social, and political aspects shape the direction of the government in preparing targets and policies that

can support the achievement of NRE development indicators at the national level. The enormous infrastructure needs to oversee the implementation of the energy transition are generally met through financial mobilization involving the role of national funding institutions as well as support from international institutions. Historically, many banking institutions in the Asian region have benefited greatly from past energy projects that relied on non-environmentally friendly resources, especially coal. This is also related to the government's capacity to be able to mobilize the required resources through inter-country networks. In the context of the experiences of countries in East Asia, bilateral cooperation between Japan and China, for example, became one of the important models of resource circulation through the provision of development assistance until China's GDP eventually surpassed Japan's (Otsuka, 2022).

In developing countries, investment for energy transition relies heavily on the role of multinational companies with the development of massive infrastructure development projects. In terms of scale, energy transition policy programs also have a very deep impact on the socio-ecological conditions of the community. External aspects of managing the energy transition also cannot always be responded to accurately by institutions that are still adapting.

Mitigation of social and environmental risks requires the government's ability to carefully map out supporting technologies sourced from its national modalities and also to adopt leading practice in terms of facilitation of government regulations. There are also many issues related to the policy coordination system, especially when the socio-ecological impacts of energy transition projects cannot be limited by administrative territory.

In many Asian countries, the practice of energy transition is also filled with aspirations for equal access to basic energy needs, improvement of people's living standards, and justice. The coal energy phasing out process faces poverty issues when there are many workers from this sector through the process of adopting technology skills and capacities to enter the NRE sectors. There are varying emphases in terms of how the government prepares intervention schemes to provide adequate employment opportunities for domestic workers. Indonesia focuses on ensuring gender equality, intergenerational equality and access for vulnerable groups to skills, upskilling, reskilling, and enrichment of human resources. Readiness



of educational institutions is a central factor in this regard. The Philippines focuses on providing incentives for new forms of entrepreneurship in the energy transition sector that adopt green jobs. In terms of gender equality, the energy transition also creates pressure on the pattern of division of labor at the household level, especially when men who are generally workers in coal-related industries lose their jobs. The process of transitioning from one field of work to another is a space that is prone to policy contradictions and their socio-economic impacts on society on a wide scale (ILO, 2022).

In the aspect of public deliberation, how the energy transition is carried out within the framework of political democratization is a concern in many countries. This is related to the recognition of the diversity of the socio-cultural identity of the community, substantive participation in policy processes from the local to the central level, as well as the redistribution of welfare. Attention to gender mainstreaming and protection of vulnerable groups is increasingly being used as a lens to criticize the implementation of energy transition practices. In East Asia, the development of NRE innovation and technology is accompanied by public demands for the fulfillment of the principles of justice, accountability and transparency regarding who will benefit and benefit from the distribution of energy commodity transmission and distribution networks (Iida, 2022).

The role of social and political elements such as civil society is noted to be one of the important aspects to encourage the integration of energy transition policies instituted by the government. Knowledge exchange among non-governmental organizations at the regional level in East Asia, for example, was facilitated by the establishment of the East Asia Climate Network (EACN). Meanwhile, there are a number of collaborative programs that also involve the role of local communities and networks connected to foundations, politicians, individuals, and community leaders in the form of periodic forums (Otsuka, 2022). Community organizing to build a strong base of policy legitimacy needs to consider the context behind public opposition that often arises in the process of infrastructure development and its integration into the lives of affected communities.

In the fourth aspect, namely the capacity of domestic business actors to develop added value in the commodity supply chain, the North-South inequality is a characteristic of power relations that gives rise to many impetus for structural transformation. Southern countries in general are

important targets for market expansion of goods and services commodities in the energy-related trade sector, in particular. However, that does not mean that the government does not have a strategy to carry out a strategic reorientation to encourage the empowerment of the national energy industry. As noted by Lennon et al. (2019), there are a number of modes of public participation in the development of energy business models in Europe which in the future can be reviewed for their relevance to the Indonesian context. This includes the establishment of energy cooperatives, development of community power plants supported by large companies, development of hydropower facilities at the local level, biogas cooperatives, development of energy production by cities, universities, schools, hospitals, and mobilization of criteria-based financialization facilities environment by utilizing a network of loan providers for the community.

A study conducted by Murshed (2021) notes that the role of leading countries in terms of energy transition innovation in promoting trade integration in the region has the potential to facilitate the technology rollover effect of developed countries. But this is not a given. How conducive regional social and political interactions will shape the nature of technology transfer and trade protectionism policies that are implemented. In addition, negotiating heterogeneous tariff structures and non-tariff barriers is part of the strategic policies of many developing countries.

## **17.5 CRITICAL REFLECTION**

Substantively, it is necessary to shift the approach to NRE management from top-down to bottom-up, and partially to integrative. This is important to avoid direct and indirect conflicts, and to avoid vertical and horizontal conflicts. On the other hand, efforts are needed to strengthen the cultural and agency base in the NRE beneficiary communities. In a number of cases of NRE development, the community has not been directly involved and has only become spectators of the NRE/EBT project. From the interacting social and political aspects, if drawn back to the pendulum of development and environmental sustainability, there are many challenges of ambiguity and policy inconsistency that have the potential to undermine aspirations towards a sustainable energy transition. Aspects of regional trade integration need to be studied carefully to map the potential of national businesses to upgrade the NRE production chain. As an agenda that also involves

contesting democratic political aspirations, the energy transition cannot be monopolized by one particular stakeholder's position and role nor can it be weakened by certain stakeholders. Awareness to open up social and political space for inclusive dialogue is a crucial foundation for Indonesia's sustainable energy transition.

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## CHAPTER-18

# DOMESTIC INDUSTRY READINESS SUPPORTING NET ZERO EMISSION 2060: A SUPPLY CHAIN PERSPECTIVE

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### 18.1 INTRODUCTION

The long, extensive use of fossil fuels has contributed to growing pollution, and eventually economic deficits. Paris Climate Agreement or COP 21 is an international treaty that brings all the world nations including Indonesia into a joint effort to prevent a global temperature increase of more than 2°C above the temperature before the beginning of the Industrial Revolution through the zero-emission goal (UNFCCC, 2021). Indonesia has committed to achieving the net-zero emission goal by 2060 (Sambodo et al., 2022). Renewable energy sources (wind, solar, biomass, geothermal, and hydropower) appeared to be a promising alternative to replace fossil fuels, reduce greenhouse gas emissions, and deliver a more reliable and cleaner energy supply toward a more sustainable future. In addition to the decarbonization of the global economy, renewable energy (RE) also plays an important role to increase energy security. Shifting toward a more sustainable energy system requires a significant transition within the current energy system dominated by fossil energy sources. Hence, to direct the development of RE, the Government of Indonesia has established the National Energy Policy (KEN) through Government Regulation No. 79 of 2014 stating that the target of new and renewable energy (NRE) by 2025 and 2050 is 23% and 31, respectively (Peraturan Pemerintah No. 79 Tahun 2014). The target

is corresponding to generate a renewable energy capacity of 45 GW out of a total capacity of 135 GW by 2025. On the other hand, Indonesia has numerous potentials for renewable energy. The utilization of the resources is, however, still very low (United Nations, 2020).

The energy transition is of course not an easy task. Collective and concerted actions ranging from technological, economical, institutional, political, and socio-cultural aspects are required (Neofytou et al., 2020). The transition toward renewable energy is not only concerning the capacity of the energy sources, but also the capability of the Indonesian industry to manufacture the required equipment/facility and manage its supply chain. The renewable energy sector is usually characterized as capital intensive due to high upfront costs and advanced technologies. Moreover, the success of renewable energy implementation is influenced by its ability to rationally manage activities to meet market demand for energy at the lowest possible cost. To that end, the supply chain of renewable energy becomes critical to effectively manage the processes of different natural resources extracted from nature and involved in the production of electricity for end-users.

The supply chain of renewable energy involves various stakeholders with different capabilities and scales, and consequently, the capabilities of industries within the renewable energy supply chain become important. It has been evidenced that limited industry capability has been the major barrier to renewable energy development in developing countries (Adenle et al., 2017). In addition, given the fact that the supply chain is responsible for 60% of all carbon global emissions (Accenture, 2022), the supply chain can also be a part of the solution to effectively manage the processes within the supply chain of the renewable energy. Since the energy transition is projected not only to have a significant economic and environmental impact and improve communal well-being and welfare but also to promote domestic industry development, it is hence important to address the transition to renewable energy from a supply chain perspective considering domestic industries in the country. It is argued that the establishment of an efficient renewable energy supply chain supported by strong domestic industries can greatly aid the transition toward renewable energy.

This chapter aims at reporting domestic industry readiness in the country and proposing action plans favoring renewable energy transition to support the achievement of the net-zero emission goal by 2060. The analysis from

a supply chain perspective of three renewable energy sources, i.e., solar, wind, and wave, was conducted. These three renewable energy sources are particularly of interest because the advanced and evolving technologies are considered knowledge-and capital-intensive. Hence, it is crucial to understand the supply chain of these renewable energies and the industry capabilities supporting the processes along the supply chain so that the transition toward renewable energy can be sustained in the long term.

This chapter is organized into five sections which this section delivers the motivation, followed by a theoretical framework of the renewable energy supply chain in Section Two. Section Three presents the profile of domestic industry readiness to support the renewable energy transition in Indonesia. Section Four discusses the managerial implications and future action plans, which are then concluded in Section Five.

## **18.2 ENERGY SYSTEM AS A SUPPLY CHAIN: RENEWABLE ENERGY SUPPLY CHAIN**

Drawn from Chopra and Meindl (2016), the supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain, or also the so-called value chain, comprises the entire processes from the extraction of raw materials to the end-use and disposal. The supply chain involves not only the manufacturers, but also suppliers, transporters, retailers, and even customers themselves. The supply chains involve multiple actors with various expertise, scales, and locations to support the processes by which components or products are acquired, manufactured, and delivered. Consequently, the supply chain is considered complex and can be globally interconnected.

