# Future is Now Q2 2019 Quarterly Emerging Trends Report/

The Future is Now, Quarterly Emerging Trends Report (Q2 2019)

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Over the past two decades, the most serious problems in public policy have revolved around the challenges of assessing uncertainty.

The direction of geopolitics, the risk of terrorism and financial crises, the rate of technological change, and the onset of climate change all require decisionmakers to grapple with probabilities and possibilities, the challenges of "time and chance." Many of the world's most consequential events, such as the 2008 financial crisis, the Arab Spring, or the rise of ISIS were outcomes that most did not expect.

In the public-sector context, developing strategy is more challenging because of two additional features. First, outcomes affected by risks are often abstract, which make it difficult to assess whether risks have been addressed adequately. Second, governments must manage risk while preserving public trust, even though individuals as well as officials are subject to various cognitive biases and shortcomings.

Strategic foresight helps organizations to perceive risk and opportunities that may emerge in the future, build the capability to think outside the box, and challenge existing assumptions. As a practice, it allows us to improve decision making under uncertainty in situations that demand subjective judgment.

By allocating some resources to future thinking, policymakers can take a powerful step from merely reactively adapting to the future to proactively shaping it.

The horizon-scanning process used to identify trends for this report expands our thinking beyond the immediate. Public-sector officials are often forced to be reactive, to devote their time and energy to managing the day-to-day pressures of governing. However, by allocating some resources to future thinking, policymakers can take a powerful step from merely reactively adapting to the future to proactively shaping it.

At the Asian Productivity Organization (APO), future thinking and strategic foresight continue to be a key feature of our internal processes. By looking out for signals of the future, the APO can develop programs that will be most relevant to member countries' long-term as well as immediate needs. In addition to the capability-building work the APO does across its member governments, we are now embarking on in-depth thematic research on areas such as the future of work and productivity in the Asia-Pacific, in collaboration with other leading organizations like Reos Partners. We are also developing certification schemes for strategic foresight to continue our mission of instilling foresight mindsets and practices throughout the Asia-Pacific.

I sincerely hope that you find The Future is Now both challenging and interesting. I hope that it will help you and your organization to tackle uncertainty head on.

Dr. Santhi Kanoktanaporn Secretary-General Asian Productivity Organization July 2019

#### SOCIAL EMERGING TRENDS

## 1-1 FUTURE SKILLS: RISK LITERACY

The technological breakthroughs and other disruptive changes in recent decades have made risk literacy an indispensable skill in the 21st century. Individuals, households, and organizations are expected to make decisions when provided with complex information, for example, when receiving healthcare. However, they are not always able to correctly interpret uncertainty and make appropriate decisions. One study found that 76% of US adults and 54% of Germans did not know how to express a 1 in 1,000 chance as a percentage (0.1%) [1].

Risk literacy is the ability to deal with uncertainty in an informed way [2]. Risk literacy is relevant in different careers and aspects of life. The capacity to weigh up different potential outcomes is essential to good decisionmaking, whether you are a farmer trying to interpret a weather forecast or a doctor trying to decide whether to try a new medical treatment. It has been found in multiple studies that statistical numeracy tests, such as the Berlin Numeracy Test, tend to be the strongest single predictors of general decision-making skill across wide-ranging numeric and nonnumeric judgments [3]. Risk-literate people are less susceptible to many common cognitive biases, such as overconfidence and the sunk-cost effect. They also capture people's ability to understand different investment plans and political polls.

While some policy influencers and policymakers have called for stricter laws and regulations concerning risk, there has been less advocacy for cultivating risk literacy in the public. A more risk-literate citizenry would be less vulnerable in crucial areas like finance and health and be more capable of handling tasks in a range of current and future jobs.



## 1-2 SMART TRANSPORT IN CROWDED CITIES

Half of the world's population lives in cities and that number will hit 68% by 2050, with most living in Asia [4]. This presents challenges in several areas, including transportation as streets become overcrowded in major cities. This will have adverse impacts on citizens' quality of life and productivity as they spend hours stuck in traffic or searching for parking, which they could be spending at work or leisure [5].

Chaotic, congested roads are a common feature of cities across the Asia-Pacific in countries such as Bangladesh, India, Indonesia, and the Philippines. In these places, rapid growth in urban populations and vehicle ownership have outstripped government's ability to build suitable infrastructure.

