The Role of Pythonic Accounting-Assisted Digital Finance Sentiment in Promoting Environmental Sustainability

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Abstract

This panel data study aims to examine the relationship between Indonesia's environmental protection achievement in terms of climate change prevention and its prevailing political economy by explicitly considering the role of pythonic accounting assisted-capital market sentiment from 2001 to 2018. This study uses fixed and random-effect models as econometric techniques. Envi-ronmental protection is measured by Indonesia Environmental Carbon Index. The political econo-my is measured by the wealth distribution index among Indonesians or known as the GINI coeffi-cient. This study concludes with two important findings: (1) The Government of Indonesia's polit-ically motivated economic policies resulting in wealth distribution inequalities significantly harm the environmental protection effort mostly in carbon emission control and waste management. Economic inequalities resulting from the politically motivated economic policy indirectly legiti-mize people's action to exploit nature by any means necessary to survive. Therefore,

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the fifth state principle of Pancasila mandating social justice for every single Indonesian can be the best explana-tion for this social jealousy phenomenon. In other words, environmental protection without fair political economy policies is an impossible mission; (2) media sentiment on digital finance shows an insignificant impact only during the first two presidencies 2001 - 2008 on the relationship be-tween the wealth distribution gap and environmental protection in Indonesia. Meaning that specu-lations or reactions from the media related to digital finance could not do anything about the exist-ing wealth distribution gap's impact on the environmental protection effort in Indonesia in the ear-ly 2000s but it starts to change after 2005 in Indonesia due to capital market maturity after Asia economic crisis 1998-1999.

Keywords: Python, Pycharm, Sentiment, Polarity, Carbon

บทบาทของตะกอนการเงินดิจิตัลแบบใช้ภาษาบัญชีไพทอนเพื่อส่งเสริมความยั่งยืนด้านสิ่งแวดล้อม

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บทคัดย่อ

การวิจัยโดยใช้ข้อมูลพาแนล มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างความสำเร็จในการป้องกันสิ่งแวดล้อม โดยใช้การป้องกันการเปลี่ยนแปลงสภาพอากาศและระบบเศรษฐศาสตร์การเมืองทั่วไปของประเทศอินโดนีเซีย โดยการพิจารณาบทบาทของตะกอนตลาดลงทุนแบบใช้ภาษาบัญชีไพทอน ในช่วงปี ค.ศ. 2001 ถึง 2008 งานวิจัยนี้ใช้วิธีแบบจำลองเชิงสุ่มด้วยเทคนิคเศรษฐมิติ โดยที่การป้องกันสิ่งแวดล้อมวัดจากดัชนีคาร์บอนสิ่งแวดล้อมของประเทศอินโดนีเซีย ในขณะที่เศรษฐศาสตร์การเมืองวัดจากดัชนีส่งมอบความมั่งคั่งของชาวอินโดนีเซีย หรือประสิทธิ์ความไม่เสมอภาค ผลของงานวิจัยมีสองด้านคือ 1) นโยบายกระตุ้นเศรษฐกิจเชิงการเมืองของรัฐบาลอินโดนีเซีย ส่งผลให้เกิดความไม่เสมอภาคของการส่งมอบความมั่งคั่ง และเป็นผลเสียต่อความพยายามป้องกันสิ่งแวดล้อม โดยเฉพาะอย่างยิ่ง การควบคุมการปล่อยก๊าซคาร์บอนและการจัดการของเสีย ความไม่เสมอภาคทางเศรษฐกิจ อันเกิดจากนโยบายกระตุ้นเศรษฐกิจเชิงการเมือง เป็นการอนุญาตการกระทำของมนุษย์ที่เป็นการหาประโยชน์จากธรรมชาติ ไม่ว่าจะด้วยวิธีการใด ๆ เพื่อความอยู่รอด เป็นการกระทำที่ถูกกฎหมาย ดังนั้นหลักการแพนคาซิลาที่ห้าของภาครัฐ ที่กำหนดความยุติธรรมทางสังคมสำหรับทุกคนในประเทศอินโดนีเซีย จึงเป็นคำอธิบายที่ดีที่สุด เมื่อกล่าวถึงปรากฏการณ์ความอิจฉาหรือริษยาทางสังคม

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กล่าวคือ การป้องกันสิ่งแวดล้อมโดยปราศจากนโยบายเศรษฐศาสตร์การเมือง เป็นพันธกิจที่เป็นไปไม่ได้ 2) ตะกอนสื่อเรื่องการเงินดิจิตัล แสดงผลกระทบที่ไม่สำคัญ เพียงแค่ในช่วงสมัยของประธานาธิบดีระหว่างปี ค.ศ. 2001 - 2008 ว่าด้วยความสัมพันธ์ระหว่าง ช่องว่างการส่งมอบความมั่งคั่งและการป้องกันสิ่งแวดล้อมในประเทศอินโดนีเซีย ซึ่งหมายความว่า การคาดการหรือปฏิกิริยาจากสื่อ ที่เกี่ยวข้องกับการเงินดิจิตัลไม่สามารถส่งผลใด ๆ ต่อช่องว่าการส่งมอบความมั่งคั่ง จากความพยายามป้องกันสิ่งแวดล้อมของประเทศอินโดนีเซีย ในช่วงต้นทศวรรษที่ 20 แต่ทว่าเริ่มมีการเปลี่ยนแปลงหลังจากปี 2005 อันเป็นผลมาจากการเติบโตของตลาดลงทุนหลังผ่านวิกฤตเศรษฐกิจทวีปเอเชีย ช่วงปี ค.ศ. 1998 - 1999

คำสำคัญ: ไพทอน ไพชาม ตะกอน สภาพขั้ว คาร์บอน

Introduction

The Indonesian government has actively pursued the growth of Indonesia's downstream processing and refining industry in the mining sector during the past few years. Particularly, the Indonesian government has passed a number of restrictions that forbid (or heavily tax) the export of raw ores and minerals. In order to promote the development of new processing and refining fa-cilities, it has also been providing tax benefits and other incentives. At least four new smelters, with a total combined value of over $12 billion, are anticipated to start up in Indonesia in 2017, while more smelters and refineries are anticipated to finish up their development in the next sever-al years (World Bank, 2016).

The Indonesian Government has concentrated its efforts on growing the domestic down-stream refining industry in the oil and gas sector while upstream business operations have stalled due to the relatively low global oil price, in order to lessen Indonesia's dependence on crude and product imports. The Indonesian government is anticipated to release a request for proposals in 2017 for the construction of up to eight small-scale oil refineries close to the key oil blocks. This is in line with the recent decision of the Indonesian government to prioritize the construction of local infrastructure (including pipelines) and demand the onshore construction of a liquid natural gas plant for the Masela project, which is Indonesia's largest deep-water gas project and is located in the Arafura Sea, Moluccas (Asian Development Bank, 2017).