Any energy system is a supply chain that contains multiple and interconnected actors, i.e., suppliers of energy sources, suppliers of components, power generators, and customers/users, that vary depending on fuels, materials, technologies, infrastructures, labors, equipment required for the system's development, manufacture, installation, and operation. The supply chain of the energy system is usually nationally interconnected and shaped by a country's policies, regulations, industry institutions, available resources, and markets. The principal goal of the energy system supply chain is to meet the energy service demands of end-users across the national economy, which can be in the form of electricity, heat, and transportation.

Thus, the supply chain of the energy system from renewable sources is called the renewable energy supply chain (RESC).

The renewable energy supply chain (RESC) is described as “the transformation of raw energy into usable energy and involves an effective set of management principles from the point of acquisition of energy resources to the point of consumption of useable energy” (Luthra et al., 2015). The RESC consists of five phases, i.e., acquisition, generation, transmission, distribution, and demand, that cover all processes from raw materials (input) through the finished product (output) to provide a continuous supply of raw materials, deliver demands of energy service, and promote the adoption of renewable energy. The RESC can be separated into three processes: upstream, production, and downstream, as shown in Figure 18.1 (Jelti et al., 2021).

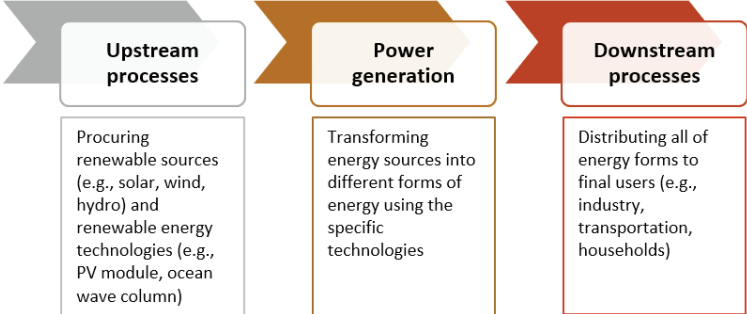


Figure 18.1 A Framework for Renewable Energy Supply Chain  
Source: Jelti et al., 2021

The previous energy system has had a significant impact on the supply chains that exist today. Within Indonesia, the system has progressed from using fossil fuels such as coal, oil, and gas as the principal sources of energy to renewable energy sources such as solar, wind, wave, and biomass. With these fuel-type transitions, numerous co-evolving technical, political, social, and institutional transitions are also occurring. The fossil-based energy system which has grown over several decades has resulted in a mature, highly interconnected, and complex supply chain. Moreover, it leads to a system that today relies on ingrained technical and social commitments, thus rendering it prone to inertia and lock-in.



Therefore, it poses challenges for renewable energy to develop. When compared to incumbents (fossil-fuel energy systems), renewable energy faces many internal and external risks such as uncertainty due to the immaturity of the technology and its related supply chain and high investment cost. These issues should be appropriately understood for technologies to be provided. As technology enters the market, its supply chain expands to include skills and resources associated with its deployment, such as planning, design, manufacturing, construction and installation, operation and maintenance, and decommissioning, as well as associated sectors such as legal and financial services.

By understanding the supply chain of renewable energy, bottlenecks or limits along a complete supply chain, from the source of raw materials to decommissioning, which can have an impact on the scope of development, deployment, or operation can be identified and resolved. The supply chain plays an important role because technology can only advance at the rate that the most constrained supply chain allows (Aslani et al., 2013). There may also be more pervasive cross-cutting difficulties that affect the supply chains of renewable energy (manifested as technology-specific bottlenecks). The issues will vary to some extent among countries depending on the technologies, available supporting industries, laws in place, and social-cultural factors. The renewable energy supply chain differs following the specific renewable energy sources which are discussed in the following.

### **18.2.1 The Solar Energy Supply Chain**

Solar energy has recently been described by strong growth in technology investment and a large number of innovative initiatives (El-Karmi and Abu-Sikhah, 2013). Solar energy can be coupled by two means, including solar photovoltaic and solar thermal. The upstream process is based on the implementation of solar photovoltaic or solar thermal power generation systems. The production process emphasizes mainly on producing electricity either by solar photovoltaic technologies that directly convert sunlight into electricity (i.e., PV modules or thermodynamic cycles driven by solar concentrating collectors). The electricity is generated based on the principle of photovoltaic effect, voltage, and direct current generated in solar cells. By using an inverter, the resulting voltage and current can be converted into electric power. Finally, the downstream process in the supply chain

consists of a continuous supply of electricity to end-users. Figure 18.2 presents the photovoltaic supply chain including the upstream processes, power generation, and downstream processes.



Figure 18.2 The Photovoltaic Supply Chain  
Source: Jelti et al., 2021

Figure 18.2 demonstrates that the critical photovoltaic (PV) supply chain lies in the upstream and production processes which involve the PV module assembly, Tier-1 suppliers (the PV module assembly), Tier-2 suppliers (solar cell production), Tier-3 suppliers (production of solar cell components such as ingot and wafers), and Tier 4-7 suppliers (production of raw materials used to make both general and specific components of PV main components). It is observed that the tiers in the PV supply chain are capital and knowledge-intensive. Therefore, it is very important to provide all necessary technologies and large production volumes by a sufficient number of companies within each tier to make the PV supply chain competitive.

### 18.2.2 The Wind Energy Supply Chain

A wind power plant uses a windmill to convert the kinetic energy of the wind into electrical energy. The wind energy supply chain involves three processes as follows: the upstream process involves the production of the wind turbine. The wind turbine contains certain components, including the mast, propeller, nacelle, blade, and rotor (Letcher, 2017). The production process regards the electricity generation from wind resources. Two types of wind energy plants are available, namely offshore, and onshore wind. The working principle of the wind turbine is that the wind moves the rotor capturing the kinetic energy of the wind and converting it into mechanical energy. The power from the rotor is channeled to the generator using a gearbox, which converts mechanical energy into electrical energy. An installation site with high wind intensity is very important to choose. The system works, firstly, by rotating the blades by the wind, and then the propeller drives an axis into the nacelle so that the alternator produces alternating electric current

by rotating the axis. Inside the mast, a transformer is required to adapt the voltage to facilitate transmission to the electrical grid. Due to storage costs, most of the wind-generated electricity is not stored, that are caused by technical limitations. The next downstream process includes the distribution of electricity within the smart grid infrastructure to final customers.

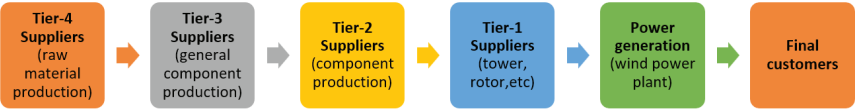


Figure 18.3 The Wind Energy Supply Chain

Source: Jelti et al., 2021

Similar to the photovoltaic supply chain, the wind energy supply chain is also capital-and knowledge-intensive. The number of components required to manufacture the wind turbine is much more than that of the PV module. Figure 18.3 presents the supply chain for the wind energy supply chain in which the critical processes are upstream and production processes. However, it is important to note that the main challenge in the downstream part is grid integration and load balancing.

### 18.2.3 The Wave Energy Supply Chain

Wave energy is one of several forms of renewable energy that does not harm the environment compared to other forms of other energy, especially those producing emissions to the atmosphere. The wave power plant converts wave energy into generating electricity. The upstream processes deal with the production of floating devices to harness the power of the wave. The floating devices placed on the surface of the wave capture the natural movement of wave currents which are then converted to electricity (Lynn, 2014). The downstream process deals with the distribution of electricity to end-users based on their energy needs. Figure 18.4 presents the supply chain of wave energy. Similar to the solar and wind energy supply chain, the critical processes within the wave supply chain lie in the upstream and production processes which require high investment and specific expertise/technologies.

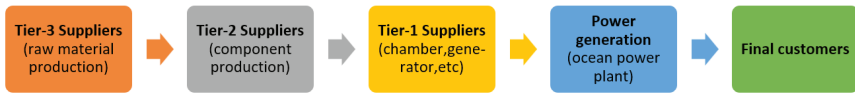


Figure 18.4 The Wave Energy Supply Chain

Source: Jelti et al., 2021

### 18.3 DOMESTIC INDUSTRY READINESS OF RENEWABLE ENERGY SUPPLY CHAIN

As above mentioned, the solar, wind, and wave supply chain are characterized by knowledge and capital intensive. It is, therefore, necessary to evaluate the readiness of domestic industry in Indonesia to support the continuous development of renewable energy to realize the net-zero emission goal by 2060. Given the fact that Indonesia has been blessed with abundant energy sources, Indonesia should aim to become an energy-independent country by mastering technology and increasing energy supply chain capabilities supported by domestic industries.

This section reports domestic industry readiness for solar, wind, and wave energy supply chain which is evaluated based on the number of existing domestic companies, production capacities, and specification suitability. Three levels, i.e., mature, emerging, and developing, were adopted. The mature/established level, the highest level, refers to the conditions in that many domestic industries are capable of producing the respective components with high production capacity and compliance with the specifications.

The emerging/potential level, the medium level, is defined as when some domestic industries can produce the respective components. However, several challenges in terms of production facilities, technology immaturity, and limited experience in production processes, exist. Once these challenges can be overcome, the components have a great opportunity to be developed further. The developing level, the lowest level, represents the conditions when the number of industries that can produce the required components is very limited or lacking, the technology is still progressing, and production experience has not been available yet.