Driverless cars promise to alleviate congestion by communicating with one another, sensing obstacles, and contributing to more organized traffic flows. However, most of this technology is being developed in North America or Europe where the streets are more orderly [6]. Many argue that roads in places like India, where driving behavior is more erratic and there is a greater variety of traffic on the streets such as rickshaws, scooters, motorbikes, and even animals, are bound to be congested.

> Training driverless vehicles in these contexts is challenging. For example, Uber's former COE Travis Kalanick said India would be the last place to get driverless cars [7]. Still, congested cities also present a major opportunity as testing grounds for transformative urban solutions.

Tata Elxsi is building a self-driving system and driving around Bangalore to build up a local dataset of videos, LIDAR data, and high-precision GPS readings. The Indian Institute of Technology Madras is developing intelligent transport systems by setting up sensors along Chennai's commuter corridors [8]. While these projects are still in their infancy, they are key steps in enabling cities to manage their current and future transport issues.

2

#### SOCIAL EMERGING TRENDS

## 1-3 Rethinking inequality

The concept of inequality, in terms of wealth and income, has become mainstream in recent years and the subject of numerous policy discussions and societal debates. The top 1% of the world's richest people own 50% of the planet's wealth. Rapid economic growth in the Asia-Pacific in recent decades has reduced poverty but also been accompanied by a growing income gap in many countries [9].

High, sustained income inequality is linked to a range of negative consequences including lower growth, more crises, and weaker demand [10]. Growing inequality can create large social costs by obstructing individuals' educational and occupational choices, damaging social trust, and increasing pressure for inefficient populist policies.

However, some researchers and thinkers are challenging this focus on disparity. They argue that the overemphasis on income inequality masks the kind of inequality that people are most concerned about: unfairness. Inequality as unfairness refers to some people being treated preferentially and others unjustly. Researchers have found that people prefer unequal outcomes to equal outcomes, provided that rewards are distributed based on merit and that there is equal opportunity [11].

This suggests that inequality is a bundled concept, containing three separate but related ideas. The first is equality of outcome, or that people should receive the same outcomes regardless of circumstance. The second is equality of opportunity, or that in society everyone should have equal opportunity regardless of their background. The third is the idea of fair distribution, or that benefits and rewards should be allocated fairly based on merit.

When policymakers, activists, and other groups aim to tackle the challenges that inequality presents, it is critical to fully grasp the concept of inequality that people consider the most relevant. In the present debate, inequalities of outcome are often taken to mean unfair distribution. However, in the workplace, if everyone is rewarded equally independent of merit, then this can create major disincentives for performance and workplace cohesion.



#### 1-4

#### SMALLER, FRACTURED FAMILIES

Several driving forces are propelling changes in family structures and household life in the Asia-Pacific and the wider world. Higher average household incomes, advances in female education rates, growing labor market opportunities for women, and longer lifespans are seen across the region [12]. As a result, young people are waiting later to marry, couples are having fewer children, and more married people are working outside the home.

Some of the key aspects of family change in the region are outlined here. First, rather than parents or the extended family being involved in marriage, there has been a shift to self-choice. Overall, marriage prevalence is expected to decline, and family sizes are set to shrink. There is some regional divergence in trends. Women in East Asia and Southeast Asia have begun remaining at work after marriage [13]. Meanwhile, in South Asia, arranged marriages persist and women still marry relatively young. Childlessness drives smaller homes in hyperurban areas like Tokyo and Beijing, where urban convenience is prioritized despite cramped conditions. There are more nontraditional family forms as divorce rates surge and more couples choose to co-habit without marriage.

These changes, driven in part by economic development and urbanization, have knock-on effects on labor markets and productivity [14]. There are long-term pressures on public finances from older populations such as long-term care costs and pension expenditures. A proportionally lower working-age population means tighter labor markets across the region, potentially a serious bottleneck for sustained growth.

What solutions to these challenges exist? How will countries in the Asia-Pacific meet the challenges and changes associated with shifting ideas of family? Policymakers in countries faced with low marriage and birth rates can make it less burdensome for women to marry and raise families while still working. For example, employers can provide parttime positions with benefits and both public- and private-sector employers can expand access to highquality childcare for working mothers.

The case of Germany, with its Alliance for the Family initiative, offers a good illustration of how different social actors can be engaged to develop solutions [15]. This initiative involves participation from individuals, businesses, associations, voluntary organizations, and local governments, all contributing to the search for creative solutions.



# 2-1 SWARM INTELLIGENCE

Swarm intelligence refers to the collective behavior of various objects, each performing simple functions and interacting with one another like insects or a flock of birds [16]. Information systems designed according to this principle manage their processes in a decentralized way through selforganization. These sorts of systems are connected to several technologies such as driverless cars, power grids with distributed energy sources, and search and rescue robots.

