TAHU

KATALOG HASIL DISKUSI

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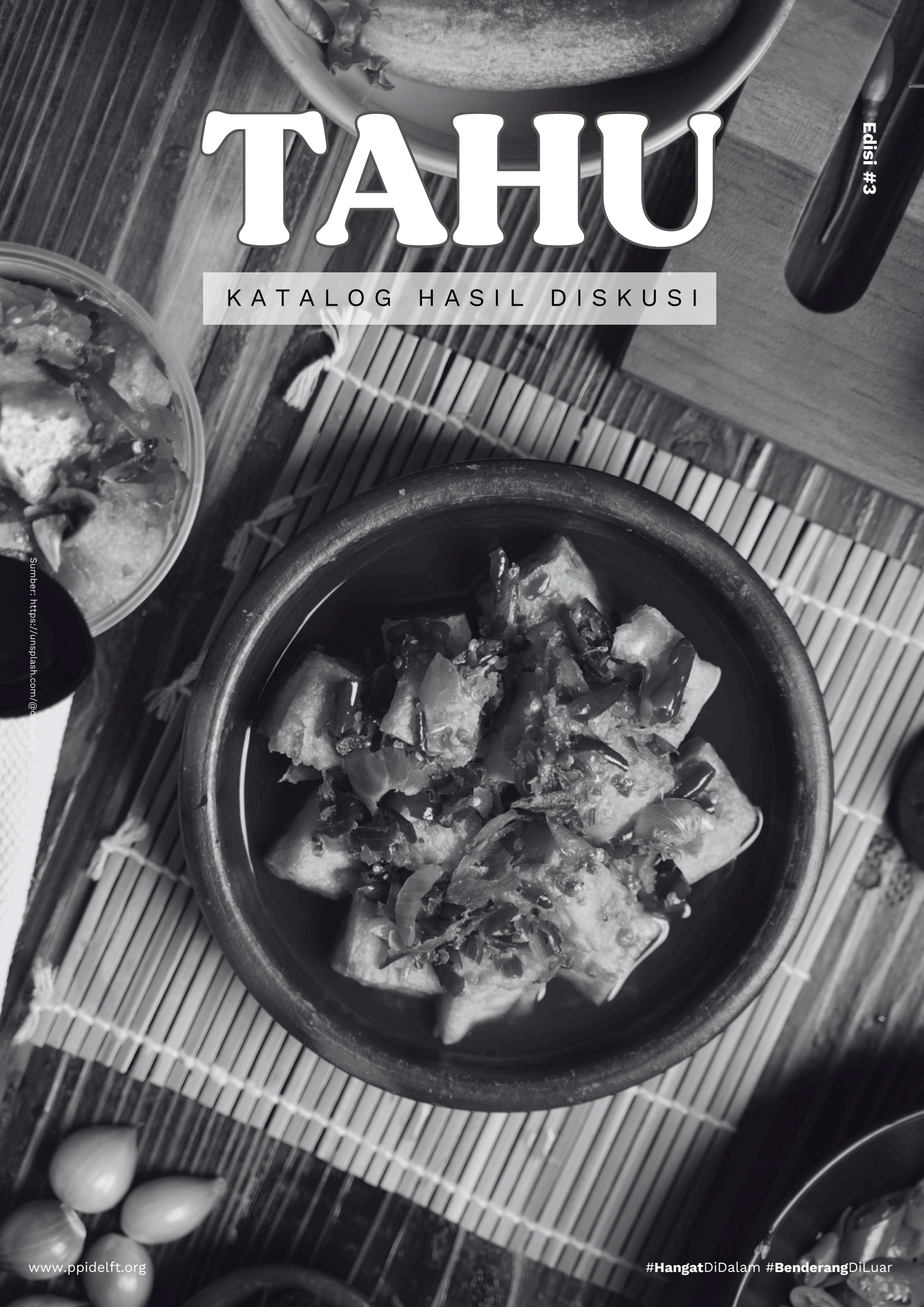

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#**Hangat**DiDalam #**Benderang**DiLuar

TAHU #03

2026 Edition

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Source: Aryo Wicaksono

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Source: Vicky Wijaya

EDITORIAL

The *Katalog Hasil Diskusi* (TAHU), or in English, simply means the Catalog of Discussion Results, is the magnum opus of each year's board of the Strategic Studies Division/ *Divisi Kajian dan Keilmuan*. Every year, new people will take responsibility to bring this division to life. With each generation, the dream of a better PPI Delft will always emerge. The dream of more meaningful discussions, more critically written papers, and the formation of more engaging participation from members. This year, those dreams have been initiated, with some far exceeding expectations, but some are still far from what was promised. Nonetheless, the third edition of TAHU, which is the culmination of our hard work and a reflection of a year of dedication, effort, and persistence, remains impressive, at least for me.

During the 2025/2026 administration, the Strategic Studies Division held seven discussion sessions. In addition to the KOPI format, there was one additional discussion, namely SUSU, which also became a new program in this year's administration. Each discussion had themes that were very different from the others, making the seven discussion sessions that have been held special in their own way. Those seven discussions are led by one or more speakers per session, where their profile pictures, names, and backgrounds are displayed in every story in this catalogue. Furthermore, for the first time, this catalog will be written in English, so that the discussion results carried out by the Indonesian Students Association are not only circulated among Indonesians, but can also reach more readers who are interested in what we're discussing here in Delft.

This third edition of TAHU would not have been published without the help of those who spent time in the writing process. Many thanks to Thoriq and Rangin, as discussion partners from the Board of Management. Then to Ovi and Ode, who have accompanied me in the journey of this division from the beginning, followed by Bayu, Mas Brian, and Aileen, who joined along the way. Lastly, to Kak Grase and colleagues from the Media Division who helped with design, layout, and publication.

Finally, there is no greater joy than that the results of the discussions at TAHU may bring meaningful benefits to its readers. Every discussion is not simply a round of discourse with one speaker leading and the audience listening; it's about the willingness to share knowledge, the desire to learn, and the hope for a better change, from both sides. May every article written here echo the spirit of those moments, capturing not only what was said, but what was felt. And may it leave, even in the smallest way, a gentle and positive impression on you as a seeker of knowledge.

Warmest regards,

Ammar Akila Azhar
Head of the Strategic Studies Division
PPI Delft 2025-2026

Source: https://unsplash.com/@asthetik

KOPI

KOPI stands for *Koloqium Pelajar Indonesia*, which means a seminar for Indonesian students. It serves as a collaborative platform where external parties can share their experiences, research insights, and ideas in a formal setting to enrich the academic and intellectual growth of PPI Delft members. In its implementation, this event is not only intended for Indonesian students but for all parties interested in the topic.

A Night of Indonesian Cinema at KOPI #1 x Indelftnesia 2026

From Loetoeng Kasaroeng to Jumbo

Edited by Alifia Tsabita Oviningtyas

Nama yg foto

In December 2025, the Indonesian student community gathered for KOPI, a collaborative intellectual forum organized by PPI Delft together with Indelftnesia 2026. The event brought together two speakers and a lively moderated discussion to explore one of Indonesian culture's most enduring and underappreciated forces: its cinema. The event proved that Indonesian film is far more than entertainment—it is a living archive of the nation's politics, anxieties, and aspirations.

Ari Purnama: A Century of Boom and Bust

The evening opened with Ari Purnama, PhD, an assistant professor of screen media from Utrecht University, who traced the full arc of Indonesian cinema through what he called its defining pattern: boom, bust, and boom again.

Cinema first arrived in the Dutch East Indies in 1897 through the concept of gambar hidoep (moving pictures), though domestic film production only began in earnest in 1926 with Loetoeng Kasaroeng—a film made by a Dutch director but featuring an entirely indigenous cast and a story drawn from West Javanese legend. Despite the native faces on screen, Ari was quick to note the structural irony: all technical roles—camera operation, lighting, framing—were handled by Chinese-Indonesian or European technicians, while indigenous figures were largely confined to acting coaching and dialogue instruction.

The post-independence era under Sukarno (1950–1965) gave rise to what Ari called the birth of a national cinema consciousness, spearheaded by Usmar Ismail—widely regarded as the "Father of Indonesian Cinema." Ismail's Darah dan Doa (1950) and Lewat Djam Malam (1954) embodied a nationalistic realism deeply influenced by Italian Neorealism, using real locations and direct sound rather than studio sets and dubbing. Film companies like Perfini, Persari, and the state-run PFN (Produksi Film Negara) attempted to build a sustainable industry, but production plummeted from 65 films in 1955 to just 16 in 1959, overwhelmed by competition from 660 Hollywood imports that year alone, alongside Indian films and Malay-language productions from Singapore.

The New Order era under Suharto (1966–1998) was the most productive period in terms of raw output—production surged from 8 films in 1969 to over 50 by 1971, eventually averaging 60–70

Ari Purnama
Assistant Professor of Screen Media, Utrecht University

films per year through the 1970s and 80s. But productivity came at a price: heavy censorship, state-mandated self-censorship to avoid cuts by the Lembaga Sensor Film (Film Censorship Board), and the consolidation of exhibition power under Group 21, owned by Suharto's family associate Sudwikatmono, which aggressively prioritised foreign films over domestic independents.

The 1990s brought near-total collapse. Production fell from 90 films in 1990 to just three in 1999, gutted by the Asian financial crisis, the explosion of television sinetron, and the monopolisation of cinema screens. The revival, Ari noted, began almost defiantly with Kuldesak (1998) and gained commercial momentum with Ada Apa dengan Cinta? in 2001. He closed his session with a quote that framed the evening: "The Indonesian film industry has gone through peaks in the 50s, dips in the 60s, a rise in the 70s, a collapse in the 90s—and now we're in a boom again."

Maria Angelita: Cinema as a Way of Life

Where Ari provided the historical scaffolding, Maria Angelita—known affectionately as Lita—furnished the rooms with meaning. Her presentation explored Indonesian cinema not merely as an industry but as a reflection of how Indonesians actually live, fear, grieve, and dream together.

Lita opened with contemporary data that surprised some in the room: in the first half of 2025, local films dominated Indonesian box offices by a staggering margin. Jumbo, an animated film, exceeded 10 million viewers, while the top-performing international release—Mission: Impossible – The Final Reckoning—reached only 2.49 million. By 2024, Indonesia had surpassed 2,000 cinema screens nationwide, and local productions had accumulated over 80 million viewers across the year. This was not just market share—it was a cultural statement.

Lita traced how film had been instrumentalised across political eras. In the post-independence phase, children were frequently cast as symbols of the newly liberated nation—innocent but full of potential—as seen in Si Pintjang (1951) and Djendral Kantjil (1958). During the New Order, the state was more explicit: a 1981 Film Production Code of Ethics mandated that religious figures (kyai) be depicted as moral guardians, and female

ghosts like those in Sundelbolong were interpreted by scholars as stand-ins for anti-communist, anti-Gerwani narratives, positioning women as threats requiring patriarchal containment.