To support domestic industrial development within the country, the Government of Indonesia deploys an indicator called domestic component

level (Tingkat Komponen Dalam Negeri—TKDN) that represents the percentage of the domestic-produced components. The TKDN is usually used as one of the selection criteria to select a winner in Engineering, Procurement, and Construction (EPC), to provide credits for businesses that contribute to the development of domestic industries. The TKDN is not only facilitating domestic industrial development but also providing economic benefits for the community (e.g., creating a job market).

**18.3.1 Domestic Industry Readiness for Solar Energy Supply Chain**

Based on the solar energy supply chain in Figure 18.2, Table 18.1 reports the number of domestic industrial companies and their capabilities to produce the main elements of the PV system. It is observed that 60% of the main components of the PV system have been supported by the mature capabilities of domestic industries. The critical components/part such as silicon wafers and tempered glass are still imported from other countries. Two components, i.e., charger controllers and inverters, however, also need to be improved. The inverters accounting for 8% of the total cost, indicating a high-cost component, implies the necessity to invest in this technology to improve the supply chain capabilities for PV while achieving economic benefits. By mastering the inverter technology, the domestic contents of the PV system (TKDN Level) increase, and the cost can be reduced, which is then contributing to the overall cost of the PV system. Furthermore, the current TKDN of PV Module is 43%, implying that 43% of the components of PV module are manufactured domestically and the rest components are still imported. Meanwhile, the cable has a relatively higher TKDN of 80%.

Table 18.1 Domestic Industry Readiness for Solar Energy Supply Chain

Main Components of PV System	Number of Domestic Industrial Companies	Industry Capabilities		
		Mature	Emerging	Developing
PV module	11 (with a total capacity of 515 MWp)	x		
Cables	1	x		
Structure/Mounting	2	x		
Charger controller	15		x	
Inverter	20		x	

Source: PSE, 2020

Figure 18.5 presents the spatial distribution of current domestic industries based on the solar energy supply chain presented in Figure 18.2. The number of components for Tier-1 until Tier-7 are 6, 41, 74, 33, 1, 1, 1 respectively (Sari and Sopha, 2020). According to data, Tier-2 to Tier-4 suppliers have a limited number of companies because these tiers are capital-and knowledge-intensive and require large production volumes to be competitive. On the other hand, Indonesia possesses all raw materials and basic components required to manufacture mounting, battery, cable, and PV modules (Tier-7).

According to Sari and Sopha (2020), the supply chain capability of Tier-2 to Tier-4 is 76%, 73%, and 79% respectively. It implies that the capability to produce solar cells, and further ingot and wafer production, inverter, battery module, and charger controller, should be improved. The lack of technological maturity to produce photovoltaic components is the reason for medium readiness. Hence, one of the ways to improve photovoltaic supply chain capability in Indonesia is to improve the manufacturing capability of local suppliers of those components through governmental support. The supply chain significantly expands after Tier-4 because the processes are less complex, and capacity can be easily expanded in a short timescale. On the other hand, cable and mounting have the capability of 100% at all tiers.

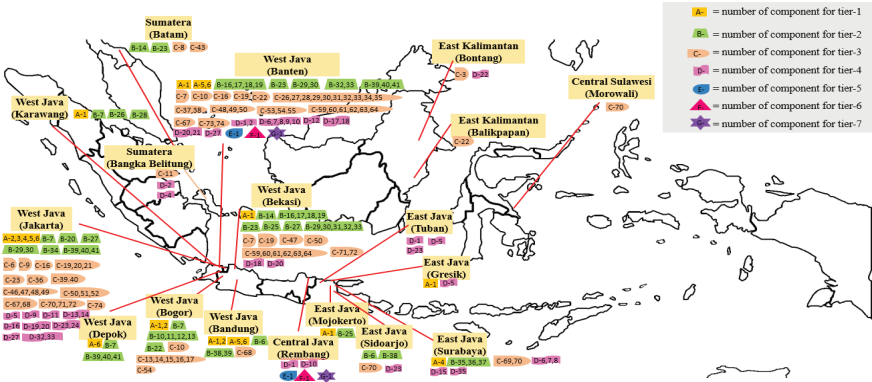


Figure 18.5 Spatial Distribution of Domestic Industries for Components of the PV System

Source: Sari and Sopha, 2020

In addition, Figure 18.6 presents the spatial visualization of the domestic industry readiness for solar energy supply chain according to Table 18.1

(PSE, 2020). It is also interesting to note that most of the existing domestic industries for PV (Tier-1) are located in the west region of Indonesia. The majority of PV system component suppliers are located in the Jakarta and West Java areas such as Banten, Bekasi, Bogor, Bandung, and Depok. Few suppliers are in East Java. Suppliers located in Central Java are dominated by Tier-3 and Tier-4 suppliers, corresponding to suppliers of raw materials, basic components, and general components. These circumstances may hinder potential users to implement photovoltaics because of the high transportation cost to access photovoltaics suppliers and its related services such as maintenance and repair. Nurwidiana et al. (2021) have evidenced that the absence of sufficient PV facility supports is one of the obstacles to PV adoption.

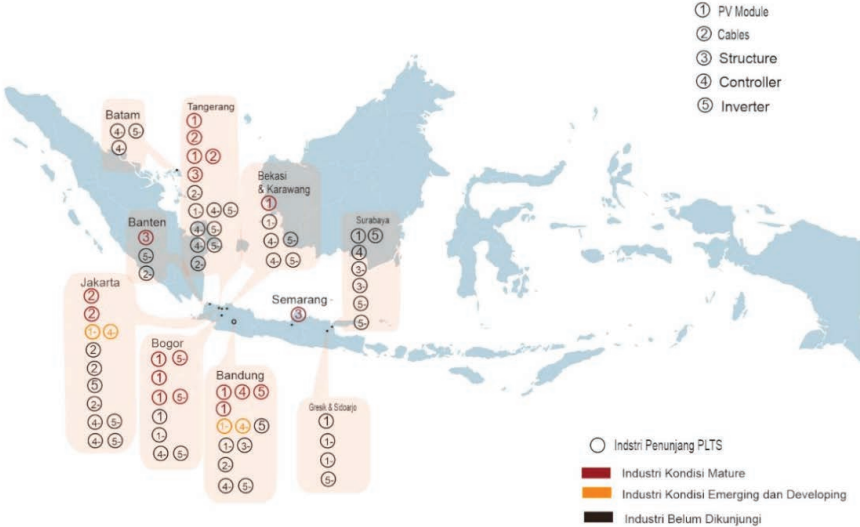


Figure 18.6 Spatial Visualization of Domestic Industry Readiness for Solar Energy Supply Chain  
 Source: PSE, 2020

**18.3.2 Domestic Industry Readiness for Wind Energy Supply Chain**

In Indonesia, two electric wind turbines with a horizontal power shaft have been installed in two locations, i.e., Sidrap and Jeneponto, Sulawesi, with an electric capacity of 75 MWp and 72 MWp, respectively. Each generator set of SWT 3.6–130 type produces 3.6 MWp. These typical wind turbines specifically the main component such as fiberglass propeller

blades of 64 m long and an electric generator were made by a Denmark manufacturer and a tower component of 138 m high was supplied by China manufacturer. For this wind turbine, it was only a small part made by the local manufacturer such as other tower components and civil works like its foundation concrete. Presently, no Indonesia company can manufacture a large propeller blade and high-power generators like the one installed in Sidrap and Jeneponto. Indonesia manufacturers are currently only capable of manufacturing supporting devices/equipment. There are at least 22 domestic manufacturing companies available in Indonesia mostly located in Java are capable to manufacture some components of the wind energy system.

Table 18.2 reports the number of domestic industrial companies and their capabilities to produce the main elements of the wind system. Both tower and gearbox have matured industrial capabilities, whereas rotor, and generator are still at the developing stage. It implies that the research and development for both rotor and generator are required. The current TKDN level of the wind power plant is about 33%, which is slightly lower than that of the PV Module. The TKDN level of the tubular tower is as high as 70% because most of the tubular components are domestically produced. However, the rotor and generator are still developing. Given that the rotor contributes to 14% of the total wind turbine, the development plan can focus on the rotor because it will facilitate industrial development with higher economic benefits than other components.

Table 18.2 Domestic Industry Readiness for Wind Energy Supply Chain

Main Components of Wind Power System	Number of Domestic Industrial Companies	Industry Capabilities		
		Mature	Emerging	Developing
Tower	2	x		
Rotor	3			x
Generator	2			x
Gearbox	2	x		
Nacelle	3		x	
Control system	5		x	
Yaw system	5		x	

Source: PSE, 2020



### 18.3.3 Domestic Industry Readiness for Wave Energy Supply Chain

Wave energy or tidal power source is mostly obtained from the seawater wave. Indonesia as a maritime country where a thousand island spreading over the sea has high wave energy potential. Oscillating Water Columns (OWC) is a typical wave energy conversion technology that uses the kinetic energy from the air caused by an ocean wave. At the moment, 19 available manufacturing companies are capable to manufacture OWC although it was not related directly to the product of wave energy facility, and other 20 companies can also be capable to manufacture the devices that support the facility of generating electricity from the wave energy.

Table 18.3 Domestic Industry Readiness for Wave Energy Supply Chain

Main Components of Wave Power System	Number of Domestic Industrial Companies	Industry Capabilities		
		Mature	Emerging	Developing
<b>OWC (Oscillating Water Column) Technology</b>				
Capture	19		x	
Chamber	19		x	
Turbine	19			x
Generator	19			x
Control and instrumentation	19		x	
<b>Pendulum Technology</b>				
Pendulum	1		x	
Support structure	1		x	
Pontoon	1		x	
Transmission system	1	x		
Generator	1			x
Control and instrumentation	1		x	

Source: PSE, 2020

Table 18.3 reports the number of domestic industrial companies and their capabilities to produce the main elements of the wave energy system. It is necessary to note that the wave energy system is currently in the development stage. No wave power plant has existed in Indonesia. However, the components of wave energy can be manufactured by domestic industries in Indonesia because of the availability of raw material resources, although

no mature industries are currently available because the technology for the wave energy system is still developing. Nevertheless, the components to produce the turbine are already manufactured within the country.