While individual units within the swarm can only perform a limited range of functions, together they can perform tasks that are beyond the comprehension of a single unit. For example, an ant colony may build bridges, wage war, and create superhighways of food and information. Collective systems are often capable of learning, adapting to change, and exhibiting resilience to unexpected events without requiring the coordination and control costs associated with centralized systems [17]. There are existing applications of swarm intelligence systems, often in the development and pilot stages. The US Department of Defense announced a successful microdrone demonstration in 2017 which could carry out complex missions more cheaply and efficiently [18]. Those microdrones could make collective decisions, fly in formation adaptively, and self-heal. NASA is planning on deploying swarms of tiny craft for space exploration, while the medical community is looking into using swarms of nanobots for the precision delivery of drugs and performing microsurgery, among other applications [19].

Aside from robots, there are now algorithmic systems such as Unanimous AI which use individual humans to make collective predictions, with some demonstrated success [20]. Swarms of humans use the associated software to input their predictions in real time, making microchanges to the rest of the swarm and input of other members, outperforming individuals and crowds working without the algorithms.

## 2-2 PRIVACY-PRESERVING AI

Artificial intelligence (AI) enables the rapid analysis of vast amounts of data which were once too large for humans to properly evaluate. While this can empower businesses, governments, and individuals in numerous ways, it also raises concerns regarding privacy. Sharing is one means for solving one of the largest challenges for AI development and adoption: its need for large volumes of data.

However, privacy concerns exist as a bottleneck for AI adoption, preventing many companies from leveraging the full benefits of this breakthrough technology. Companies worry about giving up sensitive data or trade secrets, most notably in the healthcare sector where exposing patient data is an obstacle to wider adoption of medical AI [21].

When AI systems are integrated into an organization's processes, information that was previously siloed becomes accessible. Previously anonymized data can become deanonymized. The current practice of employing AI while still protecting privacy involves sending information scrubbed of private details to a central hub for study in a laborious and slow process [22].

However, new approaches to AI are being developed that allow for privacy to be preserved. These new methods would allow organizations to benefit from the collective wisdom of peers and competitors without giving up sensitive information. Some of these methods include federated learning, differential privacy, and secure enclaves [23].

Owkin, a French startup, has connected more than 30 hospitals and research centers to a system that learns from all of them, while keeping each institution's data on its own computers [24]. VIA, a US startup, uses federated learning to pool data about the conditions of power transformers so that utilities from different countries or even continents can learn from one another.

## 2-3 ADVANCED FOOD TRACKING

Food travels a complex path from the farm to the table, and any records of this journey are kept in local systems, so information is left disaggregated and siloed. This poses a challenge for organizations interested in finding the sources of food contamination and in reducing waste. According to the World Health Organization, around 600 million people, or around one in 10 worldwide, fall ill after eating contaminated food [25]. The UN Food and Agricultural Organization estimates that around one-third of the food produced for human consumption gets lost or wasted [26].

A pair of technologies could help seriously reduce both food poisoning and contamination: blockchains and enhanced food packaging. The first, blockchain technology, can be used to solve the traceability problem. Growers, distributors, and retailers can be integrated into a common blockchain to create a trusted record of a food path through a supply chain. In a test using this technology, Walmart was able to trace the origin of a "contaminated" item in seconds rather than in several days [27]. Many major food-business giants such as Walmart and Carrefour have joined IBM's food-related blockchain, Food Trust. There are solutions being developed locally in the Asia-Pacific as well. For example, SunMoon Food Company Ltd has incorporated blockchain technology into its supply chain for Fuji apples as well as its frozen durian products [28].

To prevent food poisoning in the first place, research centers and firms are creating small sensors that can monitor food quality and safety in cases, pallets, and individual products. Some examples include Vitsab International and Timestrip UK, which have developed similar sensor tags that change color if a product has been exposed to above-recommended temperatures [29]. These types of sensors, if integrated into packaging, will also help to prevent food waste by showing that food is safe to eat.



#### TECHNOLOGICAL EMERGING TRENDS

#### 2-4

#### RACE FOR A BETTER BATTERY

Today, the race to build a better battery is of enormous import, with the rise of electric cars and renewable, often intermittent, energy on the power grid. Whereas in the past, batteries were mainly used in consumer electronics, now they capture the attention of the world's largest multinationals, universities, and governments. Battery technology competition has a geopolitical dimension as well, since dominance in energy storage is expected by some to be akin to the control of coal in the 19th century or oil in the 20th.