With over 80% of these projects being led by independent power producers and the remain-ing projects being run by the Indonesian state-owned power utility, PT PLN, the total capacity of the newly signed power purchase agreements is 17,800 MW. A variety of fuel sources, including many renewable energy projects, will be used in the 35,000 MW new electricity generation project to create about 109 new power plants. 2016 saw the completion of AC Energy's purchase of a size-able stake in the 75 MW Sidrap wind farm in South Sulawesi, Indonesia, which will become the country's first utility-scale wind company. Early in 2017, this project reached a financial close, and commercial operations are anticipated before the end of the year.

Recent significant foreign divestments have highlighted the need for regulatory reform in the mining sector. With the sale of a 56% stake in PT Newmont Nusa Tenggara to the Indonesian-owned PT Amman Mineral Internasional in 2016, the New York Stock Exchange-listed Newmont Mining Corporation and the Japanese company Sumitomo Mining Corporation completed one of the largest mining transactions in history. This transaction was valued at approximately US$2.6 billion when all associated disposals were taken into account. On the Indonesian island of Sumba-wa, the Batu Hijau copper and gold mine is run by PT Newmont Nusa Tenggara. Additionally, in 2016, BHP Billiton completed the sale of its 75% ownership in seven metallurgical coal contract of work businesses in the Indomet Coal project in Central and Eastern Kalimantan to its current Indonesian-owned joint venture partner Adaro Energy for US$120 million (including the one mil-lion tonnes a year Haju mine, which started producing in 2015). Additionally, Freeport McMoran is anticipated to be forced by the Indonesian government to sell a sizable chunk of its stake in the world's largest gold and copper mine, the Grasberg project in East Indonesia, in 2017 (Rodrik & Sabel, 2019).

The "polluter pays" idea, which holds that each person or organization that damages the en-vironment is accountable for the appropriate actions taken, is adopted by the Indonesia Environ-mental Law. Therefore, generally speaking, every person who is in charge of enterprises or activi-ties that result in environmental pollution or environmental destruction and cause harm to any third party or the environment is required to make restitution or take certain corrective measures such as installing or improving waste treatment units, restoring the original environmental func-tion or eliminating the causes of the environmental pollution or damage (Andaiyani & Falianty, 2017, p. 20).

Economic Inequality Leads to Environment Exploitation

The Environmental Law also establishes a strict liability regime, according to which any-one who uses, produces, or manages hazardous and toxic materials or poses a serious threat to the environment is entirely responsible for the harm they cause, without having to provide evidence of the specifics of their error. This is a law loophole optimized by individuals whose poor financial conditions have forced them to be involved in illegal mining or known as Artisanal and Small-scale Gold Mining (ASGMs). The growth of micro-businesses is also impacted by ASGM's exist-ence. Particularly in light of the present COVID-19 epidemic,

ASGM operations are seen as occu-pying the informal sector and serving as a method of providing job possibilities and sources of revenue. Thousands of ASGM locations may be found throughout Indonesia's many regions, and at the moment, almost two million people depend on them for their daily needs.

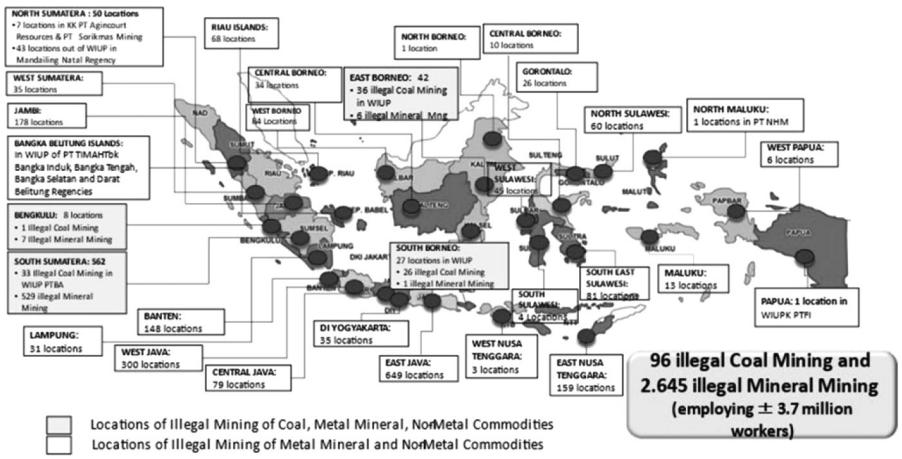

Figure 1: Artisanal and Small-scale Illegal Mineral Mining locations in Indonesia

Source: (World Bank, 2016)

According to the Ministry of Environment and Forestry, no particular training is necessary for these types of mining operations. In order to supplement their income, many rural populations opt to work as miners or mix farming with mining. It is challenging for miners to switch to other forms of employment when they are paid with processed gold extracted during mining operations. Due to democratization and advancements in human rights awareness, such mining techniques are spreading more widely. The majority of ASGMs in Indonesia employs a conventional technique that involves amalgamating mercury to extract gold. However, the usage of hazardous mercury has serious negative effects on the environment and human health. The use of mercury, typically in very large quantities, is the main way that gold is recovered during the mining process. More than a thousand tons of mercury are discharged during mining operations. Globally, 10 - 19 million peo-ple are thought to be at risk from mercury exposure. Many emerging nations are particularly af-fected by this issue (Atkinson et al., 2011).

Mercury is almost universally used in Indonesian ASGMs to extract gold from ore prior to amalgamation. When heated to high temperatures, a mercury-gold amalgam is created when the mercury and gold precipitate. The mercury is then evaporated to extract the gold. The mercury method of primary gold processing is less effective because it can only extract 10–40% of the gold that is present. To recover the residual gold from the original processing waste, many miners use the cyanide technique in additional processing. In order to increase the amount of gold produced, miners frequently do this by processing waste twice with cyanide in several locations. It was ob-served in numerous places that many miners think mercury improves the quality of gold while cy-anide enhances the quantity of gold.

With high levels of mercury and dust produced during the traditional processing methods used by miners, they are typically only able to extract a small amount of gold, leading to environ-mental and health issues for both the processing workers and the nearby communities that are not actually engaged in mining activities. For instance, residents residing in the Tulabolo sub-watershed have had mercury levels detected in their hair. According to the United Nations Envi-ronment Program (UNEP) 2018, there were 2220 tons of mercury emissions worldwide in 2015, with 49% of those emissions coming from Southeast Asia, 18% from South America, and 16% from Africa. From 2010 to 2015, mercury emissions from small-scale gold mining accounted for 38% of all global emissions. The United Nations lists Indonesia as the third-largest mercury emit-ter in the world, behind China and India. Over the past two decades, Indonesia's ASGM industry has considerably grown its mercury contamination. Nearly 90% of Indonesia's small-scale gold mines still employ mercury in their processing techniques due to practical considerations (Pepin-sky, 2013).