Based on the profile of supply chain readiness for solar, wind, and wave energy, it can be concluded that the current domestic industries to support the development of renewable energy in Indonesia still needs to be significantly improved because the renewable energy supply chains have only been partially supported by domestic industries in Indonesia. Figure 18.7 presents the spatial of domestic industry readiness for both wind and wave solar energy supply chain (PSE, 2020) based on Table 18.2 and Table 18.3.

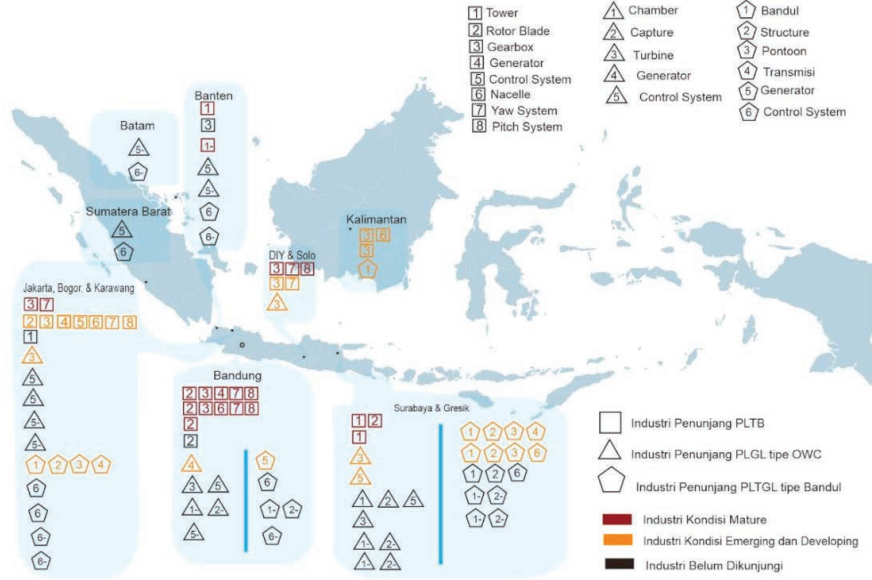


Figure 18.7 Spatial Visualization of Domestic Industry Readiness for Wind and Wave Energy Supply Chain

Source: PSE, 2020

### 18.4 MANAGERIAL IMPLICATIONS AND FUTURE ACTION PLANS

Developing renewable energy does not only regard the technology, but also the supply chain of the renewable energy system ranging from the processes of procuring renewable energy sources, transformation processes, and distribution of energy service to end-users (e.g., industries, households,

transportation sector). Given the significant role of the renewable energy supply chain toward effective and efficient renewable transition and the capital and knowledge-intensive nature of the renewable energy supply chain, it implies that strong domestic industries should have existed in all tiers of the renewable energy supply chain. In that way, dependency on imports and/or bottlenecks within the renewable energy supply chain can be minimized or eliminated. Hence, this leads to further cost reduction and reliability improvement.

Among the three energy supply chains, it appears that domestic industries have sufficient capabilities to support the solar energy supply chain in Indonesia. Given that the TKDN level of the solar PV system is 43%, it implies that more than half of the solar PV components are still not manufactured within the country, thus indicating import dependency, although the potential PV users far exceed the current capacity of PV. It is worth mentioning that several components such as wafers are required to be manufactured within the country to meet the required local material contents, implying further development of domestic industries which strengthen the reliability of the solar energy supply chain and consequently supply chain cost reduction. The wind power plant has currently the TKDN level of 33%. It implies that capacity building to manufacture rotor and generator of wind power system is necessary because both components are still at the development stage. The wave energy supply chain has currently not been sufficiently supported by domestic industries because a very limited number of domestic industries have the mature capability to manufacture the required components for both wind and wave systems. Different from solar which has already regulations on local material contents (TKDN), the regulation of local material contents for wind and wave systems has not existed yet. Therefore, it opens the opportunity to develop and structure TKDN for the wave system by deploying a supply chain perspective.

It is observable that most of the existing domestic industries supporting renewable energy supply chain are located in Java. Future development should be evenly distributed throughout Indonesia and engage local manufacturing industries to efficiently fulfill the local energy demand.

Potential action plans to support the development of the renewable energy supply chain favoring the net-zero emission goal in 2060 can be targeted in the short, medium, and long term. Action plans in the short term

can focus on providing financial incentives for the industries to conduct research and development and master the relevant technology. Because renewable energy technologies have high investment costs, particularly in developing countries, reflecting unattractive financial/risk profiles, green financing through either de-risking or direct incentives to fund green projects is critical to support renewable energy development. Feed-in-tariffs, investment subsidies, or tax breaks have been implemented as the main driver to support the development and promote domestic supply chains of renewable energy technologies (Burke et al., 2019). The financial incentives can further be coupled with the target of production capacity through the regulation. To further increase its economic attractiveness, fossil fuel subsidies should be gradually removed together with the introduction of the carbon tax. Medium-term actions can focus on research and development of the technologies and standardization to ensure the quality and competitiveness of domestic industries. It is necessary to develop modular and general components that can be used in multiple supply chains. It can lead to price reduction, and more renewable energy users can be expected. Furthermore, the renewable energy system can be enhanced to address sustainability by extending to a circular supply chain as explored by Sopha et al. (2022). Long-term actions should focus on the Indonesian Government's consistent commitment to the net goal of zero-emissions through strong leadership, consistent policy/regulation framework, political stability, and local industry-based empowerment involving small- and medium- enterprises that are the economic backbones of the country.

## **18.5 CONCLUSION**

The renewable energy transition requires collective and concerted efforts from diverse aspects, i.e., technology, economy, socio-culture, institutions, and governance. Renewable energy is characterized by evolving and advanced technology, implying the knowledge and capital intensive, and the involvement of various stakeholders from acquiring the energy resources and their supporting technology, transforming, and delivering it to final customers. Hence the necessity to understand industry capacity and capability using a supply chain perspective is crucial to efficiently manage the whole supply chain processes at the lowest possible cost. This chapter provides insights on the domestic industry's readiness to support

the development of three renewable energies, i.e., solar, wind, and wave energy. It is analysed that current domestic industries have not yet been able to produce the required components entirely although the raw materials have been available in Indonesia. The current domestic component level of the PV Module is 43%, whereas that of the wind energy system is 33%. The wave energy system is currently still at the prototype stage. Hence the domestic component level for wave energy has not yet existed. Given the relatively low capacity of the domestic industry to support the supply chain capability to support renewable energy development, action plans to support the development of the renewable energy supply chain favoring the net-zero emission goal in 2060 can be implemented in the short-term (e.g., financial incentives in the forms of the feed-in tariff, investment subsidies or tax breaks to domestic industries coupled with the target of production capacity through the regulation), the medium-term (e.g. research and development, standardization) and the long-term (e.g., leadership, consistent policy/regulation framework, political stability, and local based industry empowerment).

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## CHAPTER-19

# TOWARDS SUSTAINABLE ENERGY TRANSITION

Rachmawan Budiarto

### 19.1 THE ENERGY TRANSITION PATHWAY

The energy transition is the pathway to transform energy system from unsustainable fossil-dominated fuel to a sustainable system. It is also the way in implementing crucial mission to prevent or at least to optimally minimize inter-generation-transfer of externalities in developing energy system. Managing various challenges, especially in addressing a framework of energy trilemma, is a key for success of the energy transition. The trilemma expresses a balance between energy security, energy access/affordability and environmental aspect. Each aspect has a target to be met. However, these three aspects are often conflicting with one another.

The energy transition process is determined by multi variables involving a wide range of stakeholders. The transition is a gradual process in which its intensity and speed are heavily dependent on the capability to manage the multi variables within the system. The capability covers sources of funding, business and industry readiness as well as technical detail on the energy network, both fuel and electricity. These challenges are unique to each country, even to each region.

In Indonesia, for example, the dependence of the electrical energy system on coal is a complex challenge. Related to it is how fast the phasing out coal power plant can be managed. The concern includes regulatory and investment considerations. The speed of the electricity system in absorbing

collaboratively electricity from roof top photovoltaics is another example. The existing procedures applies limitations based on various variables, such as existing installed power in house having plan to install the photovoltaics. This represents a bold characteristics of the energy transition, namely intensive bargaining among stakeholders, who have various interests, trying to find out new configuration of the system. Therefore, this transition takes time to process gradually.

A sustainable energy transition is a long-term process. The transition to a low-carbon system has big targets of national and international priority. It is among the national interests to firmly manage this transition phase. Still, it needs to be carried out by also giving all stakeholders time to adapt to the dynamics, relationships, and various uncertainties of the new system (Mundaca et al., 2018).

The top-down approach from driven by government and the bottom-up initiatives powered by people should be in line. Energy initiatives at the local level, both in rural or urban area, will contribute to the development of a sustainable energy system with decentralization as one of its main characteristics. All stakeholders should work side by side to realise the sustainability goals of energy transition. In this regard, a shared vision is needed (Van der Schoor and Scholtens, 2014).

Perlaviciute et al. (2018) explains the need to recognize various concerns that develop in society. The transition phase should contribute sufficient opportunity to the stakeholders to collectively digest the various new things that arise. Various scenarios can be generated through a process of deliberation and harmonization that unites various narratives about an understandable future (Miller et al., 2014). This is important so that the various executed decisions do not cause injustice or a sense of injustice.

## **19.2 A PESTLE FRAMEWORK**

Among the early steps to manage the energy transition process is to understand the external and internal context. A comprehensive analysis will reveal the opportunities and risks of the energy transition. It can also present the potential/feasibility and limitations/constraints in carrying out the transition. For this purpose Budiarto et al. (2020b) suggest a PESTLE Framework, which involves political, economic, sociological, technological,

legal and environmental aspects into comprehensive analysis on the transition.