The Asia-Pacific is a major arena for this competition, with Japan and the Republic of Korea competing with PR China to develop next-generation batteries [30]. This competition is not only relevant for accelerating the adoption of electric vehicles, which would help reduce fossil fuel emissions. It also will shape the geography of the automotive sector, one of the world's most valuable manufacturing sectors [31].

Billions of dollars are pouring into battery R&D, coming from multinationals and venture capital firms from both sides of the Pacific. There are two main areas. The first is batteries developed for electric cars such as those manufactured in Tesla's gigafactory in the USA and by SK and other producers in Asia. The second area is factory-sized batteries for the electric grid, which is just beginning.

With the transportation and energy sectors accounting for around 40% of global greenhouse gas emissions, the development of nextgeneration energy storage in both these areas could have massive sustainability benefits [<u>32</u>]. Some of the latest innovations in battery technology involve using silicon or aluminum instead of lithium to increase energy density, although there are several technical challenges that must be overcome before this becomes a mature product.

## 3-1 PLASTICS: PERILS AND PROMISE



Plastics are an incredibly versatile material, first developed in 1869, that eventually supplanted the use of steel, paper, glass, and wood in product after product and market after market [33]. They were first embraced because, unlike nonsynthetic materials, they are abundant, strong, lightweight, and flexible. Originally, plastics were considered a great boon for countries looking to preserve natural resources as they could substitute for animal and plant products like ivory or wood.

Today, the costs of plastics have become much clearer, although the extent of the environmental damage they have caused has not been fully mapped out. Every step in plastics creates pollution [<u>34</u>]. They are made from fossil fuels, which means their production inevitably increases the demand for carbon-based energy sources. Plastic production requires large chemical-processing plants that emit pollutants in the air. Disposal is an issue because plastics can take hundreds of years or more to degrade and only 9% of the plastic produced per year is recycled. The growth of plastic production, around 40% of which is for disposable use, has far outstripped the ability of waste management to keep up, leading to tremendous amounts of pollution in the oceans and on land [35]. Much of the surge in production has been driven by the expanded use of disposable plastic packaging in Asia, largely generated by five countries: PR China, Indonesia, the Philippines, Sri Lanka, and Vietnam.

Recently, there have been major developments in limiting the use of plastics. Countries in Southeast Asia such as Thailand and Vietnam have plans to ban plastic use, phasing it out in stages [36]. Traditional plastic importers like PR China, Malaysia, Thailand, and Vietnam have restricted intake. Scientists have also developed enzymes that can break down plastics [37]. Some policy entrepreneurs and economists have floated the idea of a plastic tax that can be used to finance garbage collection systems in developing countries.

## 3-2 FAUX MEAT GOES MAINSTREAM

Rising populations, incomes, and urbanization in Asia are expected to drive a 78% increase in meat and seafood demand from 2017 to 2050 [38]. This growing appetite for meat over the next three decades could cause huge increases in greenhouse gas emissions and antibiotics used in foods, contributing to climate change and adverse societal health issues.

On the other hand, plant-based proteins are less land and carbon intensive and linked to lower disease risk [39]. Several meat substitutes have been developed over the past decades, and meat alternatives made of vegetable components are gaining market share. The first generation of these alternative proteins was soy based such as quorn or seitan. Some have been used in the Asia-Pacific for a long time such as tempeh and tofu. Omnipork, a mock pork product made of mushrooms, peas, and rice is widely available across East Asia [40]. More recently, a second generation of faux meat is being developed that bleeds, tastes, and looks like meat. This is one stream of future protein, in addition to lab-grown or clean meat and insect protein, that is being developed now and is the path that is perhaps closest to mainstream adoption. Next-generation faux-meat producers, such as Beyond Meat, have gone public and raised USD240 million during their IPOs. Major chains and grocery stores have started carrying their products internationally [41].

In the future, plant-based meat may be cheaper than traditional meat, once producers can enjoy the efficiencies of mass production [42]. This is because plant-based meat requires less land and fewer resources than regular meat. It remains to be seen if these products will gain a foothold in the Asia-Pacific but given that many countries in the region have a long history of similar products, they may not face major obstacles.



