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About the Economic Society of Singapore

The Economic Society of Singapore (ESS), formerly the Malayan Economic Society, was established on 28 July 1956, as a result of an initiative by graduates and staff from the Department of Economics from the then University of Malaya in Singapore.

On 28 March 1969, the Society changed its name from the Malayan Economic Society to the Economic Society of Singapore, in response to the new independent and sovereign status of the Republic.

Since 1976, the Society has been one of the founding members of the Federation of ASEAN Economic Association (FAEA). The Society published a journal, the Malayan Economic Review (MER), which was later renamed the Singapore Economic Review (SER) in 1969. The SER is now regarded as the leading journal in the Asia Pacific and it is in the Social Sciences Citation Index (SSCI) indexed journal.

Today, ESS has expanded to include members from the academic, government and business sectors. The Society organizes conferences and networking sessions to foster discussions of current economic issues relating to Singapore and the region.

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Our Mission

Since Adam Smith, the study of economics was largely motivated by the need to investigate the opportunities that people have for good living. Viewed in this light, economics is to promote a spirit of inquiry for the common good of humanity:

- A ***willingness*** to investigate issues in the local, school and wider community.
- A ***readiness*** to recognize social, economics, ecological and political dimensions of issues needed to solve them.
- The ability to analyze issues and to ***participate*** in action aimed at achieving a sustainable future.

(UNESCO, Teaching and Learning for a Sustainable Future)

Our mission is to help strengthen the foundation for economics to promote the above traits among citizens and fulfill what it has originally set out to do for mankind.

The foundation we mention above comprises outlook, attitude and values. We hope our economics will promote:

- a responsible and compassionate outlook to life. We believe that every one of us must bear responsibility for the development and change of the society in which we live. Our sense of responsibility must extend beyond the afflictions caused by our own actions to include miseries around us, especially those that are within our ability to help remedy. We hope that every citizen will be mindful of the consequences that follow their actions; this will be the first step towards building a compassionate society.
- intellectual inquisitiveness by encouraging people to question both the unknown and the known. We hope to see minds freed from conformism, conservation and short-sighted interests so that morbidity will not settle in the minds of especially our young learners.
- a balance between positive and normative economics. We need to remind readers that economics is not a value-free mathematical subject; and that it is the product of a relentless effort to understand the world around us and to question the fundamental values required for sustainable living.

Together, these will lay the foundation to enable us to master the art of living, which is essentially the art of making choices that will be in line with promoting a good and harmonious living for all. This is economics for society.

Foreword

Last year, Singapore celebrated its 50th year of independence. Over the past five decades, our nation has enjoyed remarkable economic growth. Based on figures obtained from the Singapore Department of Statistics, Singapore's real Gross Domestic Product (GDP) per capita increased by more than ten-fold – from $5,300 in 1965 to more than $70,700 in 2015.

What is notable is that our economic growth was achieved without sacrificing our environment. Our pioneer leaders firmly believed that Singapore's economic development should not, and cannot be achieved at the expense of our environment. Indeed, Singapore was one of the earliest countries to create a ministry dedicated to the care of the environment. We have been instituting policies which ensured that Singapore developed sustainably including waste and water resource management.

Economics plays a key role in shaping the policies and legislation that guide Singapore's sustainable development. It can inform the design of policies to manage the competing demands from our domestic and economic sectors while facing the constraints of finite land space and limited natural resources.

Both economic and environmental considerations have always been factored into Singapore's development journey, and this will continue as our city grows. However, given the complexity of environmental issues, their solutions require not just economic tools, but also support from the community and strong political will. Thus, we developed the Sustainable Singapore Blueprint to direct our sustainability efforts till 2030. The latest 2015 edition outlines our national vision and plans through three themes: "A Liveable and Endearing Home", "A Vibrant and Sustainable City" and "An Active and Gracious Community" – to create a more liveable and sustainable Singapore.

Countries around the world increasingly recognise the need to protect the environment and embrace sustainable development. At the 2015 United Nations Climate Conference in Paris, Singapore joined more than 190 countries in adopting the landmark Paris Agreement on Climate Change. This is a significant step in the right direction as climate change is a global problem which requires the efforts of every country to resolve.