**Political Aspect.** These factors are typically revolved around how and to what extent government and legislative body may influence the undertaking of energy transition. It includes development and reinforcement of policies related to coal mining and consumption as well as renewable energy resources. The effective affirmative policies to internalize the externalities of energy system could speed up the transition.

**Economical Aspect.** A systemic effort in advocating for energy transition should consider the economic aspect of the current energy system and how transition may affect stakeholders. Economic factors include economic growth, income generation, cost of living, investment, globalisation, etc.

Increase use of renewable energy resources encourages regency development, support business activities, develop new infrastructure, create job opportunities, and open isolated remote areas. They contribute to the region and national economic benefits, while decrease negative economic impact due to the externalities of fossil-based energy system.

**Sociological Aspect.** It is the aspect concerning the social environment of the region which includes cultural trends, demographics, education level, health consciousness, as well as career and business attitudes of the population that live there.

Recently, Indonesia is still in an early phase of energy transition. This early phase is represented by use of renewable energy, which often comes in the form of off-grid system. The renewable energy based system is often applied to increase electricity ratio in remote/isolated areas. For an off-grid system to operate effectively, it requires community engagement, commitment and capability in system operation and maintenance. However, not only for an off-grid system, people attitudes, beliefs, and values as well as capability are also vital for an on-grid system. It is the time to prepare sociological aspect also for the next phase of the energy transition, where there will be far more intensive use of various renewable energy technologies to support urban area in on-grid schemes.

**Technological Aspect.** This concerns with any technological advances that may affect the energy transition. Implementation of renewable resources to fulfil energy needs must be supported with technologies that are reliable

and cost-effective. Indonesia has enormous potential in various renewable energy resources. Though, which energy resources and technologies best suited for implementation will be different from regions to regions. Thus, an assessment should be made and tailored to the region. Furthermore, the readiness of the technologies should be considered as well. Related to the energy trilemma, it should be a top priority that Indonesia accelerates the systemic effort in increasing the capacity of national renewable energy at least to supply its own energy demand. The country could not change its status of a fossil importer to be an importer of renewable energy technologies.

**Legal Aspect.** These aspect relates with the government and legislative interventions, which usually overlap with the political aspect. The energy transition is regulated and bound by law and enforced in the effort to maintain fairness and wellbeing of the community. Furthermore, a set of enabling policies and related regulations is needed to increase support from financial support, strengthen affirmative approach to develop capacity on national industry as well as also optimal balance between centralized management of energy system and rapid increase of public/private role in energy transition.

**Environmental Aspect.** These factors become important due to global warming and the increasing need to shift from non-renewable to sustainable resources. The factors cover changes in climate, weather, carbon footprint, air pollution, and so on. The consideration to environmental aspect could affect, the growing coal mining activities that should be better managed so that they can decrease detrimental effects to the environment. It includes mining activities in supply-chain of battery industry as well. Moreover, effective realization of environmental aspect will determine speed and intensity of externalities internalization.

### **19.3 BENEFIT SUSTAINABILITY OF ENERGY SYSTEM**

The system is focused on energy services, which are expressed as various benefits generated by energy carriers for the benefit of human life (Modi et al., 2005). Examples of energy services are heat for cooking, light for lighting a house or factory, mechanical power for grinding, communications, and others. Meanwhile, Lovins (2004) defines energy service as a function that is intended to convert energy in various devices. These functions contain

comfort, mobility, fresh air, accessibility, entertainment, electrochemical reactions, and so on.

From a macro point of view, energy is one of the determinants of the survival and development of a society through its ability to maintain various ecological processes, drive various economic activities and, in general, improve the quality of life. The intensity and sustainability of each activity are highly dependent on the availability and consumption of energy.

Realizing energy system capability to continuously deliver various benefits is among the top priorities. The benefits should be delivered without causing negative impact to various related aspects. These two variables of the system, which are capacity to continuously deliver the benefits with no negative impact, express a target of benefit sustainability which should be fulfilled by the energy system.

Especially for Indonesia as a country in early phase of energy transition, sustainability consideration is crucial. Large number of technological constructions in developing countries (note that Indonesia is not categorized as developing country anymore) did not work well according to the design time because of no adequate sustainability assessment (Pocock et al., 2016).

Sustainable development can be defined as a comprehensive process to maintain harmony between the natural and the artificial environment, as well as creating living conditions that uphold human dignity while encouraging creation of economic justice (Du Pleissis, 2002). To fulfill the sustainability aspect the renewable-based technology use needs to be well designed. In general, technology utilization can be called sustainable if it has ability to provide additional impact in various factors, such as, (1) access and quality of health, (2) community and institutional cohesion through participation, (3) the role of marginalized community groups, (4) unemployment and relative poverty, and (5) technical competence locally (Paas, 2012; Slaper and Hall, 2011; Koopmans and Koppejan, 1997). Moreover, it is clear that the sustainability criteria in applying the renewable energy based technology is met not only by fulfilling environmental sustainability aspect, but also satisfying technical, technological, social, economic, and institutional aspects.

**Technological Sustainability.** This aspect describes ability of the renewable energy technology in continuously supply electricity and/or fuel during its designed life time. It expresses reliability of the implemented

renewable energy technology. It can be realized by fulfilling standards during the steps of design, installation, commissioning, operation, and maintenance. Appropriate design could be managed by finding an optimal solution, which is a compromise on various variables, such as renewable energy resources, utilization purpose and scenario, market availability, technology quality, installation challenge, budget constraint, as well as capability to operate and maintain.

**Social Sustainability.** Community is not the object of technology and development. On the contrary, it becomes a subject who participates in managing technological developments which can later produce various benefits, which are not limited to financial benefits. From the initial planning stage, the community is inclusively placed in a strategic position in discussing, finding, and determining the various components and steps to be enforced.

In this phase many national and international programs in Indonesia apply renewable energy technology in an off-grid system. For the off-grid system to operate effectively, it requires community engagement, commitment and capability. It is also true for the next phase of energy transition, when there will be more renewable energy technology in on-grid scheme. Public participation can be inspired and more strongly driven by champions. The champions can advocate for the energy transition in the national or regency context. They may come from within the government and from public or civil society organisations as well as from business entities. Their existence is vital for the success of the energy transition process.

The systemic process to meet social sustainability needs at least six steps, namely, (1) ensuring the legality of land ownership, (2) involving local communities to actively participate from the beginning phase of design to the construction activities, (3) preparing designs by also following the local wisdom, (4) utilizing sustainable energy sources which are available at local level, (5) utilizing sustainable and affordable materials at the local level for construction and operation as well as (6) fulfilling quality standards that are generally applicable locally, while still referring to international standards (Pocock et al., 2016).

Without public acceptance and support, a sustainable energy transition will be impossible to be performed. Public acceptance is something that is not simple. It depends on the characteristics of the energy project, the

location of the program, and various psychological and social factors in general. This relates also to the need for social justice. In addition, public acceptance is dynamic, develops over time and can manifest in various forms.

In this regard, there is no single solution that can address this complex challenge. It is necessary to develop various options of solution to also gain public acceptance. Two-way communication is needed so that the role of the community can be adequately internalized into the policies drawn up. The inclusion of the role of society inherently in policy is critical to the success of the energy transition.

Unfortunately, although it should have been included in the planning process from the start, public acceptance was often managed not in a proper resource plan and schedule. Engineers, policy makers and program developers tend to misjudge the complexity and causes of public resistance (Perlaviciute et al., 2018).

For this reason, it is necessary to consider more humanizing energy policy (not dominated by techno-economic considerations). This will position the energy into productive discourses that are built on various sides of human experience, social identity, and meanings that are believed by the public. There needs to be a balance of adequate participation, respect for alternative positions, and a feeling of inclusion among various stakeholders who come from very different backgrounds and experiences with energy (Miller et al., 2014).

**Economic Sustainability.** The use of renewable energy technologies should be managed to drive sustainable economic benefit in various levels. The renewable energy technologies can provide direct benefits in the form of electricity cost decrease, which is enjoyed especially by business actors. If this is well performed, this decrease in energy expenditure, for example, will not only benefit business actors but also be useful for the surrounding community. A certain part of the saving in energy can be managed by the community. The savings can later be allocated for the purpose of operation and maintenance including purchasing spare parts for replacing of the renewable energy system is damaged. Before being used for the purpose of maintaining the energy system, the savings can be also allocated to support various business activities.

In addition, new businesses will emerge that will become an additional source of profit. These businesses include ones that directly provide various products and services related to the renewable energy or ones that are supported by the renewable energy. Moreover these growing new businesses will open wide opportunity for new green jobs in various occupancies.

**Institutional Sustainability.** Optimum institutional support is needed to increase the role of renewable energy technology with its ability to provide benefits. The institution can play a role in optimizing the potential of various resources. This role includes mobilizing and managing funding, improving and utilizing human resource capabilities as well as building various agreements needed to develop and implement various regulations.

In increasing use of community-based renewable energy, both in rural and urban areas, the role of local institutions becomes very important. For example, local financial institutions will be able to provide financial services as well as technical and management assistance. Vocational schools or other training/educational institutions around the site can build community skills and knowledge. Furthermore, local institutions that are initiated inclusively will have much more potential to survive because they rely on pre-existing social capital. In the future, this local institution will continue to develop in facilitating the increasing role of renewable energy.

**Environmental Sustainability.** Utilization of renewable energy will reduce CO<sub>2</sub> emissions. This strategic achievement is not only macro in nature, but also has an implication at the micro/local level. This becomes important in the midst of the increasingly clear various negative impacts of CO<sub>2</sub> emissions. The ability to reduce and prevent CO<sub>2</sub> from renewable energy investment decisions can be calculated quantitatively.