The post-Reformasi era, Lita argued, broke open this tightly controlled representational universe. Women began appearing not as victims or spectres but as full protagonists—Final Girls who survive and resist without male rescue. Marlina si Pembunuh dalam Empat Babak (2017) and Yuni (2021) were her centrepiece examples. She also highlighted the concept of found family as a recurring theme in Indonesian cinema—groups bonded by shared struggle, financial hardship, or illness who end up closer than blood relatives—arguing this reflects a deeply collectivist cultural fabric. The session ended on an optimistic note, pointing to the rise of animation and regional diversity, with films increasingly departing from a Jakarta-centric gaze to represent Eastern Indonesia, local languages, and indigenous ecological knowledge.

“The Indonesian film industry has gone through peaks in the 50s, dips in the 60s, a rise in the 70s, a collapse in the 90s — and now we're in a boom again.”

Discussion

The most animated exchange centred on the structural dominance of exhibition networks—Cinema 21, CGV, and Cinemax control the vast majority of Indonesian screens, leaving local films with an average of three weeks on screen against Hollywood's three months, compounded by Indonesia's significant lag in government film subsidies compared to countries like South Korea and the Netherlands. The discussion also examined the chilling effect of censorship, with the 2008 Anti-Pornography Law tightening an already restrictive environment and filmmakers routinely pre-censoring their own work, as illustrated by Perempuan Punya Cerita (2007). The conversation turned finally to horror: where the Suharto-era kyai was an omnipotent hero who always prevailed, Pengabdi Setan (2017) renders the same figure powerless—a shift participants read not as a rejection of religion, but as a more pluralistic society willing to ask whether faith alone is sufficient against the darker forces threatening collective life.

The KOPI x Indelftnesia evening left attendees with the conviction that Indonesian cinema remains one of the richest lenses to use to understand a nation that is still in the process of knowing itself.

Maria Angelita
Master Student at Museum and Heritage Studies, Reinwardt Academie

KOPI #2 Dialogue on Road Safety

Improving Road Safety for Commercial Vehicles in Indonesia

Edited by Ammar Akila Azhar

Netherlands' Sustainable Safety: Policies, Challenges, and Vision Zero Roadmap

This first session explained how the Netherlands' road safety policy evolved, how today's strategy works, and which challenges remain, with a focus on sharing lessons relevant for Indonesia. The speaker, Martijn Dijkhof, team lead for implementing the Dutch Strategic Plan Road Safety, traced developments from the 1950s rise in car ownership to the current Safe System / Sustainable Safety approach and Vision Zero agenda.

He began with history: in the 1950s–1970s, car ownership grew rapidly, new roads were built, and fatalities peaked at about 3,300 deaths in the mid-1970s, prompting the creation of a dedicated road safety research institute and a significant increase in government budgets and legal measures such as mandatory seat belts and motorcycle helmets. Over time, policy moved away from isolated measures toward a systemic approach that reshapes the whole traffic system.

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The core concept is *"Duurzaam Veilig"* (Sustainable Safety), a Dutch Safe System approach that emphasizes prevention, human limitations, and safety by design rather than blaming individual road users. It is built on five principles: three design principles (road functionality, biomechanics, and psychologics) and two organizational principles (clear responsibility and continuous learning and innovation). Roads are classified to have only one main function (flow or exchange), speed and mass differences are limited, and the road environment must match user competencies so that form, function, and use are consistent.

Despite long-term progress, current Dutch crash patterns show persistent problems: six out of ten serious road injuries involve cyclists without a motor vehicle, one in five fatalities are car occupants in single-vehicle crashes, one in eight fatalities are cyclists in crashes with cars, and pedestrians still die in collisions with cars. These patterns led to the National Road Safety Strategic Plan 2030, adopted in 2018, which combines Vision Zero with Sustainable Safety and was co-developed by several ministries, provincial and municipal associations, transport authorities, and civil society organizations.

The plan has five core elements (structural attention, unity and cooperation, risk-based policy, integrated approach, and monitoring/adjustment) and nine policy themes covering infrastructure, traffic heterogeneity, technology, vulnerable and inexperienced users, and risky behaviours such as drink-driving, speeding, distraction, and repeat offending. Looking ahead, the biggest challenges are rising cyclist and mobility-scooter casualties driven by more cycling and population ageing, plus traffic distraction, so the Netherlands is reviewing its strategy and preparing new agreements with partners to target these trends more sharply.

Commercial Vehicles and Road Safety: Lessons from Dutch Research for Indonesia

Martin Damen, researcher at the Netherlands' Institute for Road Safety Research (SWOV), unpacked the hidden risks of commercial vehicles, the unsung giants of daily life that deliver our packages but often clash perilously with the vulnerable. Drawing from SWOV's decades of independent analysis, he highlighted how delivery vans and trucks, which are vital to modern life, pose unique risks despite the country's cycling-friendly streets.

In the bike-loving Netherlands, where roads claim 4 deaths per 100,000 people, delivery vans and trucks fuel a quarter of fatalities—60% from trucks alone. These crashes rarely harm the drivers; instead, 93% of truck victims and 75% of van victims are outsiders: cyclists crushed in blind-spot right turns, pedestrians caught

(From left to right)

Martin Dijkhof
Team Leader, Strategic Road Safety Planning, Ministry of Infrastructure and Water Management, the Netherlands

Martin Damen
Managing Director of SWOV,
Institute for Road Safety Research

Road Condition in Delft (Source: Frithasya Jeniardina, 2025)

reversing, or others in head-on provincial road collisions and urban intersection failures. Trucks run 7.5 times the risk of cars, vans 3.5 times, as they log 3-4 times more kilometers. The villains? A toxic mix of mass-speed physics, shared streets teeming with seniors on bikes, drivers with fatigue from sparse rest stops, age-related maneuvering woes, and even burst tires from overload. Serious injuries, meanwhile, surge toward 15,000 yearly, a stark reversal from past triumphs.

Indonesia's vibrant streets face similar tensions, with scooters, walkers, and bikes mingling amid high-stakes traffic. Damen praised emerging local plans to upgrade key roads and vehicles but urged focus on logistics: timed deliveries, protected paths, and motorist accountability. Solutions like speed caps or side guards don't eliminate crashes but soften their blow, proving that collaboration between governments, firms, and researchers can shift the narrative from reactive fixes to proactive harmony.

This blend of stories underscores a universal truth: roads thrive when we prioritize the frail over the fast. As e-commerce booms everywhere, rethinking truck flows could safeguard lives without stifling progress.

Youth Warriors Unite: Indonesia's Push for Safer Roads

Joining online from Indonesia, Dr. Elly Sinaga, president of the Indonesia Road Safety Partnership, or IRSP, brought a message of hope and teamwork to tackle Indonesia's roads. Founded back in 2005 with a former transport minister at the helm, IRSP rallies governments, companies, and communities to slash crashes and save lives. She painted a stark picture. Motorcycles dominate 77% of 2024 wrecks, hitting young millennials aged 15 to 39 the hardest at nearly half of all victims.

Elly's passion shone through her flagship project, the Indonesia Youth Road Safety Warriors. Launched during the pandemic, it drew thousands of university students from seven campuses. They soaked up online webinars from global experts on leadership, campaigns, and core safety know-how. Then came hands-on thrills: a full week of riding drills at Astra Honda Motor's safety parks. These young trailblazers pitched their own creative drives, from social media blasts to school talks, birthing the IYRSW Coalition in late 2021. Today, alumni connect worldwide through the global YOURS network, keeping the momentum alive. IRSP doesn't stop there. They team up with firms like Astra Honda

Road Condition in Jakarta (Source: Alifiah Rina (pexels.com/@alifiaharina/)

for rider workshops tied to corporate good, guide national policies like the Road Safety Master Plan, and train over 250 local transport officers across Jakarta, Medan, Pekanbaru, Surabaya, and Yogyakarta. Elly led 45 delegates to Asia's top road safety conference last year, soaking in fresh ideas.

Looking ahead, she eyes deeper bonds with Dutch stars like SWOV and TU Delft. Think about adapting safe road designs, youth protection drives, sharper data tools, and joint research. Road safety is everyone's job, Elly stressed. By uniting sectors, Indonesia can turn chaotic streets into lifelines for all.

Indonesia's Road Safety Push: Regulations and Enforcement in Action

Imagine navigating Jakarta's bustling streets on a motorcycle, alert to every truck and pothole. A single fatigued driver or mechanical failure could change everything. In sessions four and five of a Delft webinar, Indonesian officials revealed the scale of the challenge and outlined structured responses blending regulation with enforcement.
Amirullah from the Ministry of Transportation presented 2024 data showing over 151,000 road crashes nationwide. Goods transport accounted for 27,000 incidents, buses for 21,000, with more than 26,000 fatalities. Human factors drive 70 percent of these—fatigue from insufficient rest areas, untrained drivers bypassing formal schools, and vehicles failing due to poor maintenance. Their solution centers on the Safety Management System for public transport companies. Mandated by laws such as the 2009 Traffic Act and 2019 ministerial regulation, it requires firms to appoint safety managers, identify risks, provide defensive driving and emergency training, monitor via GPS, and conduct annual audits. Compliant companies receive five-year certificates, shifting focus from profits to passenger protection.

Next, the representative of the National Police addressed road user behavior, emphasizing comprehensive strategies. They patrol high-risk zones, revoke licenses for serious violations, target overloaded vehicles, and expand electronic traffic law enforcement cameras nationwide. Preventive efforts include community seminars, social media campaigns, and leaflet distribution to raise awareness.

These presentations underscore multisector collaboration. By combining robust safety regulations with proactive policing, Indonesian authorities aim to transform hazardous roads into reliable networks. The path forward demands sustained commitment from government, companies, and citizens alike.

Sumber: https://unsplash.com/@picoftastyAssistant

SUSU

SUSU stands for *Suar Diskusi*, which means a beacon of discussion. It is a discussion forum for PPI Delft members featuring one or more discussion initiators. Topics are not limited to technology, socio-political issues, or national strategic matters, but also include hobbies and personal interests. Speakers may come from within PPI Delft (bachelor, master, or PhD students) or from external circles such as alumni, diaspora, experts, or non-PPI Delft students. The program aims to facilitate idea exchange among members, broaden their perspectives, connect those with similar interests, and serve as a platform for PPI Delft to discuss positions on national issues.

Source: Ridan Bramantya

SUSU #1

Climate Finance, Policy, and the Future of Indonesia's Energy Transition

Edited by Belina Aileen Santoso

Amidst the ongoing instability in the global geopolitical landscape, countries have yet to fully acknowledge that the financial losses from climate impacts will exceed the costs of taking immediate climate action. Due to current geopolitical dynamics, there has been a power vacuum in global climate leadership, where doors have been opened for new powers to fill strategic roles.