Nonetheless, transboundary environmental problems remain a key challenge, most notably air pollution caused by irresponsible companies using slash-and-burn methods to clear land cheaply. These companies have to realise that such practices will ultimately have a negative impact on their bottom-line, as consumers become increasingly aware of the cause of the haze and thus demand products that are more sustainably produced. Economic analysis has also enabled us to estimate the costs imposed on countries that have been affected by forest fires and haze. In this regard, ASEAN will be conducting a regional study on the economic, health and social impact of haze in 2015 on the ASEAN region, which would enable countries to have baseline economic, health and social data to understand the impact of transboundary haze.

The collection of articles in this bulletin will delve deeper into the relationship between economics and the environment while considering other relevant disciplines. I thank the writers for their insightful contributions, and also commend the Economics Society of Singapore for introducing this bulletin, which serves to make the subject of economics more accessible to students and the general public.

I wish all readers an enjoyable time on this issue.

Masagos Zulkifli
Minister for the Environment and Water Resources

Note from the Editorial Team

The theme of this issue, Man and the Environment, could not be a timelier one. 2016 marks the first year of the implementation of the climate change agreement reached in Paris last year. A solution to the environmental challenge of our generation may finally be in sight. And most timely, we say, as we increasingly experience for ourselves the effects of global warming.

The environment is not just about the global climate of course, and this issue covers a broad scope of other environmental concerns too. Apart from an essay on climate change (The Road to Paris and Beyond), this issue also features essays that discuss less obvious forms of pollution (Light Pollution in Singapore - Is Public Lighting a Boon or a Bane?) and the tricky issue of transboundary pollution (The Indonesian Transboundary Haze Pollution).

In our Education section, we feature a collaborative piece by the staff of Singapore University of Technology and Design (SUTD) and a member of our editorial board that explores how a multi-disciplinary approach can be used in the teaching of climate change in economics.

Good titles on a range of environmental matters are presented in the Books section for your reading pleasure.

We must not forget, of course, about the humans behind the issues. The environment matters because it has real human effects. We attempt to capture the homo sapien's (as opposed to the homo economicus's) view on the environment in the Perspective section where we interviewed two environmental advocates from Waterways Watch Society.

The winning entry of the MAS-ESS Essay Competition 2015 bookends this issue.

We hope all readers will find the content interesting, and more importantly, thought-provoking and wish you a productive journey through the pages as we begin with an interview with Professor Euston Quah, a most apt choice for this issue's theme on Man and the Environment.








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Earth's environmental problems are far from being resolved. A large part of these are due to ever-growing cities. Despite more efforts are made to improve cities, it has been difficult to change cities. One of the fundamental reasons is that people are not motivated to help change their cities. Apathy is now the number one obstacle to positive change. There is hope and Love is the antidote.

What you love, you will sustain. *Cities of Love* aims to urge, persuade and provoke fellow residents of our earth to collectively shape the cities we live in. To achieve this, her residents must again uncover the reasons to love and therefore sustain her cities. To this end, *Cities of Love* tries to identify the ingredients that could possibly be the reasons for such active love. When a city is filled by the people who love their cities, then can a city have a greater chance of advancing towards a better tomorrow. Love is a mighty force to be reckoned with.

Cities of Love comes alive with augmented reality! See, watch, and read beyond the contents of the book. Scan the pages for more photos and maybe selfie videos of the author in a new city exploring urban developments around the world. Immerse and discover more things to love about cities and inspire yourself to do the same with yours. An app will be available for download (from the App store and Google Play store) soon.