Around 195 tons of mercury were estimated to be discharged annually into the environment in Indonesia alone. This sum accounts for 20% of the world's mercury emissions. About 57.5% of this mercury is discharged into the atmosphere, 15.5% into the water, and 14% into soil or sedi-ment. Humans are exposed to mercury pollution in a variety of ways. In the mining industry, it is poisoning brought on by employees being exposed to mercury up close. Outside of this, mercury contamination spreads through rivers, lakes, and other waterways. The majority of ASGM sites in Indonesia lack a consistently safe means of mercury waste

disposal, thus miners typically dump the material into adjacent rivers. However, the atmosphere is the primary source of exposure. By inhaling mercuric air created during the amalgam smelting process, consuming contaminated food, and through direct skin absorption, people can be exposed to mercury. Even in extremely small amounts, mercury can have dangerous consequences on the skin, kidneys, lungs, and digestive sys-tem. High dosages of mercury can permanently harm the kidneys, brain and nerve system, prenatal development, and lungs. The legal community mining area approved by the government is one ex-ample of the sustainable growth in the gold mining industry that has drawn a lot of attention in the last 10 years. However, implementing sustainable development in this sector has turned into a dif-ficult conundrum. To guarantee the miners a moral and legal way of life, research on the possibili-ties for alternative income is required. The negative consequences of mining for human health in-clude respiratory complications such as pneumoconiosis, asbestosis, and silicosis caused by inhal-ing fine particles from the large amounts of dust generated by mining activities such as blasting and drilling.

Digital Financing Comes to Solve the Situation

It is believed to be effective to group mining actors into cooperatives and provide financial support through digital financing in order to reduce the quantity of unlawful ASGM activity. Fi-nancial inclusion is encouraged by digital finance since it lowers transaction costs. The develop-ment of digital finance has increased the viability of entrepreneurship in rural groups to some ex-tent, significantly reducing the poverty-causing nature of farmers, and farmers' income has in-creased as a result. Rural residents' access to credit has been expanded, and by using the Internet, they can start their businesses at a lower cost than before. Many societal problems, including eco-nomic development, employment, poverty, and income inequality in industrialized and developing nations, are helped by financial inclusion. However, developing nations are where the problems and difficulties associated with promoting financial inclusion are most apparent (World Bank, 2016).

In developing economies, it is positively correlated with GDP growth by up to 14%. Finan-cial inclusion, a crucial component of social inclusion, is particularly helpful in reducing income inequality and poverty by expanding prospects for upward mobility for underprivileged groups in emerging economies. Having access to a transaction account, which enables people to send and receive money as well as save money, is typically viewed as the first step toward financial inclu-sion. As a result, they will find it simpler to go about their daily lives, make progress toward their goals, plan for crises, expand their enterprises, invest in their children's education and health care, and get easier access to other financial services like insurance and credit. The World Bank reports that 69% of individuals globally have a transaction account, or nearly one-third of adults, or about 1.7 billion people, remain unbanked, despite substantial efforts to improve financial inclusion (Se-tiawan et al., 2021).

This development and use of new technology have been accelerated by the COVID-19 pan-demic. The number of contactless payment transactions in Indonesia doubled from 2020 to 2021, accounting for half of all in-store payments, while the payment value tripled as a result of social distancing efforts. Electronic money projects, which focus on the financially excluded, particularly those in rural areas, have made significant headway in this regard. E-money regulations were first implemented by Bank Indonesia in 2009, and a pilot project was then launched in 2013. In 2014, e-money regulations were changed to allow fourth-class banks to collaborate with distinct business-es. In addition, the Financial Services Authority introduced restrictions for branchless banks in 2014. Banks are permitted to participate in both e-money therefore bank-led versions appear to predominate (Hardoon et al., 2020, p. 1). Digital finance led fintech would likely improve bank efficiency, which leads to increased interest rates on deposits and improves households' utility, Fintech could reduce the cost of the bank, which is likely to reduce the loan rate and increase the deposit rate, Fintech also may reduce the transaction cost of capital, which increases the possibility of a country raising money from abroad.

Digital Finance and Digital Identification Conundrum

The national electronic identity program which covers 86% of the population has also been implemented well in Indonesia. Additionally, the country has outlined an ambitious aim to digitize all social benefit payments by 2017. However, Indonesia does not have a single real-time ID data-base that is connected to financial services for electronic Know Your Customer (KYC) technology and transaction validation. Similar to this, e-money-based solutions are not integrated, which has confused both the supply side and end users. The lack of the credit infrastructure necessary to un-derwrite small and microloans is another significant hurdle, which emphasizes the commercial case for alternative credit scoring utilizing non-traditional data. Regulators' coordination may also be enhanced, especially when it comes to issues that span industries.

Digital Finance Assistance in Reducting Economic Inequality

Access to credit makes it possible to invest in enterprises and human capital, which has the potential to lessen social inequality and drive economic growth. However, for a variety of reasons, commercial banks frequently have a restricted desire to extend credit to people due to a lack of customer data to evaluate creditworthiness, lenders frequently struggle to grasp the risk profiles of persons who are less integrated into the financial system (Tama et al., 2022). For instance, it's pos-sible that the individuals lack a credit history, a history of utilizing financial services, and verified information about themselves. Some people in the population cannot obtain formal credit because they do not have the necessary documentation, formal sources of income, or collateral. Gender disparities in credit access are also caused by these obstacles (Asian Development Bank, 2017).