The change is particularly evident in the "recalibration" of the U.S policy, where withdrawals of support for key initiatives such as the Just Energy Transition Partnership (JETP) have been observed. Moreover, Germany has been seen to step forward to replace the U.S. role, while China shows its major power in energy efficiency (Energy Service Company or ESCO) that has reached the thousands in comparison to dozens in extent.

This geopolitical scene will serve as the foundation for the discussion between Mas Hari, a climate finance expert from the Climate Policy Initiative (CPI), and Indonesian students in Delft. The conversation hopes to highlight the battle Indonesia faces in its journey to transition between climate urgency and the financial and policy realities.

Indonesia's Climate Finance Gap

The financial challenge is revealed through a large investment gap, where Indonesia needs an estimated Rp 3,461 trillion to meet climate targets (NDC, or Nationally Determined Contribution). This financial amount exceeds the government's fiscal capacity.

Globally, the comparison is obvious; the cost of climate action is far lower than the potential economic loss from nonaction, with an estimated $1,000 trillion USD in discrepancy.

The message is clear: The more we wait, the higher the discrepancy between the cost of taking the action and the potential loss from the non-action, whether it is for the purpose of migration, adaptation, or direct climate impact itself.

Although the numbers clearly signal urgency, implementation is constrained by the underlying structural challenges and fundamental contextual complexities

Hari Solagratia
Manager at Climate Policy Initiative

Financial and Structural Barriers to Renewable Energy Transition

One of Indonesia's significant challenges is rooted in its financial sector. Despite growing awareness of sustainable investment, funding for renewable energy is limited and unevenly distributed. It is thus shaped by three interrelated challenges: a conservative financial sector, overlapping and uncoordinated policies, and inadequate infrastructure.

These factors reinforce each other and slow down the development and integration of renewable energy. The financial sector plays a significant role, as access to capital determines whether or not projects can move from planning to execution - thus, without this, the transition goal may remain difficult to achieve.

The Indonesian banking sector, on the other hand, is characterised by an extremely conservative and risk-averse attitude, which is a legacy from the 1998 financial crisis. This incident resulted in regulators to enforce strice prudential rules, making funds hesitant to fund new sectors, namely renewable energy. It also does not help that renewable projects are often deemed '*not bankable*' or too risky.

The private capital is skewed toward mitigation projects like solar or wind farms, as they are able to generate direct revenue. However, adaptation projects such as flood defense or agricultural resilience remain underfunded as the private sector does not find them as profitable as a business model, resulting in the dependency of these projects on public funds. Lastly, while there has been a mandate to establish a sustainable Finance Committee, other stakeholders have yet to fully agree the promotion of green financing.

Policy and Market Distortions

In terms of governmental policies, there have been a few unintentional obstacles created for accelerating the adoption of renewable energy. The Domestic Market Obligation (DMO) for coal keeps coal-based electricity artificially cheap. This reduced incentives for industry to improve energy efficiency (thus slowing growth of ESCO providers), and creates an uneven playing field for renewable energy sources that compete against subsidized prices. Meanwhile, the proposed carbon tax, intended to be used as a financial instrument to reduce emissions, has been delayed due to concerns over its impact on inflation.

Moreover, mechanisms that may help companies to invest in the renewable energy sector were never implemented. Namely, an important mechanism, such as power wheeling, a mechanism that allows private electricity producers (e.g., solar farm developers) to open up their market, did not happen.

Infrastructure and Future Signals

Without significant expansion and modernisation of existing grid infrastructure, renewable energy can not be accommodated. Funding remains limited and heavily dependent on state budgets. Despite the mentioned challenges, there remain hopes and levers that may accelerate the transition to clean renewable energy.

"Bias was found in the financial allocation of sustainable or green projects. 54% of sustainable financing currently flows to the palm oil sector. The sector itself is often viewed as 'easy money'. In contrast, only 6% of this financing goes toward renewable energy."

The upcoming 2025-2034 RUPTL (electric supply business plan) represents an important signal for planning for private investors, projected for a 3-4-fold increase in generation capacity. More than half of the new capacity is expected to come from private sector participation. By providing investors with certainty and transparency, the draft hopes to bring new light to this transition process.

With China having approximately 5,000 ESCOs, Indonesia has only 25. Furthermore, Indonesia's energy efficiency target for 2023 is only 24% of the target set for 2030. This reveals a large scope of need for investments and innovation within the sector, which is hoped to be partially fulfilled according to the previously mentioned paragraph.

New financial instruments efforts have also been developed to 'de-risk' clean energy projects for investors and banks. This provides additional support to these stakeholders who may be afraid of the 'high-risk' position they may have taken previously for investing in these sustainable projects. Examples discussed include credit guarantee schemes that may protect banks from the risk of default and investment trust models that allow public funds to be raised through capital markets to finance infrastructure projects such as power transmission. All these demonstrate a path forward, which will bring challenge, but also hope for the future.

Pathways Forward

Navigating Indonesia's energy future requires a careful balance between short-term economic interests and the long-term need for decarbonization. Caution, it is also needed to prevent nonactions as justification for slowing down the reduction of fossil fuel dependence. Inter-institutional harmonisation, especially between the Ministry of Finance, Bank Indonesia, and Financial Services Authority (OJK), as well as accelerating the establishment of a sustainable finance committee, is key to building a coordinated financial ecosystem.

With consistent policies, smart use of public finances to attract private sector participation, and bold structural reforms, Indonesia has an opportunity to tackle its challenges. Us,

As the younger generation, this demonstrates that a sustainable and resilient energy transition is not only a government goal but also an arena for learning, innovation, and contribution amidst ever-changing political dynamics.

SUSU #2

Mangrove at the Crossroads

An Economic Growth and Ecological Preservation Dilemma

Edited by Dewa Gede Pradnyanata

It is an undeniable fact that mangroves play an important role in the coastal neighbourhood, especially for the Indonesian topography. Its natural features help to protect the coastal morphology against the impact of ocean waves and erosion. It is also the place where the estuary's ecosystem lives in balance. From an economic perspective, mangrove can boost the local economy through tourism development, like in Angke Kapuk, North Jakarta, and in Wonorejo, East Java, Indonesia. Moreover, the effectiveness of the mangrove trees in capturing carbon can be utilised in the carbon trading market, which can support the national sustainability efforts. Therefore, the preservation of the mangrove forest is very important to protect.

However, the positive side still falls short of reaching the ideal conditions. Indonesia, as the home of almost 20% of the world's mangrove, with the most diverse ecosystems, has lost almost 200 hectares over the last few decades, and the count is continuing to progress. The irresponsible actions by the local communities, industries, and government are the reasons behind this loss. One of the unique cases to be discussed is the loss of mangrove vegetation in Balikpapan Bay, Kalimantan. In this 2nd SUSU series, together with Julia and Frithasya, we discussed this issue: *Why is this the case? What are the causes? And, how to remediate the damages?*

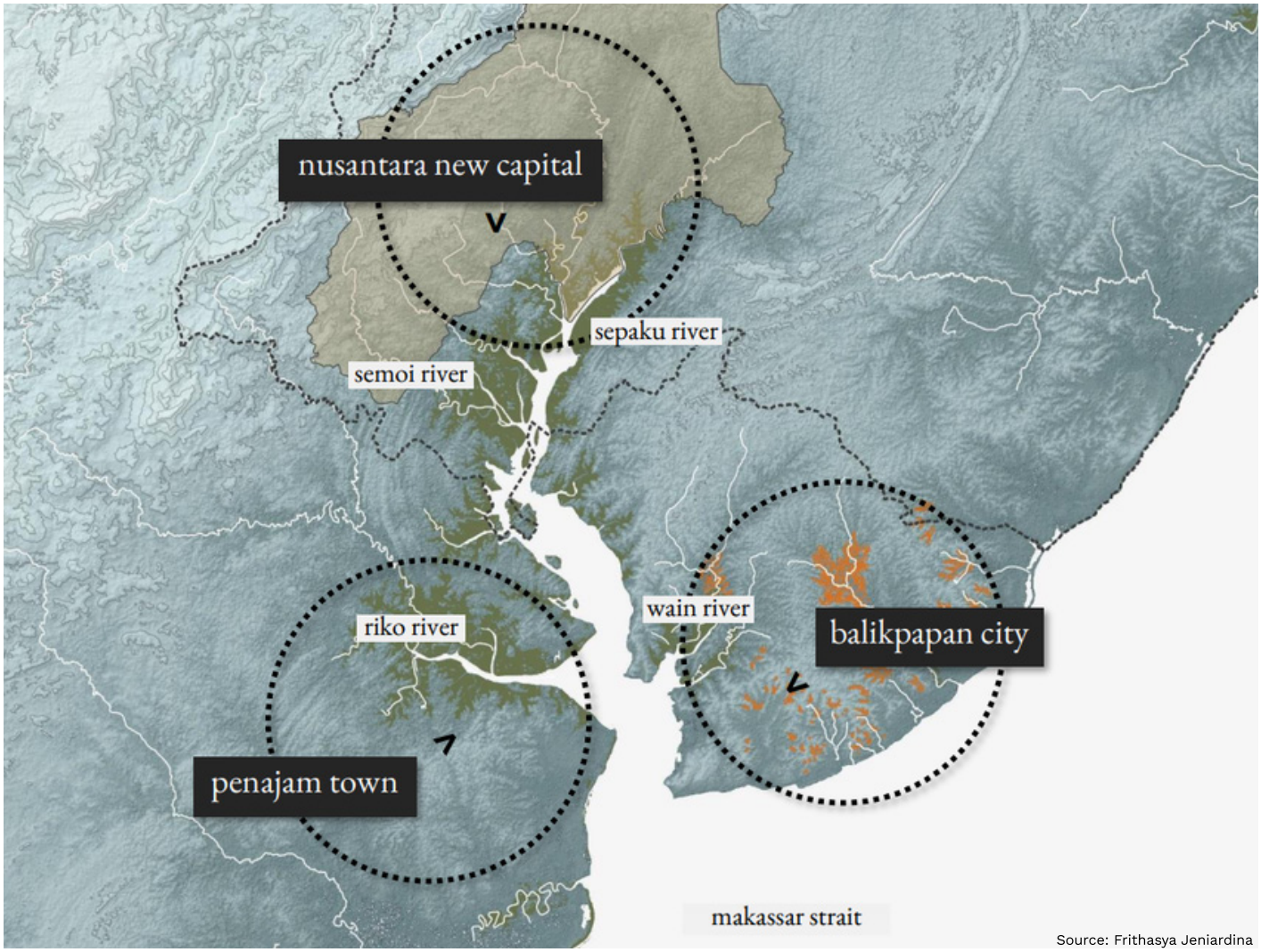
The Mangrove Forest Condition in the Balikpapan Bay

Balikpapan Bay is located in East Kalimantan province, the same province where the new Indonesian capital is located. The study conducted by Nur Afifah from Malang National University shows the reduction of the total mangrove area as much as 295,321 hectares/year. The fluctuating trend is caused by seasonal changes in rainfall, but primarily due to deforestation acts executed in several areas, yet the trend remains declining.