Meanwhile, the intersection of energy transition with circular economy also has the potential to be an additional solution to the growing waste problem. This can be found in the development of renewable waste-based energy production systems.

## **19.4 DECENTRALIZATION AND DEMOCRATIZATION OF ENERGY SYSTEM**

Interestingly, the energy system transition offers a unique opportunity to provide solutions to various problems, as described by Budiarto et al. (2019). Miller (2014) writes that this transition has the potential to broadly improve



justice-related matters. Energy geopolitics has so far been influenced or driven by an expectation of scarcity, the notion that oil and gas reserves are limited, as well as that global demand increases so that the competition for what is left will become more intense. Meanwhile, various analysts point out that global demand for fossil fuels such as oil and natural gas will begin to decrease long before supply decreases significantly, as countries take strategic steps to reduce greenhouse gas emissions (Klare, 2015). At a time when the use of renewable energy far exceeds fossil energy, the geopolitics of renewable energy will receive strong attention. This is related, among others, to raw materials, supply chains and technology (O’Sullivan et al., 2017). The accelerating use of renewable energy technologies triggers a global energy transformation with far-reaching geopolitical impacts. The new energy age would cause significant reshaping on relations between states and communities and bring about a “new world” of power, security, energy independence and prosperity (IRENA, 2022a).

Currently, the energy system is generally supported by various large and centralized power plants and oil refineries. However, as a result of the non-centralized nature of the availability of new and renewable energy, the transition will show a new form that will be more common, namely a distributed system.

In many cases, in this distributed system the energy conversion units will be located close to the energy consumers. The energy consumers will be able also to become energy suppliers at the same time. There will be energy conversion units that are smaller in size than what is common today. Consequently, this distributed system will encourage not only the distribution of technology, but also the distribution of competence, ownership, decision-making ability and authority as well as responsibility in energy supply. This transition includes various political, economic, social, and technological dimensions, depending on the nature and degree of decentralization (Alanne and Saari, 2006).

The increasing role of renewable energy encourages a new equilibrium. It can be seen that system decentralization will occur and gradually increase at various levels: local, national, international, and even global. The expansion of renewable energy use, which are also run by community initiatives, has broadened the pool of energy stakeholders. Decentralization which was initially limited to this physical aspect (e.g. in the spread of

power plant locations) unfolds an interesting development, namely the democratization of the energy system. This democratization is described with various meanings and limitations and is also addressed with various responses.

There is still no established definition of energy democracy. Though, it expresses consistently a concern about who controls the means of energy production and consumption (Jenkins, 2019). Energy democracy brings energy resources under public or community ownership and/or control. It is a key aspect of the struggle for climate justice and an essential step toward developing a more just, equitable, sustainable, and resilient economy (Fairchild and Weinrub, 2017). While the first wave of energy democracy can be seen as demand- and consumer-focused, the ongoing second wave is shifting attention towards supply and production, or the energy system governance (Tomain, 2015). Szulecki (2018) emphasizes the characteristics of governance in energy democracy. It should be characterized by wide participation of informed, aware, and responsible political subjects, in an inclusive and transparent decision-making process relating to energy choices, with the public good as its goal. A high levels of ownership of energy generation and transmission infrastructure through private, cooperative or communal/public means are necessary. In general, there are still differences in departure points and nuances in meaning, as well as objective in political systems, varieties of capitalism etc. (Stephens, 2019). This energy democratization causes tensions between municipal authorities and central governments (Emelianoff and Wernert, 2019).

## **19.5 INTERDISCIPLINARY CHALLENGE**

Currently, Indonesia is in a phase to prepare an accelerated increase of the renewable energy share in its energy mix. In the early phase, the country applies various renewable energy electricity technologies in two main categories: (1) the on-grid schemes, which is dominated by the business scheme to increase renewable-based capacity of PT PLN and (2) the off-grid schemes, which is dominated by the effort to increase the electricity ratio, mainly in rural and remote areas.

Many cases in the early phase show lesson learned to be elaborated for a better further phase. Novitasari et al. (2020) conducted analysis on a case in Karimunjawa District, a small islands located north of Java Island Indonesia.

Solving the problems of renewable energy development in the district is not only the task of the local government. It is also the task of the regional and central government. The study presents an example of the problems, which was caused by an unclear legal status of assets for centralized photovoltaics powerplants on Parang and Nyamuk Islands as part of Karimunjawa. Moreover, the local stakeholders had no adequate information who will be responsible to handle disruption or failure of the system.

Furthermore, the case study reveals four challenges faced for electricity management in the islands. First, the development of renewable energy needs to be accompanied by ability in using the delivered energy for productive purposes. Second, the collaboration of related parties is needed, such as community, government, academics, etc. Third, technical, social and economic assistances should be carried out in the pre-project phase, during installation and after the installation of the system. Fourth, community engagement in the management of renewable energy in the islands is indispensable.

Another study conducted by Budiarto et al. (2020a) in Sinarlaut Village, which is located in Agrabinta District, Cianjur Regency, West Java Province. The community is mainly farmers, and some cooperatives produce palm sugar from coconut tree sap. The farming activities produce various agricultural waste. One of them is a plentiful rice husk. This study performed a feasibility analysis focusing on implementing gasification technology to support palm sugar small industry. It was conducted not only on the technical aspect but also on the multi-variable sustainability aspect.

The study described multi-variable challenge in implementing the gasification technology in the village. A cross-sectoral involvement of local stakeholders is required to deliver a comprehensive solution. They include (1) the role of village government and local community institutions at the village, hamlet or village level for initiating the social engagement, (2) the role of local industry, workshop, or machinery and equipment shops, as well as the adjacent technical education institution to support need of supply and maintenance, (3) local industrial and farming activities for supplying biomass waste as fuel, and (4) the role of small and medium entrepreneurship (SME) to adopt the gasifier technology.

As part of the energy transition, increasing role of the renewable energy, which drives decentralization and even democratization of energy system,

is a complex challenge. This challenge cannot be responded to by a single-disciplinary approach. It involves many variables that influence each other. The complexity is found in various levels of the transition. A breakthrough is needed to get a new perspective which in turn leads to innovative real actions. Various challenges of energy system development, which can be seen more and more in this era, can only be answered with a transdisciplinary approach. This approach allows the development of a program framework with characteristics beyond the disciplinary perspectives.

In an academic context, Stock and Burton's (2011) description, which was compiled from nearly 100 literatures, explains the meaning of multidisciplinary, interdisciplinary, and transdisciplinary in research on sustainability as well as the differences between the three. With a multidisciplinary approach the researchers and various other stakeholders aim to share knowledge and compare the results of various studies. However, there is no attempt to cross boundaries or build new integrative knowledge. Researchers in a team that is built for running a certain project can contribute to giving each their own professional perspective on a particular theme/problem. As it does not carry out an iterative research process, the focus of a multidisciplinary approach on problem solving is not as strong as an interdisciplinary or transdisciplinary approach. In this approach, the iterative process is the formulation of questions in one discipline and submitted to other disciplines in order to solve a problem, which then raises new questions for other disciplines. Through interdisciplinary and transdisciplinary approaches researchers will be able to overcome differences and explore synergies. However, the multidisciplinary approach is limited to provide diverse opinions from various experts.

The interdisciplinary approach can be considered as an improvement over the multidisciplinary approach. The interdisciplinary approach focuses on addressing systemic problems "in the real world". This forces those involved in research, who come from various unrelated disciplines, to cross boundaries to build new knowledge. The need to bridge these diverse viewpoints from different disciplines stems from the need to solve complex problems involving the intersection of humans and nature. In the interdisciplinary approach, integration between natural and social scientists is a common practice.

Meanwhile, transdisciplinary is the highest form of an integrated project. This form involves not only multidisciplinary actors, but also non-academic parties (e.g. landowners, user groups, and the general public). This is done by combining an interdisciplinary approach with a participatory approach. Transdisciplinary research can be identified by its characteristics in the form of a collaborative process between researchers and non-researchers in a real problem and a combination of research with decision-making abilities by various stakeholders.

In order to build a holistic perspective through a transdisciplinary approach, the researchers involved must strive to find various options for thinking and even to overcome the chauvinism of the single discipline of these researchers and build openness to the perspectives of other disciplines. Through this holistic perspective, a fusion between various intellectual boundaries can be carried out in order to build new disciplines to answer real challenges. The aim of the transdisciplinary approach to build new disciplines and theories is what distinguishes it from interdisciplinary. The transdisciplinary approach emphasizes a holistic nature, which increases the participation of various stakeholders.

The energy transition stimulates a systemic process towards a new equilibrium wide range of stakeholders. This inter- and trans-disciplinary challenges should be managed in various angles of sectors which drive the energy transition. It means also a well-orchestrated program in all involved fields of effort in various levels: academic, research and development, industry, business, government, and others.

## **19.6 ACCELERATED CAPACITY INCREASE OF NATIONAL RENEWABLE ENERGY INDUSTRY**

One of three pillars in the energy trilemma, which is energy security, demands ability of a country to fulfil its energy need under any circumstances. It includes the country power to diversify the energy supply in its energy mix and minimize its dependence on energy imports. These energy imports consists of fuel, technology, and human resource. However, currently Indonesia still faces the challenge of the relatively low ability of the national industry to meet the need for renewable energy technology. As consequences, the import component of renewable system is still high. It is necessary to carry out a comprehensive effort to prevent the transformation

from dependency on oil import to dependence on importing renewable energy.

To overcome this problem, it is necessary to increase the capacity of the national renewable energy industry. This capability needs to be improved in all parts of the renewable energy supply chain, with a clear step and time framework. The production capacity target could be started from relative simple components with growing feasible market. It could be then increase to capability target in producing sophisticated yet strategic component of renewable energy technologies.