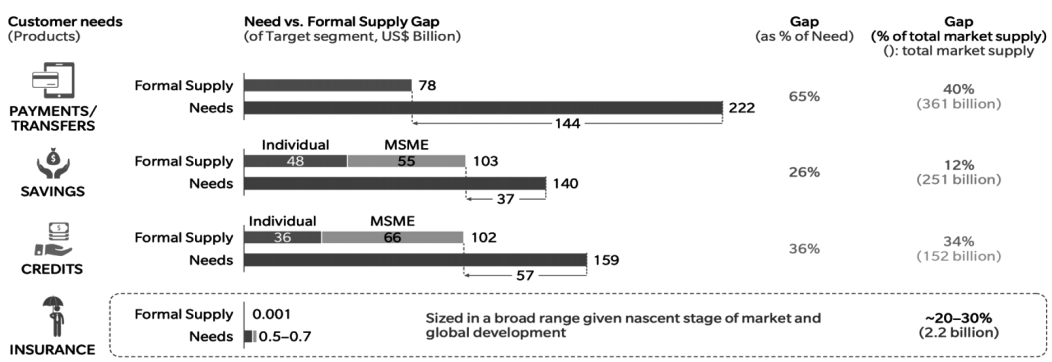

Figure 2: Digital Finance Need versus Supply Source: Asian Development Bank (2022)

Even if banks adopt gender-neutral lending policies, unintentional gender biases result from the nature of the credit policy rules and standards that are typically in place. For instance, the majority of loans to SMEs is secured by collateral. It is challenging for women to obtain a loan without a male asset owner in her family co-signing the loan agreement due to the gender imbal-ance in asset ownership. Compared to men, women are less likely to operate a company website. According to data from Indonesia, 43% of men and only 35% of women run their own websites for their businesses. In addition, women are less likely than men to own land (Alkhwaldi et al., 2022). Women-specific products and solutions are not frequently developed on the supply side. The diffi-culties unique to women are also not understood or appreciated to the same extent. A woman may find it difficult to travel to a branch to make loan repayments, for instance, due to time constraints brought on by family obligations and cultural customs. Although it may be a big convenience for women, a doorstep payment collection service or any other option may not be as useful to males. The financial services business does not appear to value these subtleties, though. Male financial agents are preferred over female ones by 54% of respondents, according to a 2016 poll on banking service expectations (Varma et al., 2022). Though 97% of agents today are men, according to the same report. Women are less likely to use digital technology than men, as evidenced in Indonesia, where 47% of women and 40% of men use no computers at all. Women's lower levels of financial literacy further exacerbate the situation. Baseline Financial Literacy Survey in Indonesia in 2013 shows that only 20–25% of women were considered to be "well informed" in financial services. These elements might prevent women from fully utilizing the financial services offered by digital technology. Due to the much lower branch density, those who live in rural areas often have less access to physical banking infrastructure. Due to the time required to go, they must pay a greater opportunity cost to contact a formal lender (Asian Development Bank, 2017).

Due to a lack of options, unbanked and underbanked persons frequently use informal chan-nels, where they may be subjected to much higher interest rates and are more likely to be taken ad-vantage of by actors who engage in less ethical business activities. The advent of branchless bank-ing gives providers the ability to use agent networks and target rural areas, frequently in conjunc-tion with streamlined KYC procedures. However, there are

still three major barriers to credit ac-cess. First, there is currently no tested substitute for the manual underwriting done by credit offic-ers in the case of individual microloans. They can leverage their local expertise when approving credit because they both live and work there (Acemoglu, 2021). Fortunately, non-traditional data, such as financial transaction data, insights based on psychometric tests, telecoms data, and geolo-cation data, can be provided via digital platforms and applications to facilitate credit scoring. The credit risks of people who might not have established conventional banking relationships, credit histories, or verified sources of income might be evaluated with the aid of these alternative data sources. As a result, suppliers can now reach a previously unexplored market, and potential bor-rowers who were previously shut out can now obtain formal credit instead of just being able to re-ceive informal loans. Players in the fintech industry are quite active in this sector. Some are acting as balance sheet lenders, using their own unique data analytics methods to give loans to particular population segments. Others have created P2P lending middleman platforms that connect investors and the business sector (Thathsarani & Jianguo, 2022).

In order to pre-qualify consumers and reduce online identity and credit fraud, suppliers are better equipped to cross-check identification data. A central fraud registry in 2016 enables provid-ers to pool data and communicate with one another about fraud and risk patterns. Second, psycho-metric testing can identify instances of fraud committed by both applicants and loan officers as well as online gaming (for example, through changes in the pattern of prepaid airtime transac-tions). In order to identify borrowers who are likely to have lied, vendors, for instance, are offering solutions that enable providers to cross-check client identities against proprietary and public data resources. Third, by employing predetermined parameters based on tools for detecting behavioral patterns, data analytics enables providers to monitor possibly fraudulent transactions in real-time. These can notify fraud teams of shady activity. The strategy for achieving financial inclusion has changed from focusing on solving broad issues to attending to the unique needs of various groups. Strong fintech ecosystems are essential for promoting financial inclusion because they make fi-nancial services more accessible to a larger population (Anifa et al., 2022).

Action must be taken by regulators, institutions responsible for setting public policy, and supply-side players to solve the structural problems preventing the extension of financial services to these groups of people. For the supply side in terms of resource and investment mobilization, the unappealing economics of serving them continue to be a problem. The solutions offered are frequently not desirable replacements for the current informal solutions for the target clients. Ad-ditionally, their general understanding and financial literacy are lacking, which is holding them back. The base-of-the-pyramid sector presents difficultie for public policymaking institutions be-cause social, economic, and political priorities sometimes clash.

It is predicted that taking advantage of this opportunity may boost GDP by 9% to 14%, even in relatively large economies like Indonesia. Up to 40% of the volume of payments shortfall and 20% of unmet credit demands might be filled by digital finance. In economies like Indonesia, the cumulative benefits of such digitally driven financial inclusion might increase GDP by 2%. Since the supply side will be mostly responsible for driving digital enablement, regulators and public policymakers must play a crucial role in fostering an environment that encourages innova-tion in digital banking. The potential for accelerating financial inclusion through digital finance is obvious, and the effects on the lives of those who are currently financially excluded as well as the overall economy would be profound. To promote and facilitate this digital innovation, regulators and policymakers must play crucial roles. Digital banking, however, is also making the financial services ecosystem more complex by breaking down traditional value chains and allowing new, non-bank participants. Policymakers must constantly be mindful of the hazards associated with this increased complexity as well as the opportunities provided by digital finance. They must be particularly conscious of the exponential growth in the amount of data produced by individuals and exploited by supply-side operators. protection of consumers, particularly for those new users (Moreira-Santos et al., 2022).

Additionally, digital technology encourages the growth of inclusive finance by increasing the efficacy of risk management. The information serves as the foundation for risk assessment, and big data technology has revolutionized how effectively it is gathered and processed. It will broaden the range of financial services that are available, raise the level of inclusive finance service com-petition, boost the supply of traditional financial services while also integrating new technologies and innovative financial services, and supply side by financial services change.

Nevertheless, the hope is still there. As part of the United Nations Framework Convention on Climate Change's program to reduce emissions from deforestation and forest degradation and to implement the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries (REDD+), Indonesia is also continuing to implement re-forms in relation to the global issue of deforestation. By providing incentives for developing na-tions to reduce emissions from forested lands (i.e., to reduce deforestation), invest in low-carbon development strategies, sustainably manage forests, and increase forest carbon stocks, this pro-gram aims to encourage businesses and governments to keep carbon stored in forests (Ahmed et al., 2022).