(From left to right)

Frithasya Jeniardina
MSc Urbanism TU Delft

Julia S. Dahlan
MSc Urbanism TU Delft



Source: Frithasya Jeniardina

There are three main factors observed that cause the loss of the mangrove area in this location, those are:

1. **The national capital mega project**, IKN (Nusantara), indirectly causes damage to the mangrove forest as the materials needed for the construction are delivered through the river and pass the mangrove area. This capital city development has a vision to become the most sustainable city by having the principle of "Harmony with Nature". However, the sacrifice of mangrove vegetation for the logistic transport does not match the jargon. Instead of relying on the local perspective, this project applies its sustainable paradigm to Western practices.
2. **Massive development of the industries** (mining and palm oil) **and coastal urbanisation.** The inland waterways in Kalimantan are the main transport for mining and palm oil products, which severely impact the mangrove preservation near the estuaries. Also, the rapid growth of the population near the coastline has forced the land conversion into residential areas. This problem is worsened by the manipulation of the Environmental Impact Assessment (EIA or AMDAL) to allow a smooth approval of the misconduct acts. By the end, this EIA is not functioning as environmental protection but just a formal justification.
3. **The local monoculture aquaculture development** in the Bay has converted the mangrove forest into large ponds. Not only is the forest being converted, but the waste from the feed is also polluting the nearby ecosystems, making it hard for the mangrove to live.

These three factors are initially aimed for the economic boost by increasing the industrial scale and making the new capital a new national economic hub. However, the irresponsible acts on the environmental impact have jeopardised the mangrove ecosystem in this region. Further actions must be taken immediately to save the mangrove ecosystem without compromising economic development. The research from Frithasya has proposed three recommendations to prevent further damage to the Balikpapan Bay.

1. The first recommendation is for the mangrove area near the new capital project. To align the project vision with local beliefs, an **eco-tourism concept** is proposed. A project called "Nusantara Heritage Forest" is aimed at preserving the mangrove forest in the upstream while also introducing the local culture and perspective on sustainability.
2. For the damage caused by industrialisation and urbanisation, an **eco-infiltrating mechanism** is proposed. Here, a strategic reforestation shall be done in critical locations around the industrial and coastal residential area by considering the coastal morphology, mangrove species selection, buffer area, and stormwater system integration. The EIA implementation shall be strict to prevent potential damage in the future.
3. A new aquaculture "tambak" system must be designed to ensure the least impact on the surrounding waters and the coastal environment. It is suggested to consider a mixed combination of aquaculture ponds and mangrove forests to protect the shorelines and remediate the ecosystem.

The mangrove preservation is the responsibility of all parties. These three recommendations will not work without the participation of the local community and the industries. The inclusivity principle must be enforced to obtain win-win solutions between the goals of raising the economy and preserving nature. Moreover, it is a big homework from the government to monitor the industrial EIA compliance. The strict implementation of the EIA will help to ensure legal protection of the environment and prevent any potential harmful activities by the industries in the future. Collaborations with academic institutions and NGO are highly encouraged. Their expertise can give another perspective to the government in making decisions.

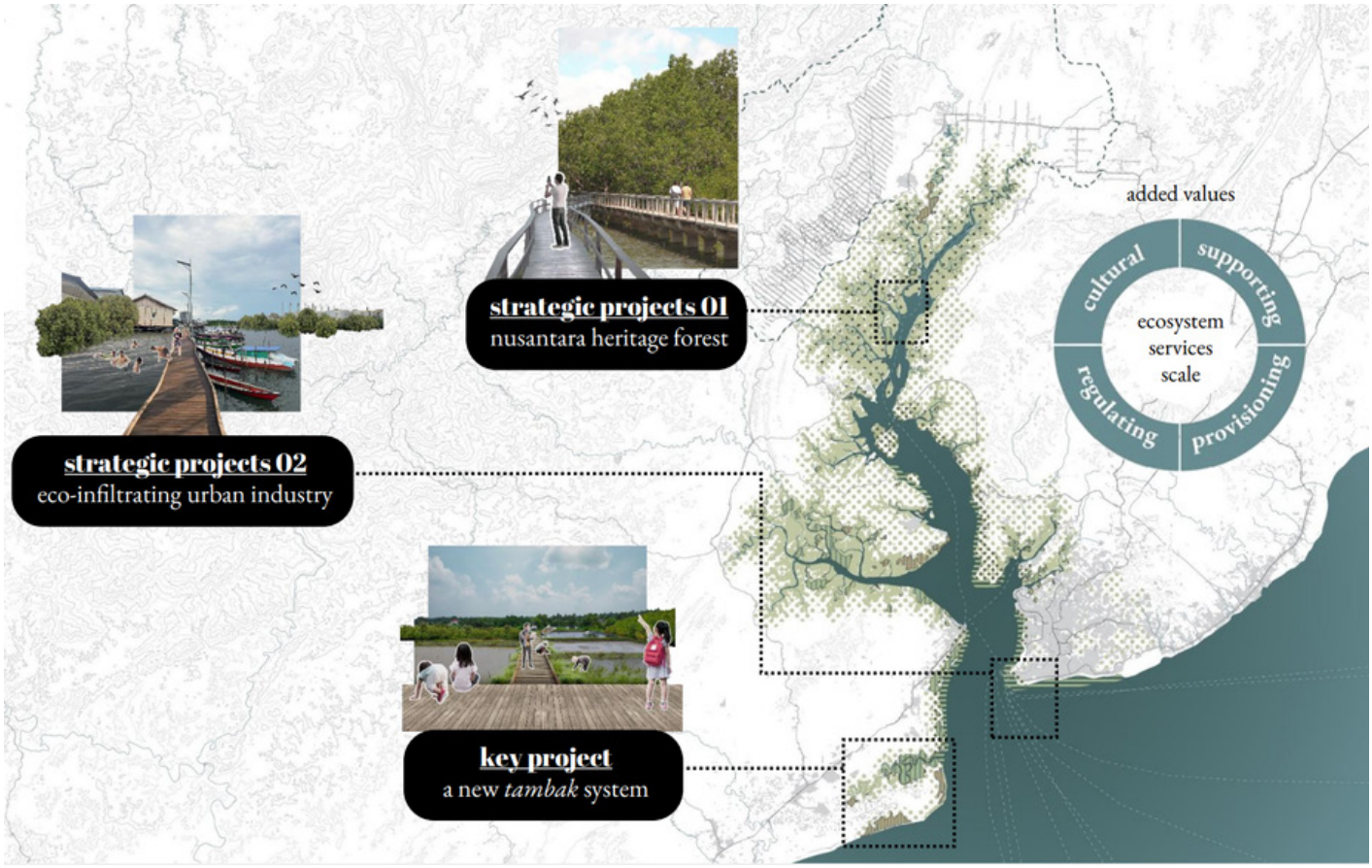
Additionally, it is worth mentioning the rights of the indigenous community in the area, such as the fishermen and the fish farmers (petani tambak). Their rights to the land and waters are protected by the law, yet the rapid developments in this region are prone to agrarian conflict in the future.

In conclusion, the preservation of the mangrove forest is integral to life in the coastal area. The economic development shall not sacrifice the existing ecosystem. The government shall have a prudential framework to harmonise the economic growth strategy with respect to the local belief in environmental preservation.

Lastly, if you are interested in this topic, feel free to read the great work from Frithasya in the following link:

https://resolver.tudelft.nl/uuid:e9d6bfe6-bfb1-4d8b-9b25-3f9ea8b5ca5a

"In the modern community, we create the dichotomy determination between nature and culture, while the indigenous people sees them as a unified entity creating a sacred connection between the people and the nature"



Source: Frithasya Jeniardina

SUSU #3

Book Club

Edited by Ammar Akila Azhar

"You cannot do statistics without logic. Otherwise, you become a data fraud, or, worse, an economist." - Nassim Nicholas Taleb

In this session of SUSU, we're shifting from an issue-focused discussion to a more relaxed, slower conversation about books. Each participant brings their own favorite books, with no limits on genre, author, or specific title. This format is intended to explore the ideas behind each book and the reasons it's currently a favorite. By not limiting the book selection, the discussion can branch into several topics at once.

At one point in the session, we discussed the development of civilization, anchored by themes from Sapiens and Guns, Germs, and Steel. At another point, we discussed a work of fiction and asked a fundamental question, "What do we seek in a book?" Sometimes reality can't compare with what happens in a fictional story, and yet people keep reading those books instead of more realistic ones, such as self-development or biography books.

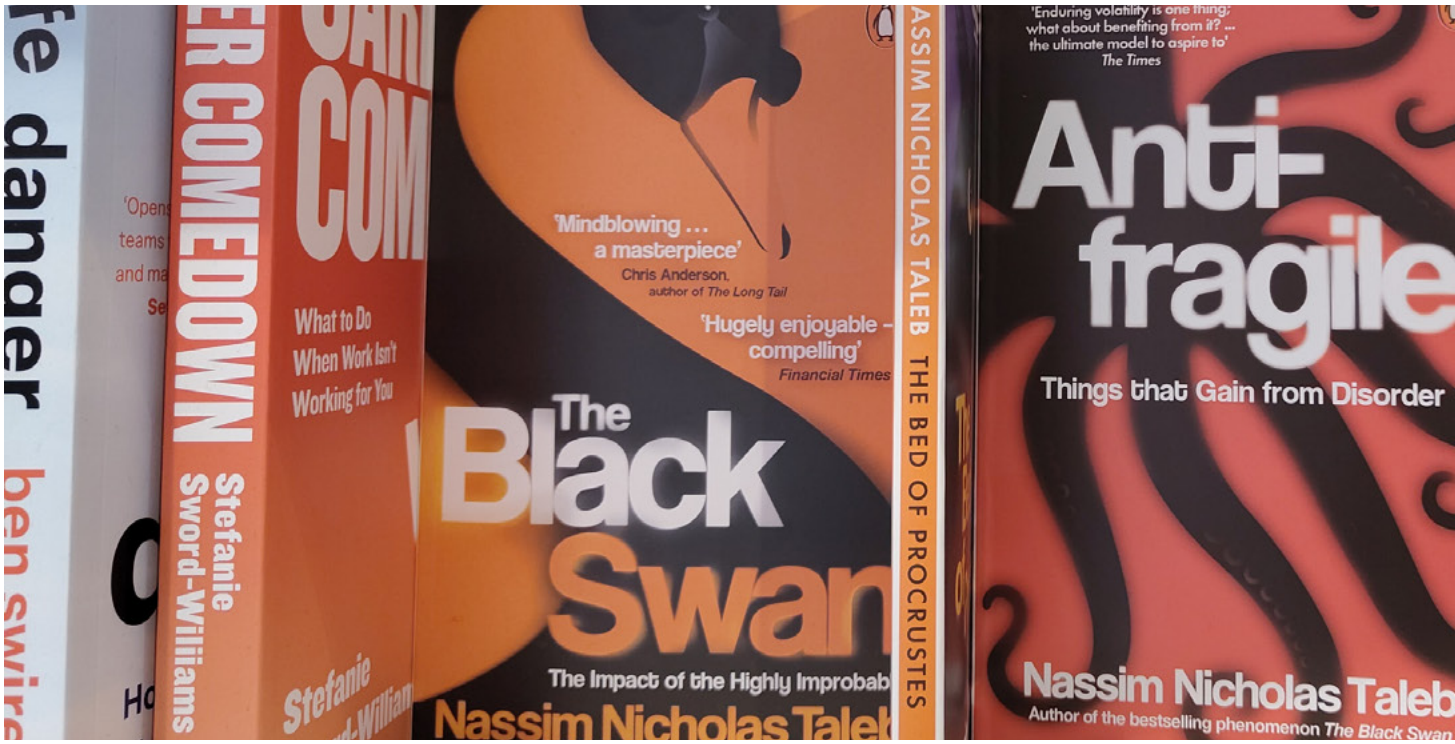
One book that truly grabs our attention is The Black Swan by Nassim Nicholas Taleb. The guy in the right-most position in the picture, Kak Fazlur, brings this book and explains why this book, and other books within the Incerto series, may give us a new way to think about uncertainty. In the next section, Kak Fazlur will give his review of this series.