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Contents

In Conversation with
Professor Euston Quah

Born in Penang, Malaysia, Professor Euston Quah studied at the well-known school, the Penang Free School (which is celebrating its 200th year bicentennary this October 21). He continued his higher education and formative years in Canada, before coming to Singapore and joining the National University of Singapore (NUS). He stayed in Singapore after meeting his wife, Juat Mei, and after a 20-year career span at the NUS where he was Vice-Dean, Faculty of Arts and Social Sciences; Deputy Director of the Public Policy Programme (now called the Lee Kuan Yew School of Public Policy), and headed the economics department, Professor Quah accepted a new challenge to head the economics division in the newly established School of Humanities and Social Sciences at the Nanyang Technological University (NTU). At NTU, he also later chaired the School of Humanities and Social Sciences. Professor Quah's areas of teaching and research expertise are in Environmental Economics and Cost-Benefit Analysis. He has published over a hundred papers in internationally-refereed journals and major opinion pieces, including more than seven books with reputable major publishers. Well-known locally and internationally for his work on the economics of the transboundary haze pollution, Professor Quah's research and book on cost-benefit analysis has been cited as a reference guide for US Government Agencies applying for some research and project grants, and much of the cost-benefit analysis framework used by the Singapore Government today has benefitted from Professor Quah's advice on several projects such as environment (air quality), home security (crimes and incarceration), health (dengue), sports (the new stadium and sports hub), transport (wall barriers at stations), community and the arts (the esplanade phase 2), and running a problem solving 'clinic' for the Gardens by the Bay project. Professor Quah was one of two invited speakers when the Ministry of Finance launched the new Centre for Public Project Management in 2011. This new department oversees the evaluation of proposed projects and provides consultation for all proposals from Ministries, and Statutory Boards requiring funding above a certain amount. Wearing multiple hats as Editor of the Singapore Economic Review, President of the Asian Law and Economics Association, President of the Economic Society of Singapore, Member of the Social Sciences Research Council, Committee and Board Member of several Government Institutions and Statutory Organisations, and inducted into the European Academy of Sciences and Arts, Professor Quah is one of Singapore's most cited and respected academic economists. **Economics & Society** interviewed Professor Euston Quah to find out his interests and views on the value of economics in our society.

On top of being the President of the Economics Society of Singapore and the Head of the Economics Department of NTU, you also serve in many committees and are a member of a very diverse range of boards (e.g. the Competition Commission of Singapore, the Complaints Committee of the Singapore Medical Council). What is your main scope of academic expertise?

I majored in Environmental Economics, a discipline concerned with the balance between environment and the economy. I am interested in cost-benefit analysis, global warming, climate change, and the governmental and political factors concerning them.

How did you come to major in environmental economics? Did this passion start from a very young age?

Before entering university, I had been passionate about history, which was my first love. I liked to study the personalities of history makers, what made them tick, what drove their passions, and so on. I enjoyed studying the biographies of people; how they grew to become the great people that we know today. But my folks told me that I couldn't make a living by being a historian. So at college in Canada, I majored in economics, which seemed the most viable. Then I discovered the *not-so-mainstream* field of environmental economics. It is about the so-called non-market goods, like clean air and water, which I became interested in. It involves decision-making when there is a trade-off between societal issues and economic concerns.

How does that (environmental economics) differ from environmentalism?

We do not position ourselves on either side, that of environmental conservationists or commercial developers. We do a cost-benefit analysis on the issue in question and try to come up with a solution that is meaningful and sensible. I believe you can't have both at the same time. It's not possible to have a shopping mall and a forest occupying the same space. You have to decide which one makes the most economic and social sense.

So what are your views of climate change, the most demanding issue of this generation?

The reason why these climate change problems are not solvable is because everybody is using the environment for free. I see the need for a price to be intact with pollution, for example a carbon tax, which would reflect the cost of emitting carbon. In this way, people's behaviour will change if they have to pay for carbon emissions.

There is this limit of carbon emissions in Europe, where they give out a fixed amount of pollution permits. Producers can only emit the amount of carbon allowed by the number of currently-possessed permits, which could be traded among firms if they wish to pollute more. This, in turn, caps carbon emission and encourages the use of less-polluting equipment. However, this would not work in Singapore, where most industries are using more or less the same technology.

Therefore, the carbon tax is much more appropriate for the case of Singapore. Carbon tax

The reason why these climate change problems are not solvable is because everybody is using the environment for free. I see the need for a price to be intact with pollution, for example a carbon tax, which would reflect the cost of emitting carbon.

is also fair because both producers and consumers pay, while the *cap and trade* (Europe's scheme) only involves producers, though the producers can also transfer the burden to consumers. Even if the carbon tax may tax the poor more negatively, rebates can be given to help the poor. The carbon tax can also be made to be revenue neutral.

Let's move on from environmental economics. Your portfolio clearly extends beyond environmental economics matters. What do you think is the value of Economics to these very diverse portfolios?

Economics is a dynamic discipline. In addition to economic issues, economics has wide applications to social issues. That is why, in my view, economics belong to the social sciences school rather than the business school. Economics helps us to understand how society should allocate its scarce resources among competing uses. Environmental issues are no different. A piece of land has many uses. It can be a source of raw materials, used as a landfill, or used for shopping malls or housing complex, or be converted to a semi-park. It can also be left as it is – the pristine, natural environment. Each competing use has its opportunity cost, as well as its relative value to society. Economics helps us understand which use is considered efficient, in the sense that it fetches the highest net value.