Political Economy Failure is the Prominent Cause of Economic Inequality

Today, democracy is falling and failing. It fails the American dream and fails everyone's dreams as well. As years pass by, a series of economic crises have led to devastating social and economic crises. The 1973 - 1975 recession marks a big failure in the Western economy after several years of enjoying post-World War II economic expansion. Economic stagnation is experi-enced by much of the Western economies resulting in a miserable 9 percent of global unemploy-ment and -3.2 percent of global Gross Domestic Product decline for 16 months. Five years later, the United States took the biggest hit with 1.3 million people lost their job resulting in even bigger income inequality (Saez & Zucman, 2020).

This similar nightmare continues in 1981 and 1982. The global financial crisis 2008 is also on the list (Piketty, 2014). Surely, the political system of democracy adopted really affects its eco-nomic aspect since production, trade, and most of the economic activities are strongly regulated by the government's economic policies. Aware of it, the European countries move

forward by princi-pally adopting the Caliphate political principles indicated by the establishment of the European Union in 1993. However, Asian countries are far from being aware of the democratic system errors they are adopting. A terrible fate is experienced by Indonesia and many Asian countries when the 1997 - 1998 economic crisis slaughters the Asian economy resulting in a tragic economic catastro-phe (Andaiyani & Falianty, 2017).

Surely, the terminology of the Caliphate is owned by the Muslim community, but the prin-ciples are adopted by the European Union in 1993 until now. The Caliphate system demands the integration of every functioning government to comply with the central government policies on principal aspects while leaving the technical aspects to every governor's discretion. The European Union always try to find common ground on many aspects including in the economic system such as their system integration on International Financial Reporting Standards (IFRS) or their joint commitment to a sustainable economy under the Paris Agreement. Together, they can achieve more by integrating and coordinating the available resources.

Historically, the Caliphate system begins with the Medina Charter. Prophet Muhammad brings the city of Medina to become the new world epicenter governing the entire Arabian Penin-sula by 632 AD. All new cities comply with the Islamic compliant aspects of politics, society, and economics set by Prophet Muhammad and leave the technicalities to each governor. Throughout history, the capital city keeps moving from Medina to Kuffah, Damascus, Baghdad, and Constanti-nople as the power expanded (Pepinsky, 2013). Income inequality affects people's environmental demand functions. At a given average income level of residents, the expansion of income inequali-ty means that the rich become richer and the poor are economically worse off than they were be-fore. This reduces the environmental needs of the poor and tends to result in the overuse of re-sources and the environment. Although the environmental needs of the rich are rising, they are more willing to directly transfer assets to areas of higher environmental quality, rather than invest-ing to improve the environmental quality of the region. The other mechanism is that, because the cost of deteriorating environmental quality is mainly borne by the poor, the benefits are mainly attributed to the rich. Compared with the poor, the rich often have more political resources and so-cial influence. For their own best interests, they will hinder the formulation and implementation of environmental protection policies, which further deteriorates the quality of the environment.

Pancasila has the same principles as the Caliphate system

Indonesia is always on the right track by declaring the Five Principles of Pancasila as its state principles. The fourth principle mandates that the people are led by wisdom and values within conventions and representativeness spirit. This mandate ensures efficient and effective govern-ance. The citizens are only required to vote for their members of parliament, and let these mem-bers do the rest. The members of parliament or MPs will convene a general assembly at the House of Parliament to choose all executives including the city mayors, governors, and the president or the prime minister. Therefore, the president or any executive officer does not need to appoint a temporary acting officer for the sake of impressing 200 million Indonesians through political cam-paigns preventing the vacuum of power or any kind of government inefficiencies. Surely, it gives the MPs more power, but the monitoring process becomes a lot easier as the MPs are very small in numbers compared to monitoring 200 million Indonesian in every political election. The corrup-tion eradication commission or the general election commission only needs to monitor these MPs' bank accounts to prevent money politics or any of their potential misconduct in every political election.

Democracy is a costly politics leading to transactional politics

Historically, politics bring benefits to Indonesian indeed. Ethical politics demanded by Douwes Dekker brings STOVIA to Indonesia which educates many young talents. Today, a brand-new political system called democracy regularly consumes USD 2 million for a city mayor election, USD 6.5 million for a governor election, and USD 7 billion for a presidential election every five years in Indonesia. Meanwhile, every political candidate spends roughly USD 40 million for a presidential campaign while their overall expenses can reach up to USD 722 million. High political costs drive the political candidates to the doorstep of the oligarchs. Nobody will give their money for free meaning that there will always be a price of freedom that the political candidate must pay to the oligarchs when they finally become the policy maker. This is the pain point where democracy cannot help to develop a sustainable economy that preserves the environment (Zucman, 2014).

Transactional politics leads to skewed economic policies priority

As the policymaker is returning the favor to the oligarchs, more economic policies are designed to please big investors only such as tax holidays and tax amnesty. On the other hand, subsidy for oil is revoked which leads to soaring prices and severe inflation experienced by every single Indonesian without exception. This is where democracy fails the second and fifth principle of Pancasila mandating social equality and justice for every single Indonesian.

Practically, economic equality and justice are impossible missions under democracy proven by the biggest democratic country itself, the United States. More and more Americans are banished from their house making it more difficult to sleep and even just to dream and making the American dream merely a fairy tale.

The Caliphate system significantly reduces income inequality

The terminology Caliphate means the successor indicating certain qualities or qualifications that every governing leader must have. Thus, a leader is not chosen by individuals' vote, but they are chosen solely based on their capacity assessed by respectable representatives. Omar ibn Abdul Aziz's Caliphate government can be the most concrete example. With an income tax of 2.5 percent and business tax of up to 10 percent only, the Caliphate reaches record-breaking zero poverty in 720 AD.

Even Arthur Laffer, the legendary founder of supply-side economics and economic advisor to President Ronald Reagan and Prime Minister Margaret Thatcher, took his inspiration from the phenomenal book of Muqaddimah authored by the Moslem great economist Ibn Khaldun. In brief, a progressive tax rate is bad for the supply side causing contraction in the economy (Sanz-Sanz, 2022). Thus, these logics and facts show that the Caliphate system is the most effective and cost-efficient political system.

Maqashid Syariah protects the people and the environment

Maqashid Syariah means the governance objectives aimed at protecting the religion, indi-viduals, intellectual and mental health, wealth, and community. The Caliphate system internalizes these five objectives within its governance and will immediately prevent anything from harming any of these protected elements. Obviously, this concept acknowledges the right of individuals and the right of the community at the same time which stands in the middle of capitalism and social-ism making it the most balanced socio-economic system. Utility maximization or maximum satis-faction is not the objective, but the objective is to give freedom and prosperity to everyone while ensuring anyone or anything including the environment is not harmed at the same time.