#### ENVIRONMENTAL EMERGING TRENDS

## 3-3 GREAT GREEN WALLS

Desertification, the degradation of fertile land into desert, is a worldwide problem that has been accelerated by a combination of forces including climate change, population growth, and unsustainable land management. One largescale solution is now being implemented internationally to combat this trend: the Great Green Wall of Africa, a massive tree-planting project stretching across roughly 8,000 km at the southern edge of the Sahara Desert [43].

Once completed, it will be the largest living structure on the planet, three times the size of the Great Barrier Reef, although now it is only 15% completed. It is a response to a problem that first emerged in the 1970s, when fertile land in the Sahel became dry and barren in a matter of years. Without productive land to grow food or sustain lives, there are greater risks of food and water shortages as well as poverty and forced migration.

The Great Green Wall project is a collaboration between 20 countries in Africa to plant drought-resistant acacia trees and has led to the restoration of hundreds of millions of acres of degraded land in countries such as Nigeria, Senegal, and Ethiopia.

Desertification also poses a serious challenge in the Asia-Pacific, including PR China, India, Mongolia, and Pakistan [44]. PR China also has created a Great Green Wall, using mainly pine trees, to combat the encroaching Gobi Desert in its Inner Mongolia region [45]. Started in 1978, it is set to continue until 2050.

According to the Chinese government, the results of this program have been positive, with thousands of acres threatening farmers' fields and villages stabilized and the frequency of sandstorms nationwide falling by one-fifth between 2009 and 2014. However, many scientists in PR China and abroad have argued that the results have been unimpressive or even disastrous. Many of the trees planted in these areas die within the first year or use up already scarce groundwater.



#### 3-4 THE POSTNATURAL AGE



As long as humans have existed, we have been influencing the rest of the ecosystem through agriculture, selective breeding of flora and fauna, etc. With the recent development of genetic technologies, in the future there may be even more transformative changes in how humans affect the world around us. Bioengineering represents a new form of genetic information creation, transfer, and inheritance, potentially leading to a "postnatural age."

Postnaturalism is "the study of origins, habitats, and evolution of organisms that have been intentionally and heritably altered with genetic engineering, and the influence of human culture and biotechnology on evolutions" [46]. It is an emerging field that covers a wide range of topics including the possible development of wholly synthetic organisms. Synthetic biologists predict that the first fully artificial cells could spark life in little more than a decade [47]. A postnatural age suggests an era when humans take a much more active role in the ecosystem, using biotechnology such as gene-drives to create or eliminate species wholesale. For example, mosquitoes that contain gene-drives, which accelerate the passing down of a sterility mutation into the next generation, have been developed [48].

Further in the future, we may see ecosystems dominated by bioengineered creatures that satisfy human needs such as organisms designed to promote rainfall or clean up pollution. The Defense Advanced Research Projects Agency under the US Department of Defense has recently awarded grants to develop bioengineered insects that carry viruses for the gene editing of plants to alter crops in the field [49]. However, this postnatural age and its associated technologies carry significant degrees of uncertainty and risk. Genetic manipulation of organisms can result in unstable and unforeseen effects on target ecosystems.

#### ECONOMIC EMERGING TRENDS

# 4-1 AI SHARECROPPERS

As the so-called AI revolution unfolds, there is now an emerging underclass of labor which is integral to the industry. These are the thousands of low-wage workers across the globe who inventory millions of pieces of data and images, enabling and empowering AI programs [50]. Some analysts have compared this class of workers to historical sharecroppers, who worked on landlords' holdings under difficult conditions in exchange for a share of the harvest [51].

These workers help to tag and affix labels to data so that computers can understand what those data mean. Al programs require these workers to categorize data, at least initially, by, for example, identifying objects like trees and stop signs for autonomous vehicle programs.

Critics argue that these workers who perform necessary functions for high-value AI work are unfairly compensated. In the USA, companies state they are paying their workers USD7–15 per hour. Many of these jobs are outsourced to the developing world, like Southeast Asia and East Africa, where wages are lower. In Malaysia, data labelers earn as little as USD2.50 per hour [52]. Another criticism is that technology firms reduce the job to the simplest and most routine tasks possible, which narrows a worker's chance to develop skills and move up the job and wage ladder.

Microsoft researchers Mary Gray and Siddharth Suri argue that this class of workers shows that the digital economy is creating new jobs, but that those jobs are not necessarily better compensated. Further, the stark difference between the low pay that labelers receive and the long-term revenue from Al products may be building inequality into the Al economy.