Since we are on the topic of the usefulness of Economics, let us get your view on this matter — there has been a movement started in UK to relook Economics education at the tertiary level in the aftermath of the 2008 global financial crisis, where Economists were blamed for trusting in their assumptions of rational behaviour too much and not foreseeing the crisis. What are your thoughts about this movement? Are Economics undergraduates being sufficiently prepared to be useful in the real world?

First, it must be understood that the Financial Crisis is not due to economics; it is a financial crisis emanating from "greedy" behaviour of certain individuals and institutions. As I had mentioned earlier, economics is far more useful than just learning about finance. The world of today is much more complex, and it would require a greater understanding of such complexity than simple or existing market models. We have now behavioural finance

and behavioural economics, which greatly complement our purely rationalistic models of economics. However, the underlying behaviour of most people would still have rationalistic motives, where decisions are governed by largely the weighing of costs and benefits of an action. In my view, cost-benefit analysis is a very important tool of decision making, for it teaches us that there is value in non-market goods, just like any market goods. It is the failure to understand this value that may seemingly result in criticisms of conventional economics. In fact, behavioural economics does not really negate conventional neo-classical microeconomics, simply because of the lack of understanding on the value of non-market goods.

Finally, what advice would you give to students as a parting gift to close this interview?

First, I observe that students nowadays tend to lack broad interests and are too narrowly focused. They should try new things and not just settle on one. I would encourage students to read more widely — especially from other subjects so that they will be aware of new information and novel concepts from outside their discipline, which can be useful in their own discipline.

I would also say that "You must have passion". If you have passion for anything; the subject, what you are writing, what you are doing, then you will succeed. Of course, success depends on other factors as well, but passion is very important.

Light Pollution in Singapore

by **Melvin Koh**

Is Public Lighting a Boon or Bane?

I brought my family on a vacation to the Australian state of Tasmania last November. Staying on a farm was a natural inclusion into our itinerary as my two-year-old adores tractors. After a long and windy drive into the countryside, we received a warm welcome from our hosts and prepared to settle in for the night.

As I flipped through the pages of the visitor log in our guesthouse, I was surprised to see that with the exception of local Australians looking for a weekend getaway, almost all the other entries were written by Singaporean families. When I brought this up to the farmer the following day, he replied with a wry smile, "Ah, they've come to escape the Singapore lights and to enjoy the obscurity of our nightfall."

Singaporean's Affinity for Street Lighting

Now as an Economics tutor, that surprised me. What he said seemed to run contrary to the wisdom which we inherited from microeconomics. Street lighting has always been regarded as a public good, alongside national defence and other services such as dengue or flood control measures. The term "public good" refers to a good which is not only non-excludable and non-rivalrous in consumption, but also socially desirable. The social benefits are mainly derived from the ability of well-lit roads to prevent traffic mishaps due to poor visibility.

Now I have to admit that I found the lack of street lighting in Tasmania slightly unsettling, especially when I drove along the murky forest trails. I also could not help but notice that almost 80 per cent of the cars being driven around in Tasmania were white. The main reason, I presume, is to improve their visibility to other drivers at night. Given our local experience with car colours and the sovereignty of consumers (reference to the dizzying array of matt and gloss vehicle colours in Singapore), I assumed that the prevalence of white cars in Tasmania was not determined solely by individual owner preferences, but likely involved some element of moral suasion from the government. In fact, regression analysis done on data from Western Australia and Victoria showed that white vehicles had a 47 per cent lower crash risk compared to black cars under dawn or dusk conditions.[1]

What surprised me further as an Economics tutor based in Singapore was the revelation that my fellow countrymen would be keen to seek out the darkness of the night to augment their experiential journeys. In fact, Singapore stands out not just as a green oasis to its residents and visitors, but also as an extremely well-lit city — as anyone who has looked down at our city skyline from a departing night flight can attest to. In addition to managing more than 95,000 streetlights along Singapore roads, Singapore's Land Transport Authority (LTA) also maintains lighting at bus shelters, covered linkways, footpaths and road crossings. Street lighting conditions are also checked every two months to ensure that any faulty lighting is swiftly dealt with.