Every individual reserve the right to own and utilizes their properties to gain profit as long as they do not harm the other protected elements namely religion, intellectual and mental health, other people's wealth, and the community. Therefore, any businessman is not allowed to exploit the environment which can cause natural disasters and casualties in the name of profit.

Data & Methods

This research employs the panel data approach and gathers data on economic inequality's impact on the environmental carbon index.

Then, the pythonic accounting programming codes are executed to capture the media sen-timent on digital finance from companies listed on the Indonesia Stock Exchange divided into the first four years of each presidency term to make the observation equal: 2001 - 2004: Megawati Soe-karnoputri; 2005-2008: Soesilo Bambang Y; and 2015 - 2018: Joko Widodo presidency.

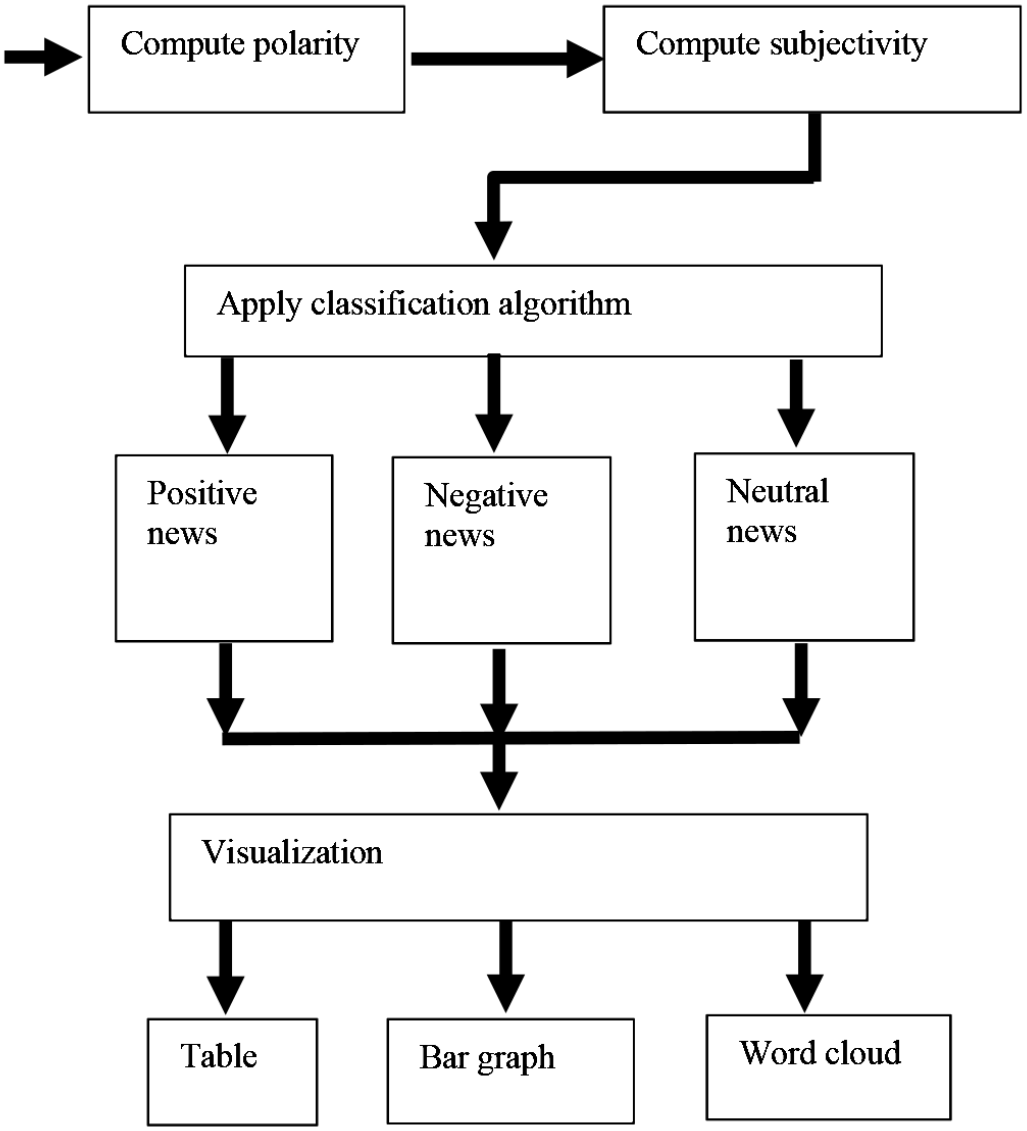

Figure 3: Python Sentiment Analysis Process Diagram

Data is obtained from the World Bank and Indonesia Stock Exchange. The environmental carbon index acts as the response variable measured by the annual metric ton of carbon emitted, while economic inequality measured by the GINI coefficient acts as the predictor variable and me-dia sentiment on digital finance measured by the polarity ranges from -1 to +1 acts as the moderat-ing variable (Nafees et al., 2018).

Measurements: Economic inequality

Economic inequality refers to income disparities among individuals. A population's income distribution is measured by the Gini index, sometimes known as the Gini coefficient to measure income inequality or wealth disparity among a population. The coefficient is a number between 0 (or 0%) and 1 (or 100%), where 0 denotes complete equality and 1 denotes perfect inequality (Feng et al., 2020). Positive wealth or income might possibly result in values higher than 1. The ratio of the regions on the diagram of the Lorenz curve is known as the Gini coefficient. The Gini coefficient is defined as A/(A+B) if the area between the line of perfect equality and the Lorenz curve is A and the area under the Lorenz curve is B. The Gini coefficient, G = 2A = 1-2B, because A+B = 0.5. When Y = L(X) is used to represent the Lorenz curve, integration can be used to get the value of B ("Heteroscedasticity and Homoscedasticity," 2007).

Although the Gini coefficient is a useful tool for examining how income and wealth are dis-tributed within a nation or region, neither income nor wealth should be treated as an absolute met-ric (Turóczy & Marian, 2012). If incomes are distributed identically within each, a high-income and low-income nation can have the same Gini coefficient: For instance, despite Turkey's GDP per person being far lower, the U.S. and Turkey both have income Gini coefficients of 0.39 to 0.40 (Sufian & Habibullah, 2021). Nevertheless, income equality is expected to be further harmed by COVID-19 (Chamlongrath & Tingsabhat, 2021). The Gini coefficient has risen by around 1.5 points in the five years after major diseases like Ebola and Zika, according to the World Bank (Agung, 2003). According to economists, COVID-19 caused the Gini coefficient to rise 1.2 to 1.9 percentage points annually in 2020 and 2021.