The research company Cognilytica predicted that the global market for AI data labeling will exceed USD1 billion by the end of 2023 [53]. This may be a boon for Asia-Pacific countries, with PR China, India, and Malaysia being current major sources of labor. Rural workers with Internet access will be suited for these jobs as they do not need formal education.



ECONOMIC EMERGING TRENDS

## 4-2 Cryptocurrency Islands

On 26 February 2018, the Republic of the Marshall Islands issued the Sovereign Currency Act of 2018, which introduced a new blockchain-based currency called the sovereign (SOV) as legal tender off the Marshall Islands for all debts, public charges, taxes, and dues [54]. It is the one of the national digital currencies to be launched so far, along with the petro in Venezuela and the crypto-rial in IR Iran [55]. The regular currency of the Marshall Islands is the US dollar and it will continue to be used alongside the SOV.

The SOV was created by Neema, an Israeli startup that has partnered with the Marshall Islands government to develop this digital currency. The "banknote equivalent" for the SOV is being developed by a Swiss smart card wallet maker, Tangem, which is producing a smart card that contains a blockchainenabled microprocessor. This will allow users to carry cryptocurrencies in their pockets. The Marshall Islands launched the SOV in the hope that it will alleviate a number of problems the country is currently facing [56]. The first is to raise urgently needed funds to better deal with rising sea levels and financial isolation. Second, the US crackdown on money laundering has made it riskier and less profitable for international banks to work with tiny nations like the Marshalls. With the new currency, money can get off and on the island without relying on banks.

The IMF and the US Treasury Department have criticized the plan and raised several concerns including the risk of money laundering, excessive volatility, and inadequate telecom infrastructure [57]. The government and Neema have countered those concerns by outlining the anti-money laundering and "know your customer" protocols that will be included when the SOV is fully launched.

#### ECONOMIC EMERGING TRENDS

## 4-3 Surveillance Capitalism

Shoshanna Zuboff, a professor at Harvard Business School, coined the term "surveillance capitalism" to describe a new form of capitalism where intimate data on individuals are collected as the raw material that can be used for behavioral predictions for production and exchange [58]. This variant of capitalism emerged with Google, as it began to collect and organize users' behavioral data when they used its search platform. This model of "free" digital services in exchange for behavioral data has become the default business model for Silicon Valley and other global tech firms, notably Facebook and Amazon.

One of the most pernicious aspects of surveillance capitalism is that this data extraction is designed to be opaque. For example, some cell phone apps record location as often as every two seconds for sale to third parties [59]. The well-known autonomous vacuum cleaner, Roomba, is planned to be able to map customers' homes and share their floor plans with interested parties [60].

Beyond prediction, such as anticipating future purchases, firms driving surveillance capitalism came to realize that they could use digitally mediated real-time interventions to nudge users toward desired outcomes. One example is the use of Facebook data to pinpoint when teenagers were most vulnerable to specific advertising cues and targeting advertising at those moments.

Ultimately, the great fear of surveillance capitalism is not simply a loss of privacy but an erosion of individuals' decision rights, the agency that people can assert over their own futures, which are undermined by predictive systems that use your own data to modify behavior in opaque ways [61]. While the degree of predictions and control stemming from existing processes remains blunt or limited, it is easy to imagine a future where these tools are more sophisticated [62].

# 4-4 DESIGN GLOBAL, MANUFACTURE

Currently there is a pilot-driven project, hosted by the Tallinn University of Technology and funded by the European Research Council, to explore an emerging mode of production [63]. This model, called "design global, manufacture local (DGML)," builds on the convergence of digital commons of knowledge, software, and design with local manufacturing technologies such as 3D printing.

This model has the following logic: what is light (knowledge, design) can be done on a global scale, while what is heavy (manufacturing) can be handled locally. Manufacturing can rely on globally shared digital resources like designs that are decentralized. This can be used for a variety of items such as medicine, furniture, farm tools, prosthetic devices, etc. Existing repositories include Wikihouse and RepRap, which produce designs for houses and for 3D printers, respectively [64]. Global, decentralized digital commons allow for different local communities to draw on nonproprietary knowledge without incurring the costs associated with multinational companies such as patents. They are also free to adapt designs to local contexts without violating warranties and intellectual property laws.

DGML offers an alternative to large-scale industrial manufacturing which may be more sustainable. This is because it minimizes the need to ship materials over long distances, makes maintenance easier, and encourages manufacturers to design products that last as long as possible.

Some real-world cases already exist that exemplify the DGML model. One is the story of FarmHack, a nonprofit network, and the French farmers' cooperative, L'Atelier Paysan, which worked together to design and produce agricultural machines suited to their needs, independent of traditional manufacturers [65, 66].