Indeed, Singaporeans have high expectations when it comes to keeping our roads well-lit. It is not uncommon to come across forum letters beseeching the government to install more lighting in dark pockets of Singapore as a safety precaution. In addition, we also seem to associate our social spaces with a surplus of lighting. Just last month, Singaporeans welcomed the news that car-free Sundays would commence in the Civic District and Central Business District, with more street lights to be installed to create public spaces. Similarly (and rather ironically), the Singapore Night Festival is associated with a line-up of bright light installations across the entire Bras Basah precinct.

Looking Up Into the Sky

So, given our love relationship with lighting, why have Singaporeans grown tired of well-lit streets and come to appreciate the "obscurity of

1 An Investigation into the Relationship between Vehicle Colour and Crash Risk. Stuart Newstead and Angelo D'Elia. Moniash University Accident Research Centre Report No. 263. May 2007.

the nightfall", as my Australian host referred to?

I think the answer can be traced back to the change in living standards in Singapore's modern history. Singapore had achieved phenomenal economic growth in the past few decades and this has allowed our residents to enjoy a reasonable level of economic sustenance. With most Singaporeans no longer concerned about daily bread-and-butter issues, we have progressed past looking into our wallets and have turned our attention towards looking up into the sky.

Figuratively, this means that we are questioning the meaning in what we do on a daily basis. Attention has shifted away from survival concerns towards fulfilling the non-material aspects of living standards. Taking reference from Maslow's hierarchy of needs, given that the Singapore government has broadly fulfilled the "physiological" and "safety" needs of its population, Singaporeans now aspire towards a "healthier" balance in their lives, such as greater work-life harmony and leading a more holistic life. Among some Singaporeans, this entails rejecting the paternalistic approach of the government and questioning the wisdom of government intervention in free markets. While the government's role in providing public goods is still

> Literally, looking up into the sky means that Singaporeans have become more concerned about the state of the environment which they live in.

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valued, some doubts have been raised about the scale of intervention. For example, questions have been asked about the amount of resources devoted towards national defence (another public good), including whether the conscription tenure for Singapore males should be further reduced.

Literally, looking up into the sky means that Singaporeans have become more concerned about the state of the environment which they live in. The recent debate over the preservation of the Bukit Brown cemetery is a good example. As mentioned in a 2015 Straits Times commentary by Professor Euston Quah and Mr Nicolas Neo, "the dichotomy of economic growth and the environment has been a growing concern to Singapore."[2] It now appears that in addition to the debate of whether we are valuing "green spaces" correctly, there is scope to consider whether there are enough "dark spaces" in Singapore. If the farmer's words are anything to go by, some Singaporeans have grown tired of living in an environment constantly bathed in artificial light, and have aspired towards a more elementary way of life involving a balance between light and darkness.

Light as a Form of Pollution

If too much light is bad, then there is scope to think of light as a form of pollution.

When one talks about pollution in Singapore, we often think of the transboundary haze problem, which has become quite a pertinent issue in Singapore. The Oxford dictionary defines pollution as "the presence or introduction into the environment of a substance which has harmful or poisonous effects". While having too much light can be unpleasant, they are certainly not harmful or poisonous to health, unless they interfere with sleep patterns.

Traditionally, when the term "light pollution" is used, it refers to the brightening of the night sky due to urban lighting, which obliterates the view of the Milky Way and stars for night sky enthusiasts. However, there is growing interest in the effects of excessive lighting on human health and immune functions. While the effects of inappropriate light exposure due to shift-work and jet-lag are well documented, an article written by Steven Lockley from Harvard Medical School[3] further considers the effects of lighting on people living on more regular schedules. Specifically, he posits that unnecessary horizontal and vertical street lighting, given their ability to permeate living spaces such as bedrooms, can have measurable effects on sleep disruption and melatonin suppression, which carry health risks. Nonetheless, these are still hypotheses awaiting further research evidence. For example, there is no direct evidence to prove that the alteration of melatonin levels has any effect on cancer risk.

2 Look beyond market value in preserving green spaces. Euston Quah and Nicolas Neo. Jun 16, 2015. The Straits Times.

3 "Human health implications of light pollution". British Astronomical Association handbook (2009).

A Cost-benefit Analysis to Understanding Light Pollution in Singapore

So, how bad is light pollution in Singapore, and is this an area which the government should be concerned about? Specifically, is public lighting a boon or bane for Singaporeans?

The key to assessing this is through a cost-benefit analysis, an economist's favourite tool. Specifically, the benefits to society from providing public lighting should be weighed against the costs of doing so. Having well-lit roads mainly reduces the risk of road accidents, while providing brightly illuminated pathways helps to keep pedestrians safe and secure. These form the main benefits of public lighting.