Incerto by Nassim Taleb

Nassim Nicholas Taleb is a philosopher, writer, and trader known for his profound thoughts on uncertainty, risk, and probability. The Incerto series is his body of work that invites readers to reflect on the random nature of life and how we can adapt to uncertainty. These works include Fooled by Randomness, The Black Swan, Antifragile, and Skin in the Game.

Critique of Modeling

Taleb often criticizes academic approaches that rely too heavily on mathematical and statistical models without considering real-world uncertainty, variability, or the assumptions underlying those models. He argues that many academics fall into an "illusion of knowledge" and fail to grasp the random nature of life. In his view,



such approaches can be dangerous, especially when used in high-risk decision-making.

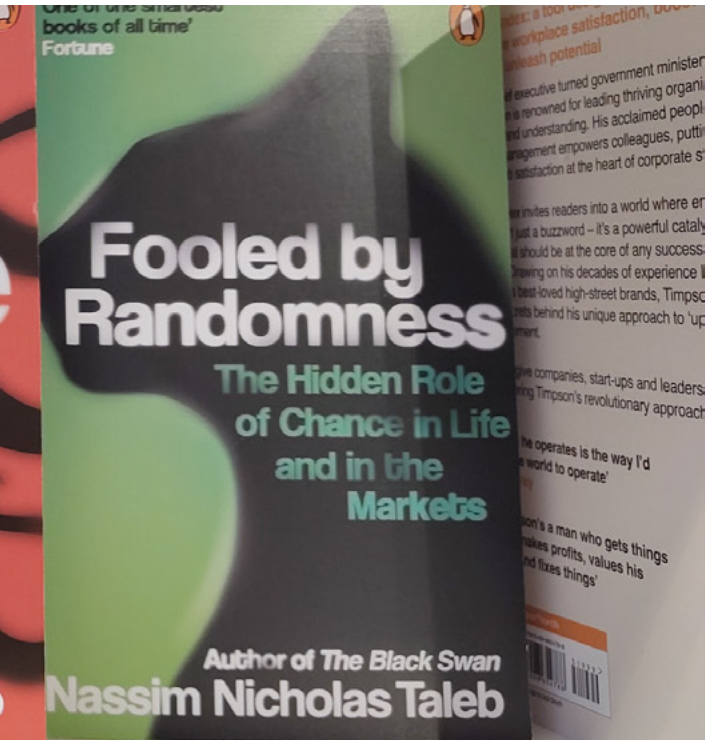
For example, economic models such as the Modern Portfolio Theory by Harry Markowitz and the Black-Scholes model by Myron Scholes and Robert C. Merton assume a Gaussian or normal distribution for market movements. Taleb criticizes these methods for ignoring rare but highly impactful extreme events (fat tails). Although these models received Nobel Prizes, Taleb contends that such recognition does not change the fact that they fail to predict and manage real-world risks. In the worst cases, these models can lead to massive losses and wipe out pension or other social security-related investment funds.

Similarly, students are not free from making flawed assumptions in statistical reporting. A common mistake is describing data using only the mean and standard deviation. By doing so, we implicitly assume a normal distribution—which isn't always accurate. For instance, if a student reports an average respondent salary of Rp3.5 million with a standard deviation of Rp2 million without checking the data distribution, the reader may be misled. Since income distributions often have a long right tail (a few people earn much higher incomes), assuming normality is deceptive: the range $\mu-2\sigma\mu-2\sigma$ could yield negative values, which makes no sense.

Reality Testing

Beyond the importance of logic in statistics, Taleb also emphasizes the need to test our assumptions or models by confronting them with reality. This process aims to obtain feedback on the validity of the proposed model. Furthermore, when a model is used for decision-making, its creators must bear full responsibility for its outcomes. He illustrates this with the "Hammurabi Code": if a builder constructs a house that collapses and kills the owner, the builder must be put to death. This underscores the importance of consequences as a filtering mechanism to remove "noise" in decision-making.

In an Indonesian context, imagine a company assigned to design and build a wind power plant for a district. Unfortunately, the engineers at that company use an overly optimistic wind-speed prediction model, resulting in unstable electricity supply and frequent blackouts. This, of course, leads to a disaster of wasted time and money. If the principle of the "Hammurabi Code" were fully applied to prevent faulty design, the designers would have to face real consequences—being required to personally fund and ensure the promised electricity supply while living in that district.



This principle could also be applied to the design and execution of public policies, such as free nutritious meals, regional minimum wages, or clean water supply systems. With tangible consequences in place, decision-makers would act more cautiously and consider a wider range of external factors, full of randomness.

Conclusion

Nassim Taleb's books may seem heavy because of the complexity of the ideas he presents and his sometimes provocative writing style. Rather than flowing linearly, his thoughts are structured like fractals, where each part is interconnected and forms a larger pattern. Taleb frequently shifts tone—from casual, street-smart expressions to elegant, layered prose à la haute couture—creating a rich, dynamic, and intellectually stimulating reading experience.

Judging the thousands of pages in the Incerto series through a few hundred words in this essay feels unfair. Still, I hope this summary provides readers with an initial glimpse into Taleb's thought. If you plan to read just one book from the series, I recommend starting with The Black Swan.

Muhammad Fazrul Rahman
PhD Candidate in Aerospace Engineering, TU Delft

Source: Ahmet Yüksek (pexels.com/tr-tr/@ahmetyuksek/)

SUSU #4

The Blessed Curse of the Archipelago

Indonesia's Mineral Wealth, the Green Transition, and the Governance of Mining

Edited by Bayu Jamalullael

Geology as Destiny

Indonesia, recognised globally as a "world geology laboratory," sits at the intersection of three major tectonic plates, namely Eurasia, Indo-Australia, and the Pacific. This unique position places the archipelago within the Ring of Fire, making it highly susceptible to earthquakes and volcanic eruptions, while also endowing it with extraordinarily rich and diverse mineral deposits, a true "blessing in disguise." The nation's geological complexity has created one of the most mineral-rich territories on Earth, spanning over 17,000 islands across a vast archipelago.

The availability of minerals in Indonesia is intrinsically connected to specific rock types formed over millions of years of tectonic activity. Acidic igneous rocks, mainly granitic formations, found in Bangka Belitung and parts of Kalimantan host significant deposits of tin, tungsten, uranium, and rare-earth elements. Intermediate igneous rocks, mainly andesitic in composition, are distributed across Java and Sulawesi, containing commercially important deposits of copper, gold, silver, and zinc. Meanwhile, the basic and ultrabasic rocks found in Sulawesi, Halmahera, and Papua contain substantial reserves of nickel, cobalt, iron, chromium, and platinum-group elements.

From Geological Wealth to Strategic Asset

Indonesia's mineral wealth is categorised into three strategic groups. Base metals, including copper, tin, zinc, and lead, constitute the foundation of industrial manufacturing. Critical minerals, with 47 types now recognised by the Indonesian government, include rare earth elements and other materials vital for advanced technologies. Strategic minerals, such as nickel and cobalt, are essential for the global energy transition. Indonesia leads global nickel production, accounting for approximately 61% of the world's mine output as of 2024, playing a key role in the global energy transition supply chain. The country also possesses the world's largest nickel reserves, estimated at 55 million metric tonnes according to the USGS, positioning it as a crucial nation in the emerging green economy.

The global energy transition has introduced a new "metal era," fundamentally transforming the demand for critical minerals worldwide. Renewable energy technologies require large amounts of minerals that were previously of limited industrial relevance. Electric vehicles alone need aluminium, nickel, copper, lithium, cobalt, and rare-earth elements for batteries, motors, and structural parts. A single electric vehicle battery can contain up to 80 kg of nickel, 6 kg of cobalt, and 10 kg of lithium. Wind turbines require iron, aluminium, copper, and molybdenum, with a single offshore turbine needing up to 8 tonnes of copper. Solar panels rely on silicon, aluminium, copper, and indium for their photovoltaic cells.

A Green Paradox

Yet this "green" transition harbours a deeply troubling paradox in that the extraction of minerals needed to build clean energy infrastructure causes extensive environmental damage. The Rock-to-Metal Ratio (RMR), developed by the USGS, measures the total quantity of ore and waste rock displaced per unit of refined metal produced. According to Nassar et al. (2022), gold sits at the extreme end of this spectrum with RMRs spanning from roughly 100,000 to over one million tonnes of rock and ore per tonne of refined gold. Copper, a cornerstone of renewable energy infrastructure, has a global average RMR of approximately 500

tonnes per tonne of refined metal, though individual lower-grade operations can generate tens of thousands of tonnes of waste per tonne produced. Even nickel, Indonesia's flagship mineral and a critical input for EV batteries, is extracted predominantly from low-grade laterite deposits that generate substantial quantities of waste material and require immense energy inputs, with Indonesian smelting operations producing an average of 93 tonnes of carbon dioxide equivalent per tonne of nickel refined. These waste mountains contain toxic heavy metals and sulfides that leach into waterways, creating acid mine drainage that can last for centuries.

The challenge facing Indonesia and the world is to meet the rising demand for critical minerals while minimising the devastating environmental impact of their extraction. Indonesia's extensive nickel reserves place it at the heart of this global dilemma. The country must choose whether to pursue rapid extraction to reap short-term economic gains from the energy transition, or to adopt sustainable mining practices that safeguard its unique biodiversity and the livelihoods of communities dependent on healthy ecosystems. This decision will shape Indonesia's development path for generations to come.