Moreover, many countries can enjoy broad benefits of renewable utilization in job creation: manufacturing, project development, sales, distribution, construction, installation, operation, and maintenance. It will be true only in an enabling environment including strong capability of national energy industry.

In an effort to strengthen parts of the renewable energy supply chain, it is interesting to consider vocational high school (VHS, Sekolah Menengah Kejuruan—SMK). It is an education institution that educates individuals as student to be skilled workers who will be employed in the industrial, commercial, and service sectors (Kacan, 2015). In Indonesia, VHS provides a formal vocational education focused on various expertise programs such as mechanical engineering, electrical engineering, automotive, and others (Suharno et al., 2020). The further direct study of VHS students at the higher education level is a polytechnic and diploma program.

There are at least two majors in VHS which have strong relevance to the renewable energy, namely electronics engineering and electrical engineering. There are 1613 VHSs in these two majors in Indonesia (Budiarto et al., 2021). The curriculum of VHS in these two majors could provide a solid foundation for accelerating the provision of reliable human resources in the department of a certain renewable energy industry.

Affirmation for VHS students and graduates needs to be provided to further strengthen the national renewable industry. It can be realized systemically not limited to skilled labour provision but also to increase the production capacity of various components of renewable energy system. Many VHSs already have laboratory/workshop facilities that are suitable for teaching/training. The technical and management capacity of these facilities can be upgraded to develop centres for repairing and producing

various components, such as components of the photovoltaics system, micro hydro-powerplant, and others. Production activities can be on track with, for example, inverters and controllers of a specific size for the photovoltaics system. This could be developed as production unit which is integrated with the business line of the state-owned enterprise. Furthermore, the VHS-based business unit could also play important role in accelerating renewable energy development and its related business activities in province level.

A well-orchestrated policy and its implementing programs of, for at least four Indonesian ministers: (1) Ministry of Education, Culture, Research and Technology; (2) Ministry of Manpower; (3) Ministry of Industry as well as (4) Ministry of State-Owned Enterprise could provide a strong supportive environment to integrate VHS into the renewable energy supply chain. The support could be delivered also by private and banking sectors. The local government has also capability in to develop VHS-based renewable energy business schemes.

## **19.7 MANAGING THE DISRUPTION IN ENERGY SYSTEM**

The energy transition opens opportunity to provoke trends that having disruptive impact on energy system. Among the trends showing the disruptive implications are as follow:

1. the growing decentralized system which drives growing interest in energy democratization (see for example Szulecki and Overland, 2020);
2. the growth of innovative business models which change not only the way of energy-related business but also the landscape of its player, role sharing and competition (see for example IFC, 2019);
3. the rapid development of numerous innovative and game-changing renewable energy technologies, including for example the hydrogen (IRENA, 2022a), the virtual powerplant (IRENA, 2022b), and a space-based energy harvesting (Chen et al., 2019);
4. wider and deeper integration of energy system into the online system, which not only opens many new benefit opportunities but also cyber-security-related risks (see for example WEC, 2019).

Various renewable energy technologies are considered disruptive due to their significant changes in the grid, business models, and regulation simultaneously (Johnstone and Kivimaa, 2018). More general, Rosenbloom

(2019) describes how the disruption causes a power shift from incumbents to new entrants or actors from other socio-technical systems. Furthermore, Johnstone et al. (2020) offered an analytical framework identifying four dimensions of disrupted system: (1) technology, (2) ownership and actors, (3) markets and business models, and (4) regulation. The first dimension relates to the different way new technology operates compared to existing established technologies, and how their novel characteristics pose potential problems for existing technologies and associated systems (Bower and Christensen, 1995). The second dimension describes various distributed actors beyond firms. It focuses on their different strategies and resources, and how new ownership models may come to challenge incumbent forms of ownership (Farla et al., 2012). The third dimension highlights a change in the dominant business models that can provoke radical effect on the market shares of incumbent companies (Christensen and Raynor, 2003). The fourth dimension is about the disruptive innovation that may give raise to significant public policy concerns and stimulating demands for new forms of regulation (OECD, 2015).

This disruption entails a significant transformation of stakeholders' role. The study which was conducted by Fitriady et al. (2021) shows a strong demand on the transformation. A comprehensive approach which is performed and supported by orchestrated stakeholders' action is needed to manage the disruptive system development to intensify internalization of energy system externalities, while broadening the stakeholders spectrum enjoying benefits from the sustainable energy transition.

**Central Government.** The effort to increase the role of renewable energy for energy transition demand a systematic, affirmative approach. It is enforced as a collaborative action amongst ministries. The government also has the responsibility to create a dynamic harmony among all related stakeholders in the energy transition. It is worthy of being mentioned that these stakeholders have competing positions in several cases, especially those having strong background in political and economic interests. A clear executive agenda within long-term national interests and capability to realize this agenda will be essential to mitigate this challenging issue.

As the trend includes the progress of numerous disruptive technologies and approaches, it is the strategic role of central government to build strong support for research and development program and its link with the



industry. This support is a part of the required systemic effort in managing the challenge of the energy trilemma in this energy transition phase with its increasing disruptive impacts.

**Local Government.** The local government plays a vital role in the energy transition in the provincial and regional levels. Together with the regional legislature, the local government can formulate and enforce regulations that aim to create an environment that optimally supports the development of renewable energy.

Various policy and regulatory options can be explored and then implemented to increase role of community or private sector. Many options of regulations are available to be considered, such as the obligation to install solar power on the roof of certain types of commercial building prior to issue of a construction permit or operational permit. The local governments can also be a champion by setting a bold example to the community for cleaner and more sustainable energy. Regional budgets can be allocated to achieve it, for instance, by installing the PV system in government buildings and public infrastructure. This budget is also used to run adequate operational and maintenance activities.

Furthermore, by increasing strategic affirmations, the local governments can grow different local companies running innovative business models in renewable energy. Integrating all stakeholders having capabilities to play active roles opens broader opportunities to harvest the benefits of the renewable energy. The benefits includes green jobs that are available for local people.

**Legislative Institutions.** The legislative institution at all levels possesses the authority and capacity to integrate renewable energy into the political agenda and then various laws and regulations. Therefore, it occupies a critical role in the energy transition. Among the anticipated expanded role is its strong collaborative strategy with the government to support the national renewable energy industry. This can be applied by giving stronger legal affirmative policy for national players to supply service and good without jeopardizing their growing competitive capability. The legislative institution is also a vital player in harmonizing stakeholders dynamics in their transforming business strategy and culture. A legal and political approach will be essential to mitigate competing interests among stakeholders to produce positive results.

**Banking/Financial Institutions.** Among the biggest challenge is providing a strong financial support for a wide range of programs in the energy transition. The support is needed mainly to build new renewable energy systems, to modify fossil energy based infrastructure and to develop supporting industrial system. It is also required to modernize the energy system which should now have solid capability to absorb the supply from decentralized renewable energy stations and to mitigate various new risks related to cyber-security.

It is also important to deliver additional push encouraging banking/financial institutions to reduce their support for energy projects having intensive negative externalities. This would also increase the fairness of playing field for renewable energy technologies in their competition with fossil-energy based technologies.

**Large Scale Business in Fossil and Renewable Energy.** Large scale business in the fossil energy sector enforces strong influence to the energy transition. These fossil-based enterprises can play an essential role by transforming their business strategy and culture into a sustainable energy system. One of the biggest challenge is internalizing various existing externalities in its business process.

Moreover, their vast capital and network strength could provide significant support to various parts of renewable energy supply chain. Embracing the smaller players into their business in an optimum mutual benefit scheme is a strategy to be elaborated.

Various innovations including even business model disruptions continue to develop in line with the increase in renewable energy utilization with its different technological configurations. By properly adapting its business model, the enterprises have promising opportunities to grow. It is also a bright prospect for skilled labour to fill this opportunity. The business sector could increase its capacity to create comprehensive and long-term benefits, such as decreasing technology imports and providing new jobs.

**State-owned Enterprises (SOE).** There are at least three important clusters of SOE regarding energy transition: (1) energy, oil and gas industries, (2) mineral and coals industries as well as (3) banking industry. Like other enterprises, the SOE can play a significant role by transforming the business strategy and culture into a sustainable energy system. Having also the mission to fulfil a set of government targets in the energy system,

the SOE could have even more substantial power to increase the speed and intensity of the energy transition. For example, PT PLN, which is state-owned enterprise in electricity, can significantly reduce the capacity of coal power plants, move faster to renewable energy and open more widely access for renewable-energy based electricity supplied by private sector and community.

The significant transformation of the energy infrastructure is needed in managing this transition or even disruption on the energy system. The questions to be answered include capability of the electricity and fuel supply chain in absorbing the supply from the private sector and community. The progress in technology development provide better opportunity for renewable-based electricity, biofuel and hydrogen which be produced and supplied the private sector and community. The role played by the SOEs could be a key factor for the intensity and speed of transformation on the energy infrastructure. This also expresses real affirmative policy of the central government.

**Local Business Institutions.** The government and many donor agencies currently promote public-private partnerships or other collaborative schemes for using renewable energy in the regions. Cooperative and regionally owned enterprises (Badan Usaha Milik Daerah—BUMD) can be an active player in these business schemes. Furthermore, local business has a greater opportunity in this increased initiative by running new business models based on renewable energy. It can be managed by inclusively involving local resources. The active role of this local institution can ensure significant local benefit resulted from decentralized renewable energy system. It will also realize the inherent characteristics of renewable energy in local community engagement and welfare.

**Local Communities.** In general, the existing energy system gives the local communities a role merely as energy consumers. Energy providers should fulfill their energy demand in one way flow of energy. However, in the future, a significant transition will encourage the local communities, both in rural and urban areas, to also play a role as energy producers. The local communities have a key role in achieving sustainability of energy infrastructure, which is operated not only by big business players. In this new era, therefore, local communities will have the opportunity to be prosumers.