[*During my Economics classes, some students argued that street lighting should be viewed as rivalrous in consumption, since having an individual read the papers under a lamp post would deprive another person of the same standing spot. My answer to this is simple. The intent and purpose of the government in providing street lighting is to ensure safety and not to boost national literacy.*]

The cost to public provision of street lighting is mainly the financing cost in terms of money and resources needed to construct and maintain the lights, and the opportunity cost that such spending entails. These costs are significant, given the prevalence of public lighting in Singapore, and the rigorous standards in LTA's maintenance schedule. Furthermore, light pollution can add on to the costs identified above (akin to a spillover cost). However, we run into the problem of estimating and imputing the costs resulting from light pollution. As mentioned earlier, from a scientific perspective, the exact health impact of light pollution on regular individuals has not been ascertained. It seems that at this stage, Singaporean visitors to countryside retreats are more eager to check out the wonders of the night sky, rather than to seek a permanent retreat from outdoor lighting. The benefits that they derive from staring into the night sky (no doubt an inspirational natural resource) are hard to quantify, and likewise, the cost of being deprived such a resource.

Furthermore, before government intervention can be considered under grounds of market failure, we need to assess whether light pollution qualifies as a negative externality. Negative externalities are defined as spillover costs incurred by third parties, which are not accounted for by the price mechanism.

Street lighting generates light pollution, but it is tricky to find third-parties to compensate here. This is because unlike Australia, even the thickest and wildest patch of jungle in Singapore is not far from the nearby glow of street lighting. Hence, almost every Singaporean potentially affected by street lighting is a direct beneficiary of having lit streets. Even if third-parties can be identified, the difficulty in quantifying the spillover costs in the form of light pollution also means that it is hard to determine the size of the tax to impose. On a nett basis, it is still likely that Singaporeans would regard street lighting as a socially desirable good, in spite of them being denied the majestic beauty of the night sky through living in an environment bathed in artificial light.

...unnecessary horizontal and vertical street lighting, given their ability to permeate living spaces such as bedrooms, can have measurable effects on sleep disruption and melatonin suppression, which carry health risks.

Let There (Continue to) Be Light

Overall, there is yet to be a formal framework for measuring the cost of light pollution on human health. Until more robust evidence is produced, there are other pressing issues for the government to consider at this stage to improve Singaporeans' non-material living standards (e.g. congestion, work and academic stress, and erosion of green spaces). It is also hard to say whether the "obscurity of the night" which one can enjoy in Tasmania is a deliberate effort at preservation by the Australian government, or simply a case of it being untenable for the local government to install street lighting in such vast and open spaces. Viewed from that perspective, the ability of the Singapore government to provide good lighting conditions in almost every populated part of the island is a blessing.

As LTA continues to explore ways to cut energy costs for lighting, such as through reducing the illumination level at some commuter facilities, this can also be seen as a gradual and calibrated way to return some dark spaces to Singaporeans. There are also stargazer hobby groups in Singapore dedicated to fighting for tighter lighting rules in Singapore. These include fighting for the use of "downlighting" (directing light downwards towards the ground instead of skywards) and motion-activated light sensors. From my own experience living in a HDB unit facing a brightly illuminated park, there is no light which a thick set of window curtains cannot cut out. Hence, I am still enjoying my restful sleep every night.

I should also add that before my host left us for the night, he passed me an LED torch and added with a cheeky grin, "If you bring this out after dusk, you may be able to spot one or two wallabies near the guesthouse!"