The Regulatory Architecture

Indonesia's mining regulatory framework is managed by Law No. 3/2020, an amendment to the 2009 Mineral and Coal Mining Law, and its implementing regulation, Government Regulation No. 96/2021. The system employs a structured permitting hierarchy designed to oversee the entire mining lifecycle, from initial exploration to mine closure and post-mining reclamation.

The process begins with WIUP (Wilayah Izin Usaha Pertambangan), an initial prospecting permit that grants the right to survey a designated area for mineral potential.

Following WIUP, companies must obtain an IUP Exploration (Izin Usaha Pertambangan Eksplorasi), which authorises detailed geological surveys, drilling, feasibility studies, and environmental impact assessments (AMDAL). Only after completing exploration can a company apply for an IUP Production Operations (IUP Operasi Produksi), the main "license to operate" covering extraction, mineral processing, refining, transportation, and sales. Additional permit categories include IUPK (Izin Usaha Pertambangan Khusus) for special mining areas and state reserves, and IPR (Izin Pertambangan Rakyat) for small-scale community mining operations.

"The fundamental problem is not the absence of regulations, but a systemic failure in oversight and law enforcement."

When Design Meets Impunity

However, the fundamental problem is not the absence of regulations, but a systemic failure in oversight and law enforcement. Mining Inspectors (Inspektur Tambang), who are legally mandated to supervise mining operations and ensure compliance with safety and environmental standards, often fail to perform their supervisory duties. Penalties for violations remain weak and are rarely enforced, creating a culture of impunity among mining operators. State-owned enterprises (BUMN) frequently receive preferential treatment, operating under less rigorous oversight than private companies.

The gap between regulatory design and enforcement creates a governance void that allows widespread environmental damage. Mine closure plans, although legally required, are often ignored or underfunded, leaving landscapes scarred by open pits, polluted waterways, and displaced communities with no means to restore them.

The Environmental and Social Toll

The environmental and social impacts of weak governance are serious and extensive. Freeport Indonesia's practice of dumping riverine tailings into the Aikwa River system in Papua is one of the most blatant examples of environmental neglect in contemporary mining. Over many years of operation, millions of tonnes of mine tailings have been discharged directly into the river, covering the floodplain with metres of toxic sediment, destroying the Aikwa estuary ecosystem, and polluting water sources for the indigenous Amungme and Kamoro communities. The danger posed by nickel mining to coral reef ecosystems at Pulau Gag in Raja Ampat, one of the world's most diverse marine environments, illustrates the high costs of prioritising extraction over conservation.

Acid Mine Drainage (AMD) is another significant environmental issue. When sulfide-bearing rocks are exposed to air and water during mining, they release sulfuric acid that leaches heavy metals into groundwater and surface water systems. AMD can persist for hundreds of years after a mine closes, creating a toxic legacy that far exceeds any economic benefits from the extracted minerals.

Socially, the rapid industrialisation of mining in North Maluku has led to a troubling phenomenon where easy money from mining discourages young people from pursuing education, as mining wages of approximately Rp 7 million per month attract them away from school. This pattern risks creating a long-term "resource curse" similar to

Nauru's devastating experience. This Pacific island nation exhausted its phosphate deposits, leaving it with a ruined landscape, no economic alternatives, and one of the world's highest unemployment rates.

Geopolitical Exposure and the Value Chain Trap

From a geopolitical perspective, China's strategic decision to invest heavily in overseas mineral extraction while safeguarding its domestic reserves leaves Indonesia in a structurally precarious position. China controls approximately 90% of global rare-earth element processing capacity, and its dominant position in Indonesian nickel smelting illustrates how resource nationalism, when implemented without diversified investment, can deepen rather than reduce external dependency.

Indonesia has made a deliberate attempt to move up the mineral value chain through its ore export ban. First enacted under Law No. 4/2009 on Mineral and Coal Mining and progressively tightened through successive ministerial regulations, the prohibition on all nickel ore exports has been fully in force since January 2020. The policy succeeded in its immediate objective, as Chinese firms responded by pouring an estimated USD 30 billion into domestic nickel smelting infrastructure, export revenues grew from roughly USD 6 billion in 2013 to approximately USD 30 billion by 2022, and Indonesia now processes ore into intermediate products such as ferronickel, nickel pig iron, and mixed hydroxide precipitate rather than shipping raw ore. By those measures, the ban achieved real structural change.

Yet the shift from raw ore exporter to ore processor does not, on its own, constitute an escape from the value chain trap. According to a 2025 C4ADS report, Chinese companies control approximately 75% of Indonesia's nickel refining capacity. Processing happens on Indonesian soil, but the technology, capital, corporate ownership, and off-take relationships are predominantly Chinese. Indonesia captures royalties, wages, and some tax revenue, but the margin, the technological rents, and the decisions about where refined nickel flows remain with Chinese corporate structures. True value chain participation would require moving further into

The **Code of Hammurabi.**
One of the oldest and most complete written legal codes in history
Source: Eikira (pixabay.com/users/eikira-200847/)

battery cathode materials, battery cells, and EV components, a transition that remains largely aspirational. The policy has moved Indonesia from the lowest tier of the chain to the middle tier, while handing control of that middle tier largely to a single foreign investor base.

The enforcement record of the ban also reveals a governance gap that complicates the narrative of successful resource nationalism. In 2023, Indonesia's Corruption Eradication Commission (KPK) disclosed that Chinese customs data showed at least 5.3 million tonnes of nickel ore had been shipped from Indonesia to China between January 2020 and June 2022, the very period in which the ban was fully operative. The total value of the discrepancy reached Rp 14.5 trillion, with estimated losses in royalties and export taxes of Rp 575 billion. The revelation confirmed that Indonesia had been caught off guard by its own enforcement failure, as a ban strong enough in design to reshape global supply chains proved permeable enough in practice to allow millions of tonnes of contraband ore to flow undetected. The country's challenge is therefore not merely the absence of policy ambition, but the persistent gap between what regulations declare and what institutions can enforce.

A Reckoning Written in Rock

Indonesia's story is ultimately not one of geological abundance alone, but of how a nation chooses to govern what lies beneath its soil. The same earth that yields nickel for electric vehicles also sustains the forests, rivers, and coastal ecosystems that indigenous and rural communities have depended upon for generations. The same regulatory architecture that promises environmental stewardship has repeatedly been hollowed out by enforcement failures, preferential treatment, and the quiet normalisation of impunity. Meanwhile, the global energy transition does not pause for these internal contradictions; it accelerates them, intensifying both the pressure to extract and the consequences of extraction without care. What Indonesia confronts is therefore not simply a policy problem but a civilisational one, namely, whether the country can develop the institutional resolve to govern its mineral wealth in a manner that the communities living above those deposits, and the generations who will inherit the aftermath, might consider just. The answer will matter well beyond the archipelago, for a green transition built on governance failure is neither green nor a transition worth making.

Debbie Novalina Butar
MSc Student in Applied Earth Sciences, TU Delft

Source: Vicky Wijaya

SUSU #5

The Art of Seeing Your Thesis Through

Edited by Bayu Jamalullael

The fifth edition of SUSU brought together experienced speakers from TU Delft to share strategic insights on thesis execution, time management, and the supervisor relationship. Based on practical experience in Energy Engineering and Sustainable Technology at TU Delft, the session emphasised that thesis success depends not only on research quality but also on disciplined time management, proactive communication with supervisors, and the effective use of supporting tools.

A Three-Phase Thesis Workflow

The thesis process is structured into three main phases, each with distinct time allocations. The first phase, Topic Exploration and Preparation, occupies roughly 10-20% of the total duration (about 1 to 1.5 months). During this period, students should identify 3-5 key publications to identify their research gap, draft a thesis outline including an initial methodology, and align expectations with their supervisor during a kick-off meeting. The second and longest phase, Execution (experiments, simulations, and analysis), takes up 50-70% of the total time. A recommended weekly schedule includes 1 day for reading literature and planning, 2-3 days for running experiments or simulations, and 1-2 days for data management and analysis. The critical principle here is to avoid endless reading or experimenting without pausing to analyse why certain results occurred.

The final phase, Finalisation and Defence, occupies 20-30% of the time (about 1 to 1.5 months). This includes reviewing initial expectations, evaluating data sufficiency, requesting a dry-run presentation session for detailed slide-by-slide feedback, and ensuring all administrative requirements are met. Supervisors typically focus most on the Introduction, Conclusion, and the clarity of figures and graphs during their review. The green light session usually takes place 6-8 weeks before the final defence, though this can be shortened to as little as 4 weeks through good communication with the graduation committee.

Navigating Thesis Choices

Choosing a thesis topic is often a source of anxiety for students, but the speakers offered a grounding perspective. Unless you are pursuing a PhD, your thesis topic will rarely define your long-term career. Companies generally view TU Delft graduates as engineers who learn quickly, not solely through the lens of their specific thesis topic. What you work on 5-10 years after graduation will likely be entirely different. The real selling point of a Master's graduate is the demonstrated ability to conduct independent research and become an expert in a new field within 3-4 months.

Given that a thesis takes 6-9 months under the pressure of Dutch weather and heavy workload, choosing a topic you are genuinely passionate about is essential for maintaining mental health and motivation throughout the process. Students can choose between three thesis contexts, each with trade-offs: a company-based thesis offers financial compensation and practical experience but risks exploitation and conflicting expectations between academic and corporate supervisors; a campus or PhD-project-based thesis builds closer relationships with professors and provides a clearer path to publication; and a self-proposed topic brings personal satisfaction but makes it harder to find a willing supervisor.

Student-Supervisor Relationships

The relationship with your supervisor is one of the most important factors in thesis success. There are usually three types of supervisors: the Main Supervisor, usually a professor, who is often very busy and mainly guides the academic direction, introduction, and conclusion; the Daily Supervisor, often a PhD candidate, who is more involved in day-to-day progress because the thesis may support their own research; and the Company Supervisor, for external theses, who focuses on practical and implementable outcomes.

Managing the relationship between you and them professionally is critical. Students should demand regular meetings at least every two weeks (ideally weekly) and never be too passive, waiting for the professor. Meeting etiquette matters: always come with solutions, not just problems; and distinguish between progress meetings (concepts and plans) and technical meetings (like code debugging, which should be handled with the daily supervisor or PhD candidate). Scope creep is a constant risk that students must learn to say "No" and limit their research scope from the beginning. If new potential developments are discovered mid-research, they should be noted as recommendations for future research rather than expanding the current thesis and delaying graduation.

In this process, students need to take the lead. Good practices include being clear from the beginning about your availability, working hours, and holiday plans; agreeing on expectations early, whether the priority is publication, skill development, or finishing on time; setting up a regular meeting rhythm for progress updates, midterm reviews, and green light sessions; and using brief moments before or after meetings to discuss career plans or ask for advice on writing and presentations.