#### POLITICAL EMERGING TRENDS

# 5-1 THE RISE OF HYDROPOLITICS

The availability of freshwater is required for economic growth and human security. As populations and economies grow, water resources have become scarcer and their availability more volatile, which opens the possibility of conflict. While historically these conflicts occur more often at the local level, disputes could also arise at the international level as water resource challenges spill across national borders. Water demand is expected to go up by 55% between 2000 and 2050, and water has been described as the "new oil" [67].

Water risks are expected to increase due to the confluence of several factors including population growth, urbanization, water pollution, climate change, and overextraction of groundwater. One worrying trend is the construction of new dams and water diversions across the Asia-Pacific in international river basins. Some river basins that are generating tension in the region are the Ganga and the Indus in South Asia and the Mekong and the Irrawaddy in Southeast/ East Asia [68]. These water basins involve APO member countries including Cambodia, India, Lao PDR, Nepal, Pakistan, Thailand, and Vietnam. Singapore and Malaysia also face challenges in negotiating freshwater access from the Johor River [69]. There are three main issues related to water in the 21st century. The first is scarcity, since a lack of safe, reliable water disrupts food production and can lead to severe health shocks. The second is the political implication of scarcity as insecure water resources and their knock-on effects can cause political instability. The third includes problems arising from the transboundary flow of water as difficulties in coordination, confusion over sovereignty and riparian rights, and nationalism can raise tensions and spark conflict.

What solutions are available for countries looking to be proactive about water management and prevent water-based conflict? One is for governments to pay farmers more for their role in managing "virtual water," or the freshwater consumed or transformed to produce commodities or services at their point of origin and traded across international boundaries [70]. Increasing transparency about how water is embedded in global supply chains allows us to better track water usage cross-nationally. Compensating farmers when they manage these resources well can allow for better product pricing that accounts for water use.

## 5-2 QUADRATIC VOTING

Thinkers and designers of modern democratic systems since the days of Athenian democracy have struggled with perennial problems. These include failures to protect minority rights, the tyranny of the majority, victories for bad candidates and policies, the use of majority rule to establish dictatorships, and the repeated inability of democracies to consider the views of the very knowledgeable. These issues show that democracies do not always reflect the intensity of people's needs and interests or the superior wisdom or expertise of certain voters.

Historically, a variety of mechanisms have been theorized and put into practice, for example, giving the votes of the more educated a greater weight, longer legislative terms, supermajority voting rules for certain issues, and various check-and-balance measures [71]. Still, these offer only partial or imperfect solutions to the problems presented by majority rule by introducing a greater possibility of political gridlock and capture of institutions by narrow interests.

Statistician Steven P. Lalley and economist Glenn E. Weyl proposed a new voting method called "quadratic voting" which can account for and manage the issues associated with traditional voting [72]. In quadratic voting, people can express how strongly they feel about an issue rather than only whether they are in favor of it or opposed to it. The way this works is that voters regularly accumulate voice credits over time to be spent on elections, referenda, etc. Voters must spend these credits to cast ballots and can choose to vote multiple times in one election.

This means that if voters care a great deal about a certain issue, such as gun control, they may spend their voice credits to vote multiple times in elections where that issue is being decided on. However, the cost of each additional vote is quadratic, and therefore the total amount you pay for N votes goes up proportionally to N<sup>2</sup> [73]. Two votes cost four credits, three votes cost nine credits, and 10 votes cost 100 credits. This means that voters could express the intensity of their preferences more clearly.

Quadratic voting allows passionate minorities to outvote an indifferent majority while restraining those that care a lot about an issue from buying too many votes. This system has been tested at the Colorado State House of Representatives in its votes on appropriation bills, leading to the selection of the Equal Pay for Equal Work Act by representatives [74].

#### POLITICAL EMERGING TRENDS

#### 5-3 BACKLASH AGAINST FACIAL RECOGNITION

A growing public backlash against facial recognition technology suggests that there is an important debate occurring on its appropriate use across countries. In June 2019, Somerville in Massachusetts became the second city in the USA after San Francisco to ban facial recognition use [75]. In the UK, there are several ongoing court cases brought by individuals and activist groups against the use of face-tracking cameras by police forces [76].