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## EPILOGUE

### THE NEED FOR COLLECTIVE AND CONCERTED ACTIONS

Muhammad Baiquni and Wahyudi Kumorotomo

**A**s we are moving forward on the multi-dimensional issues and are facing global changes and challenges ahead, it is the time for the G20 leaders and global citizens to reflect on the future of human life on earth. The G20 has committed not only working for short term crisis solutions, but also collaborate to achieve the 2030 Agenda for Sustainable Development Goals (SDGs). In 2016, the G20 leaders have agreed on a commitment in advancing and supporting the implementation of the sustainable goals within the members and beyond, which is formulated in the G20's Action Plan on Sustainable Development Goals (OECD, UNDP, 2019). This SDGs action plan is implemented and annual progress updated (United Nations. 2015). The Indonesian Government have set a National Policy of Action Plans for Sustainable Development Goals, which the implementations have been rooted at village level. Given the geographical setting as an archipelagic state, Indonesia adopts both sectoral top-down and local actors bottom-up approaches.

The three main agendas of the G20 Indonesia 2022 Presidency, which relevant to the recent Covid-19 global pandemic crisis, changing digital technology on lifestyle, and the transition towards sustainable energy have been discussed. The authors have formulated recommendations based on their topics for policy options and actions to be undertaken in the future. Global issues have to be managed properly with commitments

and collaborations among the leaders of G20. The G20 2022 theme of “Recover Together, Recover Stronger” as a call for solidarity and mutual respect and togetherness in finding out solutions from the global pandemic and economic crisis.

During the Covid-19 global pandemic crisis, Indonesian Government committed to tackle the pandemic with massive vaccinations of the population in mega-urban densely populated area as well as scattered population in remote and isolated islands. The Indonesian Government has accentuated to mobilize medical health doctors, nurses, and students as well as civil servant, volunteers, police, and military apparatus to support the vaccination schemes over the archipelago. Hard challenges have to be faced in communicating facts on pandemic to the people in multi-level understandings and in various cultural context of the archipelago. Fortunately, *Gotongroyong* as social solidarity emerged and strengthened in communities. This local wisdom of *Gotongroyong* can be found in many part of the islands especially in rural community. *Gotongroyong* is a mutual-help and mutual-benefited of community with intrinsic values of respect, responsible, and redistribution (3R) as well as solidarity, sharing, and strengthening (3S). With limitation on chemical pharmaceutical products in the market, many people seek for natural local medicine spice ingredients which can be found in their garden, farm yard, and forest nearby in their ecosystems (Baiquni, 2009).

The G20 remaining agenda on the future of global health architecture is how to address issues on should inclusiveness, fairness, and justice for humanity. During Covid-19 pandemic, global health become a huge and more complex in term of its structures, sectors, and actors involved. With respect to inclusiveness, this global health architecture need a mutual understanding among leaders of governments, business, and civil society to open the opportunity for participation and collaboration. In global market of health equipment’s and pharmaceutical products should treated in fairness trade schemes. Related to justice for humanity, the G20 leaders should go hand in hand through policy decision and action plan direction in providing health system in providing services to the people with promotive, preventive, curative, rehabilitative, and palliative care. Regarding technological development and advancement in the health service and rising the hospitality tourism industry within the global economic system, it is important to

integrate health service in more orientation on happiness of the people and holistic approach of the ecosystem.

Global changes and challenges have also been shaped with digital technology, which disrupted many aspect of our life. The digital technology create opportunities as well as threats to whom it may use for their life, such as in economy, culture, politics, and many others. Digitalization has opportunity to enhance the process and progress of the people more equal to achieve prosperity. In term of geographical context of space and time, Indonesia as archipelagic country and many developing countries which cover most of the world population need access, literacy, talents, and contents on digital technology and supports systems. However, digital technology has also potentials to increase inequality and injustice at the community as well as at the county levels. Therefore, cooperation among G20 country members should take concerted actions in creating enabling conditions to make digital transformation marching forward in recover together and stronger from the pandemic and the crisis.

In the last two decades, digital access have been spreading over the archipelago in Indonesia and many developing countries. The first geostationer telecommunication satellite Palapa Indonesia have been launched in 9 July 1976 to cover the archipelagic state of Indonesia. Since then, the government provided telecommunication infrastructure as well as human capacity building for research and development of the telecommunication technology. The digital technology then become very vast transformation in society and in spatial unity of Indonesian archipelago.

Even in remote and frontier islands, the Indonesian people are enthusiastically accessed the internet and everyday spend hours to follow national news and global entertainments via computers and smartphones. The use of digital technology for economy have created opportunity to micro, small, and medium enterprises to work at home and to access broaden market but specific targeted consumers. Many handicraft products and creative economy services become robust using digital technology. Meanwhile, digital transformation in Indonesia have to face many changes and challenges not only in term of technology itself but also human quality and capacity to develop future digital world.

In the digitalized and globalized world, people in the G20 countries realized that the world become flat in term of equal access for the people in

many part of the world. However it also created tensions and disorientations among people who are lack of digital literacy to behave properly in the virtual reality. The world is moving forward in digital transformation, affecting many aspects of life which may create both tonic and toxic in our life. The critical questions remind is that digital technology divides or unites our society, bring long distance closer or reverse, are we interact more on human way or digital machine, is the digital technology will save world resources especially energy for the future?

World energy consumption is increasing significantly due to the modern industrialization and huge population number with massive consumption lifestyle. Rich countries consume more energy per capita compared to developing countries. The G20 have to consider in searching and shifting the energy source from fossil fuels to renewable energy resources with technological innovations in conserving our world and addressing the threat of climate change. Triple E (energy, economy, and ecology) should be integrated if we wish to formulate policies that are ensuring spatial, social, and ecological justice. Sustainable energy transition is needed to shift from heavy and dirty energy which produce high carbon emissions to clean and renewable energy sources which more efficient and sustainable.

The G20 leaders should formulate policies and implement concerted actions on energy transition, which requires unwavering commitments from governments around the globe. The global citizens should undertake collective actions, which requires deep awareness and genuine participation in line with the climate goals to preserve healthy and comfortable life on earth. Countries should work together to realise successful international cooperation. A holistic framework that is implemented globally can bring countries together and provide financial assistance, technology development and transfers, and capacity building that are essential for accelerated energy transition.

## **G20 LEADERSHIP, COMMITMENT, AND COLLABORATION**

The G20 leadership is formulated by the so-called triumvirate system, a form of leadership held by three countries with the alternate role. In 2022 Indonesia as the current president, Italy that formerly has served as the president, and India that will become next the president. The triumvirate system of G20 leadership has characterized by more flexible, inclusive, responsive, and effective. Such new global governance has its advantages

and disadvantages (Luckhurst, 2016). The G20 circular leadership system would positively assure inclusiveness and fairness among the members. But it would be a problem when the rotation role of G20 leadership do not perform well or in fact deepening the political rifts among the leaders.

The Sherpa tracks play important role in carrying out negotiations and achieving consensus among the G20 leaders. The Sherpa tracts which consists of 10 engagement groups and 11 working groups, and 1 initiative group coordinate meetings and discussions to provide recommendation on the G20 agendas and priorities. The Engagement Groups which are focus on certain theme or interest groups such as Scientists as S20, Think-tank as T20, Urban Planners as U20, Member of Parliaments in P20, Labour Organizations as L20, Youth Organizations Y20, Woman as W20, Businesses as B20, and Civil Society Communities as C20, have many contribution in mutual understanding and may create collaboration for concerted actions. Beside these the Engagement Groups, the Working Groups are also play important roles to knits the agendas to formulate commitment and collaboration into actions.

The G20 summit in each cycle is a communique which expressing members' commitments and vision for the future, drafted from the chosen recommendations and deliverables from ministerial meetings and other work stream ([www.G20.org](http://www.G20.org)). With no permanent secretariat, the G20 events are not easy to manage in long term guided to achieve the goals. This is a challenging new global governance such manifested by the G20 which Indonesia may take benefits in consolidation of development programs and also contribute share experiences in global level (Salim, 2011).

## **CONCERTED ACTIONS**

The big challenge for G20 is to ensure that all manifested commitments would turn into concerted actions. Sometimes, what we find from an international forum is too many meetings, discussions and seminars, that are only focused on communiqes, commitments, and documents. All the authors in this volume proposed that the G20 have to deliver commitments into concerted actions in their respective countries and moving forward to assist their neighbourhoods in shaping a better world. Global issues such as health service, digital transformations, and sustainable energy transition

should be addressed with collaborative and concerted actions among the stakeholders of governments, businesses, communities, and citizens.

Concerted actions need a multi-disciplinary approach and assiduous collaborations. From the Indonesian experience, we learnt that containing the Covid-19 pandemic should involve people from various professions; medical doctors have to engage with social analysts, geographers and planners as well as communicators and facilitators in distributing and delivering vaccines across the archipelago. It is not easy to work in a multi-disciplinary approach, as all members of the team have to sincerely work together, with learning-by-doing process and mutual respects. Concerted actions need solid agendas that are focused on roles and shared resources to tackle issues at local, national, regional, and global levels. To follow up the agendas, all have to work within multi-cultural and multi-actors setting. The G20 leaders should have the capacity to conduct an orchestra of global community which enable and empower cultural diversity. Collaboration among the leaders and the global citizens is the only way to achieve sustainable development goals and to achieve global justice. It is a high time for all to work together across communities and cultures around the globe.

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resources (PLN Headquarter, 2018), and (2) power development planning for Maluku-Papua electricity system based on local renewable energy resources (PLN Headquarter, 2019), etc. He become a speaker in national and international forums including the 2nd Anti-corruption Working Group Meeting in the Renewable Energy sector for G20 in Bali on July 2022. Mr. Tumiran received his doctoral degree were obtained from Saitama University, Japan.



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