“Your thesis is a marathon, not a sprint. Consistency and discipline matter more than perfection.”

Thesis Assignment Rubric

Understanding the thesis assessment rubric is also essential for strategic planning. Based on the Mechanical Engineering faculty rubric at TU Delft, the grading is divided into three main categories. Content evaluates the student's ability to integrate theory from multiple sources independently, develop new theories or designs using mathematical, numerical, or experimental methods, and produce results significant enough for journal publication or industrial application. Communication assesses report quality (structure, referencing, clarity), visual presentation (investing time in clear figures and graphs is crucial, as poor visuals diminish reader engagement), and defence performance, where students should "sell the story" rather than simply presenting raw data. Process evaluates independence (acting as a project manager who takes initiative), critical thinking (being critical of one's own results, literature, and expert opinions), and openness to feedback.

Panji Baskara Tamarona
PhD Candidate in Process and Energy, TU Delft

Effective Tools and Workload Strategies

Managing your workload well is essential to completing your thesis. A master's thesis worth 15 ECTS per quarter equals a full-time job, so treat it that way. Working steadily for eight hours each day is much better than pushing too hard and burning out. The speakers recommended breaking big goals into daily, weekly, and monthly targets instead of stressing about potential problems two months away—focus on what you can achieve today.

Using the right tools greatly improves thesis efficiency. For managing literature, library.tudelft.nl gives access to journals, and reference managers like Zotero or Mendeley are must-haves for organising citations throughout writing. For data and visuals, Origin creates high-quality graphs suitable for publication (student licences usually last six months), while WebPlotDigitizer helps extract data from graphs in other papers. Store all data, including results that seem "bad" at first, on OneDrive or Google Drive, as even poor-looking outcomes might prove useful later.

A solid literature review method is just as important. Limit this phase to no more than three months and avoid getting stuck in endless reading. Use the Snowballing technique: Backwards Snowballing follows references cited in top review papers, while Forward Snowballing tracks papers that cite a key study. Research gaps don't need to be revolutionary; they might be contradictions between studies, missing data, or outdated assumptions, overlooked conditions or method limitations, a lack of economic or environmental analysis for new processes, or case studies across different regions.

For writing, students can choose Overleaf or Microsoft Word, depending on their supervisor's preference. Grammarly is advised for refining grammar and vocabulary. AI tools should be used solely for brainstorming and enhancing understanding; never accept AI-generated analysis without cross-checking against the original literature and confirming with the supervisor.

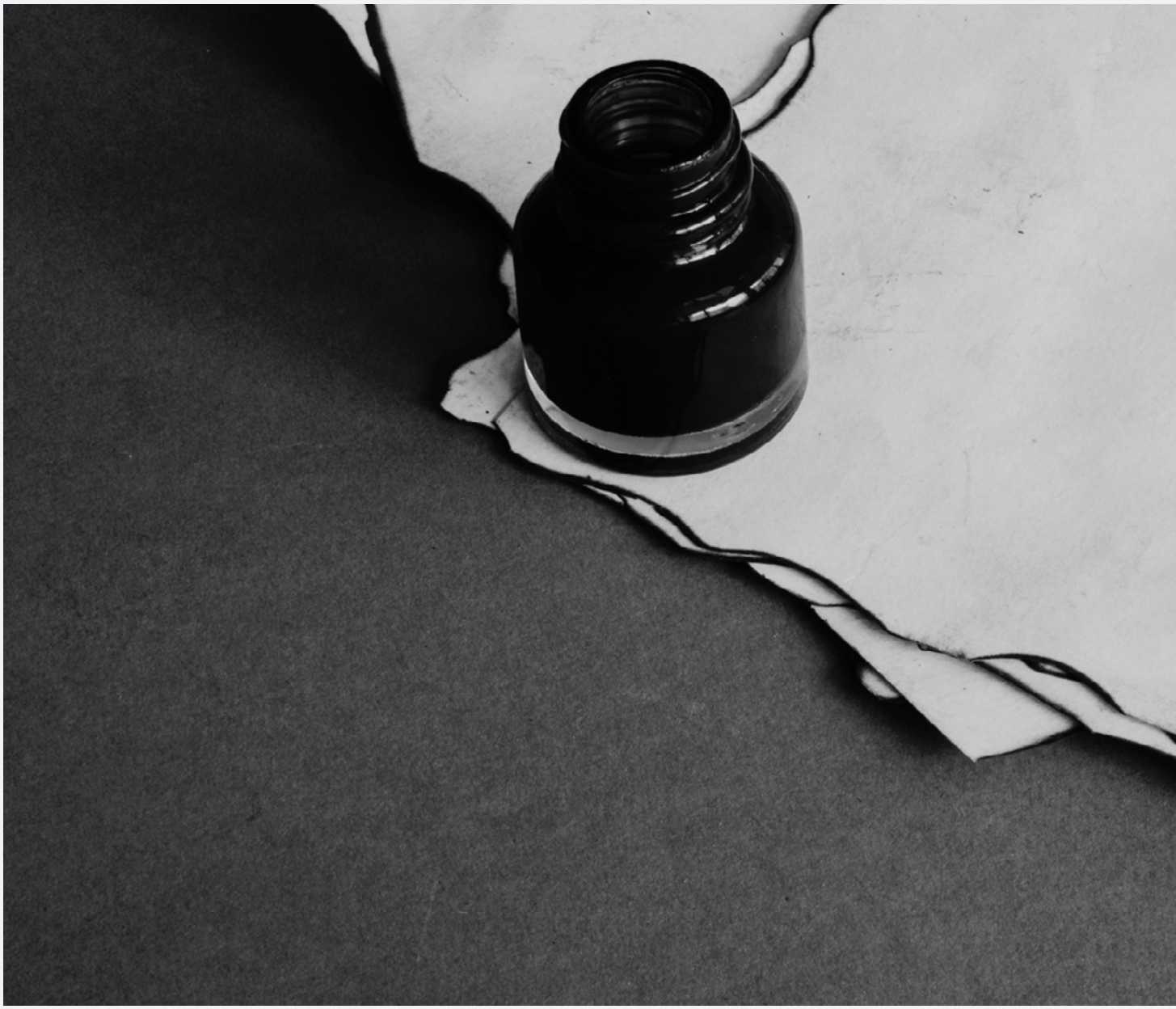
Sustaining Motivation and Writing Discipline

Motivation management deserves serious attention during the long thesis journey. Students should regularly remind themselves why they chose their topic, what skills they want to gain, and how the work benefits their future. Creating small monthly achievements and celebrating them rather than waiting solely for the final defence helps sustain motivation. Joining study groups and maintaining work-life balance are equally important. A key writing tip: do not postpone writing until all experiments are complete. Instead, write 1-2 paragraphs each time new data is obtained, gradually building the final draft as you go. In academia, "bad" experimental results still hold value as they inform future researchers about unsuccessful approaches, unlike in industry, where only successful outcomes justify investment. To graduate, students do not need perfect results; consistency, discipline (40 hours per week), and transparent communication when obstacles arise are sufficient to meet the assessment criteria.

Brian
PhD Candidate in Photovoltaics, TU Delft

"If I have seen further than others, it is by standing on the shoulders of giants. Good research is often a small improvement on the great work of others."

Source: https://www.freepik.com/



THE VOICES WITHIN

This section contains a written article submitted by an Indonesian student in Delft. It can be written in any format, such as an argumentative essay or an op-ed article, without any limitation to the theme of the article. The theme of the article is beyond the discussion topics from the previous KOPI and SUSU, which enriched the catalogue with more diverse subjects.

Source: Aryo Wicaksono

The STEM Technocratic Trap

A Reflection on Technocracy, Class, and Power

Edited by Belina Aileen Santoso

There is a distinct structural framing that is held in technocratic spaces, and it is especially load-bearing in STEM cultures: mastery in technical knowledge is equal to authority for decision-making. This is a coherent and logical stance—after all, decisions are subject to scrutiny, and there is also responsibility attached to it, hence the more knowledge one holds, the more capable they are in ensuring their decisions can be held accountable. Arguments would only be recognized when they follow numbers, models, and frameworks acknowledged by academia.

It is 'academic rigor', and it's appropriately considered as such. But academic rigor is not always epistemological—there is also political weight in it. When we zoom out, we can see that there is power attached to this framing, where technical knowledge functions as the highest form of authority. Normative STEM education operates under this power structure without considering whose knowledge counts, why it is so, and who defined the problem in the first place. The curriculum doesn't encourage these lines of questioning, not out of malice; it's simply because it lacks awareness of the relationship between politics, class, and power with their models and frameworks.

And that is something that we need to sit with and reflect on. The STEM culture is extraordinary in teaching how to solve problems, but it doesn't encourage us to consider where the problem comes from; what superstructures shape the framing of the problem. Weber calls this rationalization, where societies increasingly organize themselves into expertise and procedure. This essay does not aim to assign moral failure and contest this shift; it instead provides an illustration when such a structure goes unnoticed, which could blur decisions that are fundamentally political into neutral facts—diluted through numbers, frameworks, and procedures.

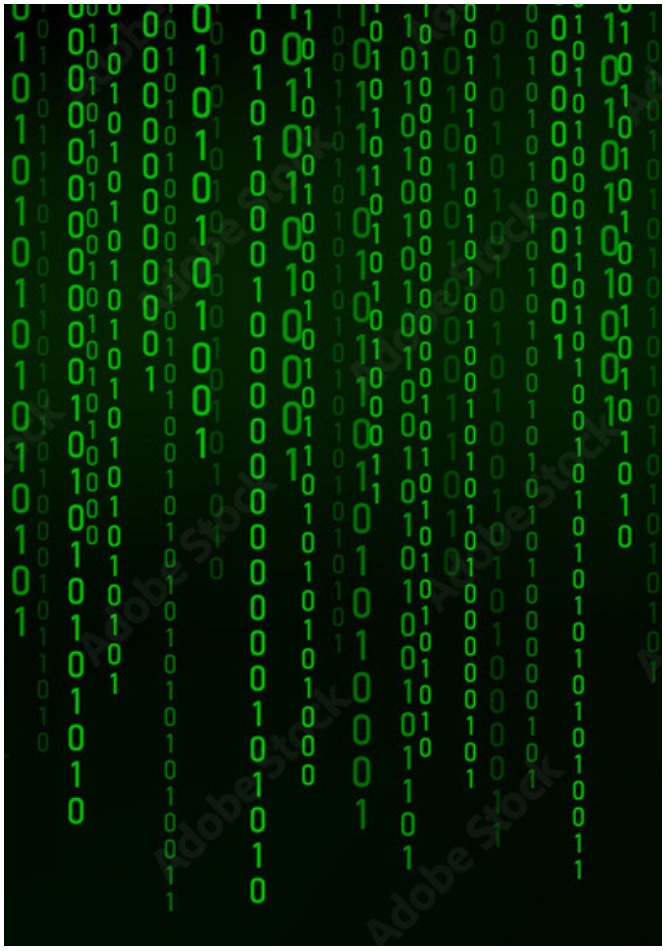
The Technocratic Lens and Class: Depoliticizing Politics

We start this essay by exploring 'the technocratic lens' concept and technocrats positioning as a class.