Much of this backlash is centered on concerns about the violation of privacy and the potential for this biometric data to be used in malicious or irresponsible ways. London police, responding to a freedom of information request, stated that its facial recognition system misidentified people as criminals 96% of the time [77]. The fear is that this technology can lead to wrongful arrests and that it can be systematically biased against women and nonwhites, since the underlying algorithms have been trained on datasets of white male faces [78]. Outside of policing, there are attempts to use facial recognition devices for airport check-ins, school security, assessment of worker competence based on microexpressions, and more [79]. Many of these uses have proved controversial since there is little regulation surrounding the sale and use of the technologies. It is also argued that this technology wedded to a network of cameras contributes to a broader loss of privacy in public spaces.

These technologies are beginning to be developed in APO member countries, with public surveillance systems imported from PR China to countries like Malaysia, Thailand, and Vietnam [80]. In the future, this issue may be become a source of contention and debate in Asia and the Pacific as it is currently in North America and Europe.



POLITICAL EMERGING TRENDS

#### 5-4 Better informing Civil servants



It is often assumed that public officials ignore evidence when designing or selecting public policy [81]. This is problematic because mistaken beliefs held by those officials can lead to the adoption of ineffective policies and the poor allocation of public resources. Researchers have found that officials in the UK and the World Bank are subject to various biases such as sunk-cost bias, confirmation bias, and framing effects of losses and gains [82]. One important arena of bias in public decisionmaking is the use of information by officials.

Surveys of nearly 2,000 officials in hundreds of organizations in Ethiopia found that the most frequently cited sources of information were formal field visits, discussions with frontline colleagues, and informal interactions,which are all forms of tacit knowledge [83]. A similar pattern was found among World Bank officials [84]. Civil servants frequently make systematic errors in estimating school enrollment data, population data, etc. for their districts. These errors are relevant because they can be compounded and result in resource misallocations.

Researchers at the World Bank showed that simply providing an external brief to civil servants had significant impacts on the level of errors they made [85]. However, the effects were mediated by the organizational contexts in which they worked. Where there are management practices that do not encourage information acquisition, researchers found that the effect of briefings on reducing errors was the weakest. Simply providing more information to officials may not be enough, and those looking to encourage stronger evidence-based policy may have to look at changing organizational culture in the public sector.

## WHAT DO THESE EMERGING TRENDS MEAN FOR THE ASIA-PACIFIC?

#### "Information is power." – Donella Meadows, US environmental scientist

This report briefly explores a range of emerging trends that may transform or disrupt our politics, economies, and societies in the future. Looking through these trends, some notable themes emerge concerning information and sense making which are worth further reflection and analysis by member governments.

One often-repeated mantra of the modern age is that "data is the new oil." While the analogy is not perfect, this sentiment captures the growing value of information today as well as some other key similarities. One parallel is that data in the form of raw information must be processed to be useful, much like oil needs to be refined. This process of converting information into knowledge or actionable insight is called "sense making." Among the trends included, it is clear that vast amounts of information are now being collected and processed by different organizations. Much of this is tied to new digital technologies such as AI, the Internet of Things, and the rise of big data.

This increase in the volume of data presents both tremendous promise and peril for APO member countries. In terms of promise, information can be shared as a global common independent of boundaries. The emerging model of "global design, local manufacturing" empowers local groups to share and learn from one another to produce useful products such as prosthetics without bearing heavy patent costs. Similarly, sensors and blockchains integrated into the supply chain allow for transparency and improved food safety. Quadratic voting promises to improve the quality of information gathered during the voting process, thereby improving representation and democratic governance. However, the risk is that this flow of information encroaches on privacy rights and leads to individuals being exploited or manipulated by malicious actors. Within APO member countries, government agencies, watchdog organizations, and individuals may need to manage the negative aspects of this new data economy, as expressed by Shoshanna Zuboff's "surveillance capitalism." Concerns about these risks have led to some of the trends identified in this report, such as the development of privacy-preserving AI and the growing backlash against facial recognition technology.

However, what these emerging trends also reveal is that raw information has little value. Data must be interpreted and ordered to lead to understanding and useful action. In many ways, our processes and frameworks to order information are as important if not more important than the data collected. We see that in the data economy, "AI sharecroppers" are integral to rendering big data usable by algorithms. Also, risk literacy, the ability to process and make decisions under uncertainty, has been promoted as a future skill. New conceptions of inequality, meat, and "postnatural" can help us make better sense of all the changes happening around us.

Today, the quote above from Donella Meadows may need to be refined. In our age of ubiquitous information, power may be understanding, not just information. Whoever is capable of not only collecting information but also processing and interpreting it will have an incredible advantage moving forward.

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