Empirical Models

We use the following panel data regression models to determine how economic inequality affects environmental index:

$$Y\text{it} = \beta 1 + \beta 2\text{X2it} + \beta 3\text{Z3it} + \mathfrak{u}\text{it}$$

Where Y stands for the environment carbon index, β for the regression coefficient, X for the economic inequality, and Z for the moderating variable of the media sentiment on digital fi-nance related to companies listed on the Indonesia Stock Exchange. With $\mathfrak{i}$ being the cross-sectional units, stands for $\mathfrak{i}$th of the three presidency terms, $\mathfrak{i}$ = 1, 2, ... , 3, and $\mathfrak{t}$ represents the time period (2001 to 2018).

A collection of cross-sectional units that are periodically inspected and synthesis of time series and cross-section data make up panel data. Panel data contains observations on specific mi-cro-units that have been tracked through time. Panel data provides several advantages, including the capacity to account for individual variation that time series cannot, which makes it more in-formative, variable, less collinear with other variables, and efficient (Anghelache, 2014).

Empirical Result

Descriptive Statistics

Table 1 reports the descriptive statistics of the observation data depicting inequality in Indonesia ever reached its lowest point of 30.0 from 2001 to 2004 while it keeps skyrocketing until it reached 40.4 from 2005 to 2008. The rising trend in equality is followed by the rising trend in carbon emission as shown by 2 metric tons of carbon emitted by Indonesia compared to only 1.4 metric tons in the previous years.

Table 1: Descriptive Statistics.

Indicator	Carbon Index	Economic Ine-quality	Media Senti-ment.
Mean	1.669	35.733	0.061
Minimum	1.406	30.0	-0.260
Maximum	2.155	40.4	0.220

Then table 2 reports the results of the fixed effect regressions revealing that the response of economic inequality to the environmental carbon index is significant and positive. Therefore, we conclude that economic inequality among individuals leads to harder environmental protection ef-forts indicated by the rising carbon emissions.

Table 2: Fixed Effect Model.

Variable	Coefficient	t-statistic	Prob.
Constant	-0.669	-1.454	0.179
Economic Inequality	0.065	5.111	0.000
Market Sen-timent (moderator)	0.000	0.103	0.920

Table 3: Random Effect Model.

Variable	Coefficient	t-statistic	Prob.
Constant	1.377	1.403	0.203
Economic Inequality	0.007	0.289	0.780
Market Sen-timent (moderator)	0.003	0.460	0.658

Table 4: Common Effect Model.

Variable	Coefficient	t-statistic	Prob.
Constant	-0.669	-1.454	0.179
Economic Inequality	0.065	5.111	0.000
Market Sen-timent (moderator)	0.000	0.103	0.920

The fixed-effect model is the most accurate model found through panel data regression analysis to forecast the association between the economic inequality and environmental carbon in-dex moderated by the capital market sentiment during three presidency terms from 2001 to 2018. The Adjusted R-Squared shows 0.68 which means that 68 percent of variations in the environmen-tal carbon index can be explained by this model.

Chow test

Chow test examines the fixed-effect with the restricted residual sum of squares (RRSS) being that of OLS on the pooled or common effect model and the unconstrained residual sum of squares (URSS) being that of the LSDV or fixed effect regression model, this F-test chooses between common-effect and fixed-effect models.

If F less than F table or p-value is less than significance level (α), H0 is rejected. The Hausmann test is conducted when the Chow test indicates that the related model is fixed-effect. However, the model's relevance is tested when it indicates the contrary.

*H*0 : $\alpha 1 = \alpha 2 = \cdots = \alpha n = 0$ (1)

*H*1 : At least one αi is different

The p-value acquired is 0.0000. Therefore, there is sufficient evidence to reject the null hy-pothesis because the p-value is smaller than (0.05). Undeniably, there is an influence of individual effect on the environmental carbon index in Indonesia. Clearly, it can be seen by looking at the heterogeneity between sectors in economic inequality and the environmental carbon index.

Hausmann test

The Hausmann test compares the random-effects model to the fixed-effect models as the following:

*H*0 : correlation (Xij, uij) = 0 or model fits fixed-effect

*H*1 : correlation (Xij, uij) ≠ 0 or model fits random-effects

$$W = X2(k) = (\boldsymbol{b} - \boldsymbol{\beta})[\boldsymbol{var}(\boldsymbol{b}) - \boldsymbol{var}(\boldsymbol{b})]-1(\boldsymbol{b} - \boldsymbol{\beta}) \quad (2)$$

When W is less than χ^2 or p-value is less than significance level (α), H0 is rejected, indicating that the fixed-effect model is the most suitable one. The p-value is 0.0000, which is less than (0.05). Accordingly, H0 is disproved, and the fixed-effect model performs better in this investigation than the random-effect model.

Lagrange Multiplier (Breusch-Pagan) test

LM test examines the heterogeneity in the model with the following hypothesis:

*H*0 $\sigma i2 = 0$or no residuals heteroscedasticity

*H*1 $\sigma i2 \neq 0$ or there is residuals heteroscedasticity

T is the time frame, K is the number of sectors, and eit is the common-effect model residual. The best model found is random effect when LM statistic value is greater than χ^2 or a probability value (p-value) is less than α.

Table 5: Lagrange Multiplier result

Effect	t-statistic	Prob.
Cross-section	0.001	0.966
Time	0.856	0.354
Both	0.857	0.354

As illustrated by the table, probability values for cross-section are more than the signifi-cance level α (0.05) proving no heteroscedasticity in residuals.

Endogeneity Test

Table 6: Endogeneity Test for the Independent Variable

No	Variable	Coeffi-cient	t-sta-tistic	Prob.
	Constant	48.04	53.347	0.04
	Market Senti-ment (moderator)	-8.51	-2.174	0.00

Table 7: Endogeneity Test for the Residuals

No	Variable	Coeffi-cient	t-statistic	Prob.
	Constant	0.3579	27.05	0.00
	Economic ine-quality	0.0007	2.696	0.01
	Residuals of economic ine-quality	-0.0001	-0.061	0.95
	Market Senti-ment (modera-tor)	-4.6300	-3.633	0.00

Table 8: Wald Test

No	Test statistic	Value	Prob.
	t-statistic	0.3579	0.95
	F-statistic	0.0037	0.95
	Chi-square	0.0037	0.95

The Probability value shows 0.95 indicating that variables used are not endogenous.

Conclusion

Economic inequality is really a serious issue in Indonesia creating a hard tradeoff between prioritizing the economy and the environment. The GINI coefficient shows a tragic economic gap of 40.4 in the most severe years indicating that too many Indonesians cannot afford the relatively more expensive energy-efficient technology for their households or their businesses or to just move from using plastic bags to environmentally friendly food packages. The effect of regressive income redistribution in the case argued above to be most important, when those who bear the costs of the environmentally degrading activity are poor relative to those who reap its benefits. The solid lines are the original marginal valuation curves. The broken lines depict the same curves after a redistribution of income from the poorer losers to the richer winners. Thus, there should be a fundamental restoration of Indonesia's political policies which will eventually affect its economic policies.