The technocratic lens aims to define problems through pre-defined frameworks established by academia and professionals. This is not a flawed practice, as frameworks go through stages of criticism, debates, and iterations before they are formally acknowledged. However, more often than not, the practice waters down discourses surrounding certain decisions into technicalities because it is the only language it is able to operate in. For example, questions about who controls land shift into 'land-use efficiency'. If extraction should even occur, shifts into 'economic feasibility'. Who becomes the bearer of the environmental cost reframed as a 'mitigation strategy'?

Numbers, models, and frameworks are presented as rigorous. But while they provide analytical clarity, they can also dilute political conflict through technical vocabulary. Rancière argues that technocratic governance replaces politics with administration—actual politics involves arguments, disagreement, and contestation over conflicting visions. Technocracy, however, converts these discourses into management problems, answering them under frameworks approved by 'academia and professionals' without asking: who are the actual subjects of this problem? What knowledge do they have? How must their priorities be incorporated?

STEM education plays a hand here. Through years of training, it instills an instinct to define problems in terms that are measurable, solvable, and verifiable—limited to established frameworks. What is supposedly one method of interpreting reality amongst many becomes a



Source: Aleksei Egorov, Alamy

definitive lens. See the world through a single lens long enough, and it becomes reality. Removing it becomes an act opposite to rigor—underlying political questions simply become noise and a footnote. Not realizing that sometimes, the most rigorous thing to do is to look beyond what the lens is capable of clarifying.

Furthermore, technocrats occupy a distinct class that does not necessarily own the means of production but exercises real authority over systems and knowledge. Through Wright and Poulantzas' framework of the contradictory class, they are neither capitalists nor straightforwardly workers—they act as the 'middlemen' who execute institutional power without fully owning it. The authority is legitimate, supported by expertise. But this expertise operates within institutions that already have interests and priorities embedded into its system, ones that already steer and define the problem.

The authoritative capacity assigned to technocrats, therefore, does not come purely from academic rigor—it comes from class-positioning. That authority is legitimized by ruling elites who treat technical language as the safest vehicle for their political will: numbers can be adjusted, and they are inaccessible to most people's scrutiny. Technical solutions operate within problem framings already shaped by existing political priorities. This creates a condition where politics are exercised through technical procedures: solving problems through predefined political framing, then justifying them through technical framing that doesn't question the power it operates within. This is what STEM professionals are prone to overlook—that they exercise real social power with real consequences for other people's lives, with very little built-in obligation to interrogate it.

"The authoritative capacity assigned to technocrats therefore does not come purely from academic rigor — it comes from class-positioning."

Case reflection: mining, indigenous land, and knowledge hierarchies

To have a better material grasp on how the technocratic lens and class operate, we can illustrate them through a mining project in an indigenous land, as it is a highly technical endeavor where the technocratic approach becomes relevant.

"The alternative is not to abandon expertise, but to develop what could be called epistemic humility: the awareness that knowledge exists beyond institutions and formal credentials."

Alifia Tsabita Oviningtyas
MSc Student in Construction Management and Engineering, TU Delft

When a mining project is conducted in an indigenous territory, the technocratic lens provides a structured framework to execute it: geological surveys, environmental impact assessments, economic feasibility, and infrastructure requirements, to name a few. They are carried out by professionals with credentials, operating under institutionalized frameworks, and producing analyses under the correct procedures and methodologies. The process is rigorous—and it is, when judged under technocratic frameworks.

On the other side, indigenous communities within the territory often bring something the technocratic frameworks don't have: centuries of lived-in observation, translated into knowledge on how the land behaves across generations. How the land moves through cycles, its limits and capacity, and its relationships with the local species, water, and soil. This knowledge is not myth; it is data on local ecological dynamics that a professional survey team may not be able to observe in a six-month feasibility study. But within technocratic frameworks, this knowledge is not registered as expert input. It instead becomes 'local opinion'; something to be noted, barely consulted, and contested against the 'real evidence' produced by the technocratic framework.

This knowledge hierarchy is not epistemological—it is political. Recognizing indigenous ecological knowledge as legitimate expertise would mean assigning real political power to these communities. It doesn't only challenge the technocratic framework—it also goes one order above it by directly introducing a legitimate opposing actor with valid knowledge and political motivations that the framework and the politics underneath were never designed to accommodate. This way, their analyses hold the same weight as the technocratic framework, through which political decisions had been affirmed. This destabilizes the careful calculations that had been done to justify the project.

Here, we can use Gramsci's concept of organic intellectuals. Intellectuals are not only defined as people with formal education and degrees, but they are also groups that help organize and legitimize the social power of institutions. Technocrats do so by translating political interests into technical legitimacy, which reframes what is fundamentally a political choice

into an intellectual decision. Economic feasibility, geological surveys, and infrastructure requirements are neutral findings, but the hierarchy assigned to them over other forms of knowledge becomes an authoritative call that conveniently aligns with extraction interests. It is still rigorous, but it uses a singular lens that is worn without questioning.

This is an instance of technocratic weaponization: a political choice to extract is treated as if it were the natural outcome of neutral calculations, with technocrats translating that choice into the language of feasibility and risk.

STEM Education and The Technocratic Trap

Normative STEM education fosters a culture that believes that its models are neutral. Systems are defined through modes of interpretation that are measurable: numbers and procedures to name some. Students are taught how to optimize solutions and evaluate efficiency through these frameworks, while not being aware that these frameworks have limited capability in incorporating political realities into it. While that doesn't necessarily render them unusable, there is limited training on how to critically examine their implementation in reality.

When operationalizing their frameworks, technocrats rarely ask themselves critical questions that go beyond technicalities: whose interests define the problem? Who benefits from these solutions? These questions are not considered structurally. The tragedy is that there is no intentional harm; they are simply operating under the normative STEM training, which assumes epistemic and political neutrality, by using frameworks that are not designed to incorporate such considerations into them, while not realizing they are operating within structures of power as a distinct technocratic class, where their frameworks become enforcement instruments of political will. Where the stakes may fall unevenly on people who aren't given a seat at the table. This is what we could call **the technocratic trap**.

In practice, political decisions—whether to build a new capital city, open a mine, or push a megaproject—are often taken before any rigorous

Source: Ridan Bramantya

analysis is done. STEM-trained technocrats then enter as problem-solvers, but their education has primed them to search for solutions inside the given framing rather than to interrogate who set that framing and why. This is how a seemingly neutral curriculum enables technocratic weaponization without explicitly endorsing it.

Althusser argued that academic institutions teach not only content, but also ideological conditions that allow for current structures to be sustained. In STEM education, students learn what is considered knowledge, who holds it under the current social arrangement (which is to say, the academic and professional class), and how decisions should be made from it. In this way, STEM education doesn't only train engineers and scientists; it teaches students the technocratic lens as a valid form of knowledge. This comes naturally, reasonably, and apolitically, but they could marginalize other forms of knowledge that do not easily translate into technical frameworks. The result is a professional class that is technically fluent yet politically underprepared. Not because they lack intelligence, but because the STEM education was never designed to critically examine their class position, and the relationship between their knowledge and power

Many STEM programs today are complemented with social electives, but understand that awareness of class relations and political positioning cannot be meaningfully developed with a single 5 ECTS course and seminars. To truly integrate these dimensions into the technocratic lens, sustained engagement with sociology and political theories is required. When treated as a small curriculum addition rather than a foundational perspective that shapes technocratic frameworks, the political dimensions of technical work may end up appearing as secondary considerations rather than fundamental ones.

Conclusion: Epistemic Humility

To be clear, this essay doesn't intend to contest technical knowledge. Professionals rightfully earn their credentials through formal training, and there are systematic methods that appropriately measure their competence. The critique lies in the structure that considers the technocratic lens as the sole basis of authority in decisions that are fundamentally social and political, and the lack of awareness of the technocratic class of their class position. The culture that treats technical knowledge as neutral when embedded in institutions with interests, reproduced through an education system that does not encourage their students to interrogate those interests.

There is no individual bad faith. But when the possession of procedures and methodology becomes sufficient justification for deciding whose land gets extracted and whose knowledge gets considered, it becomes important to critically examine our class positioning and the power attached to it. For many STEM students and professionals, this dynamic is easy to disown as something that happens 'up there' among ministers and senior officials. But every time we accept a problem framing as given, treat local communities as data sources rather than political subjects, or let feasibility models replace what must've been a public debate, we participate—however unintentionally—in technocratic weaponization. The point is not individual guilt, but to recognize the quiet power our training gives us in making other people's lives calculable. The alternative is not to abandon expertise, but to develop what could be called epistemic humility: the awareness that knowledge exists beyond institutions and formal credentials. That centuries of lived relationship with the land constitute a form of knowing. That communities bearing the costs of a decision might understand something about it that the feasibility study doesn't capture.

Epistemic humility also calls for us to be critical of our own knowledge and understanding. It asks us to understand that the world could not be perfectly modeled through our frameworks, and consequently, we have to actively evaluate the appropriateness of its use beyond its technical capabilities. When we know our model is not perfect, the answer is not to accept it at face value and consider other dimensions it doesn't incorporate as a footnote; it's to reframe and reiterate, until we produce something that is not only technically sound, but politically and socially just. Expertise without that humility is just authority with better footnotes. The challenge—for STEM education, for technocratic institutions, for anyone trained to solve problems—is to take seriously the question of whose problems are being solved, and for whom.

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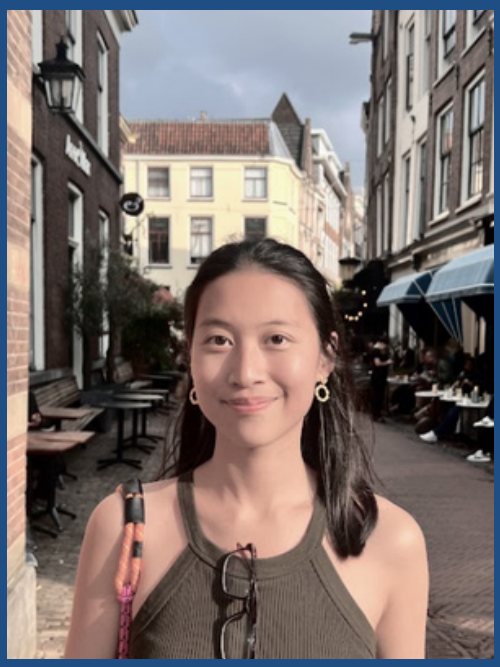

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