Democracy has failed in the United States and in Indonesia as well. It fails to give equality and justice to its people. Huge political costs for electoral campaigns push the political candidates to beg for the oligarchs' financial support. The inauguration day is the day when it's time for the elected candidate to return the favor through economic policies benefitting the oligarchs' meritorious support. Meanwhile, the oligarchs only represent 1 percent of the Indonesian population, but their accumulated wealth represents half of the total Indonesian wealth.

Obviously, politically motivated economic policies benefitting this small group only will result in even bigger wealth distribution inequalities that significantly harm the environmental protection effort mostly in carbon emission control and waste management. Big pharma and a gigantic industrial military complex are among the oligarchs influencing national economic policies in the US. For the sake of survival, economic inequalities resulting from politically motivated economic policy indirectly legitimize people's actions to exploit nature by any means necessary.

Therefore, the fifth state principle of Pancasila mandating social justice for every single Indonesian can be the best explanation for this social jealousy phenomenon. In other words, environmental protection without fair political economy policies is an impossible mission. On the other hand, the media sentiment on digital finance in early 2000s showing an insignificant impact on the relationship between the wealth distribution gap and environmental protection in Indonesia meaning that speculations or reactions from the media related to digital finance could not do anything on the impact of the existing wealth distribution gap toward the environmental protection effort in Indonesia.

In addition, the trajectory of post-pandemic global growth reveals unequal recovery, with the gross domestic product of the majority of sectors still below that of pre-pandemic levels (GDP). Only a small number of industries, including those in the commodity, health, food and beverage, and ICT-related sectors, have seen considerable GDP growth since the epidemic broke out. Low- and middle-income nations have been disproportionately impacted, as have population groups with lower levels of education, women, and young people who work in these fields, as well as smaller businesses. Additionally, the world economy is under more strain as a result of rising geopolitical tensions.

With the motto "Recover Together, Recover Stronger," Indonesia, which is currently holding the G20 presidency, has identified digital transformation as one of the three major G20 goals for 2022, along with global health and the energy transition. By putting digital transformation on the agenda, Indonesia hopes to promote a more inclusive global economic recovery, particularly through the digitization and digitalisation of MSMEs, the expansion of financial inclusion, the acceleration of digital literacy and skills, and the reform of global data governance. In the post-pandemic world, the digital economy has assumed a more prominent role as a new engine of economic growth. However, new data suggests that COVID-19 might be increasing the digital divide. To digitise and digitalise MSMEs is one agenda item under the G20 digital transformation action plan intended to mitigate this. The agenda items under the G20 digital transformation action plan also include promoting digital financial inclusion to make it possible for more underprivileged smaller businesses and unbanked populations to perform digital transactions. Even though more small and medium-sized businesses are opening accounts with financial service providers, they are still mostly excluded from formal borrowing.

There is a lot of data produced by the finance sector. Information that has been organized within a company to offer crucial decision-making insights is known as structured data. Unstructured data is available from numerous sources in growing quantities and presents important analytical potential. Every day, billions of dollars move across international markets, and analysts are tasked with accurately, securely, and quickly tracking this data in order to make predictions, identify patterns, and develop predictive strategies. The methods used to collect, analyse, store, and interpret this data have a significant impact on its value. Analysts are increasingly choosing cloud data solutions since legacy systems cannot accommodate unstructured and segregated data without complicated and extensive IT engagement.

Digitalization of the financial sector has made it possible for technologies like big data, the cloud, AI, machine learning, advanced analytics, and these to permeate and change the way financial organizations compete in the market. Large businesses are adopting these technologies to carry out digital transformation, satisfy consumer demand, and improve profit and loss. Because the data is unstructured or not captured within the company, even while the majority of businesses are storing fresh and important data, they may not know how to fully utilize it. Businesses must react to these changes in a planned and thorough way as the financial sector quickly shifts toward data-driven optimization.

Policy Recommendation

1. Indonesia needs to convene its political economy restoration to really reflect its state principles
2. Indonesia might enhance important analog and digital enablers. It might establish rules for what might be necessary before accelerating digital transformation. By considering the lessons learned from nations that have effectively adopted digital transformation, it could be able to accomplish this. For instance, Indonesia, the host nation, might discuss how it has recently drawn digital investments totaling billions of dollars and is now home to the most unicorns and decacorns in Southeast Asia. One factor for Indonesia's strong growth may be its sizable and youthful consumer base, but there must also be a supportive climate that would apply to other developing nations.

3. In essence, digital change is about people, and the Indonesian government needs to assist individuals to become more prepared. The computer abilities and literacy must also be improved. The G20 Toolkit for Measuring Digital Abilities and Digital Literacy was created by Digital Pathways Oxford University and the Centre for Strategic and International Studies as part of Indonesia's initiative to assist G20 members in measuring their digital literacy and skills. To close the digital literacy and skill gaps, more ambitious national and international complementing programs and policies are required.
4. In order to facilitate digital transformation, the G20 might help developing nations acquire and use technologies, particularly those that have been recognized as acceptable. The G20 must carry out its current commitments in the areas of digital transformation and digital trade, notably the Industrial Revolution Action Plan, the Roadmap for Digitalization, and most recently the G20 effort to promote the use of AI by MSMEs and start-ups. Using the G20 Digital Economy Task Force and Working Group, we must now operationalize and put into practice these frameworks and commitments.
5. The Indonesia government could also develop criteria for people-centered "appropriate technologies" in a manner akin to how standards are developed for climate/environmentally friendly technologies, expressing, for example, the degree to which technologies complement workers and increase productivity rather than replace workers, and maximize social welfare and might also come up with incentives to persuade private technology companies to adopt innovations that could result in more excellent jobs and, in turn, political stability. A relative tax on capital in relation to labor may also need to be reviewed by the G20 in order to encourage the development of technologies that enhance rather than replace human labor.
6. The level of security and privacy rules may be improved by the government. It may decide to adopt a set of privacy and security laws that are based on existing regulations, such as the General Data Protection Regulation of the European Union, the Personal Data Protection Act of Singapore and the development and implementation of the International Telecommunication Union's cybersecurity strategy. The G20 might

then provide technical assistance and capacity building to help members and non-members embrace the principles while making changes for the local circumstances. A nation's privacy and security legislation may have an impact on other nations' privacy and security because the majority of significant technology companies are multinational organizations with clients throughout the world.

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