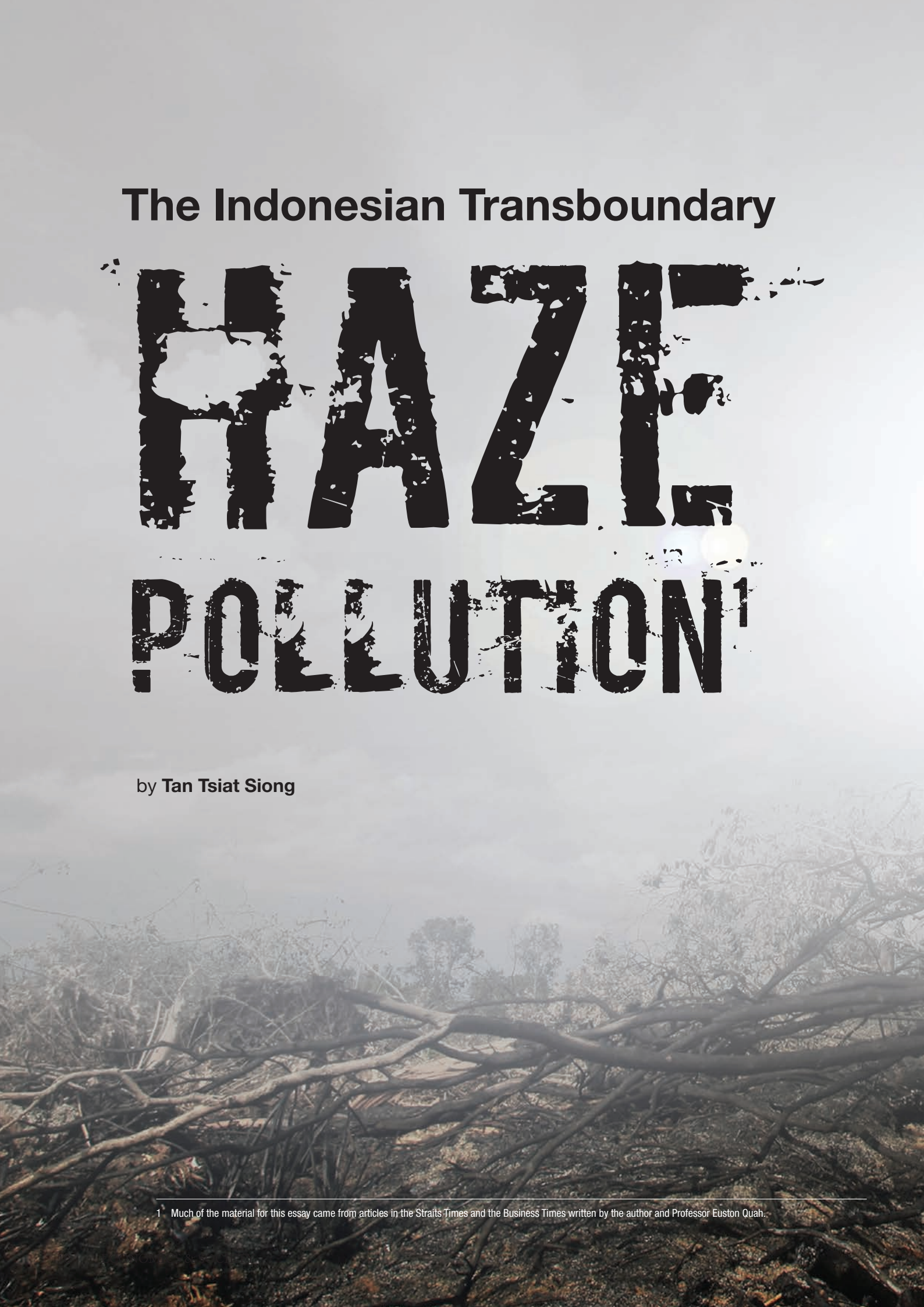
It does look like at times, we are responsible for adding to the glow that we call light pollution.

Melvin believes that a background in Economics serves as an enabler for students to make better decisions in life. He also believes that good teaching aids serve as a multiplier which amplifies students' interest and performance in the subject. He has written two books to help 'A' Level Economics students and is planning to roll out a third book, plus a macroeconomics board game later this year.

The Indonesian Transboundary

HAZE POLLUTION[1]

by **Tan Tsiat Siong**



1 Much of the material for this essay came from articles in the Straits Times and the Business Times written by the author and Professor Euston Quah.

Just last year, the haze situation brought the PM2.5 level in Singapore to a historical high of 471 (in the west region), shrouding the city-state in thick choking air. This air pollution caused by slash-and-burn practices in Indonesia has in fact affected Singapore for several decades, dating back to 1972 or earlier, and is not expected to be resolved any time soon.

In the case of pollution (a negative externality), the conventional economic tool would be to impose taxes, such that production is brought down from a level where private marginal benefit equals to private marginal cost, to a level where social marginal benefit equates social marginal cost. However, when pollution crosses national boundaries, such Pigovian taxes cannot be enforced. Singapore will not be able to impose taxes on production that occurs on Indonesian soil. Similarly, Coasian solutions of assigning "property rights", or pollution rights, would also be difficult without a supranational authority as an implementer. As a result, there is no optimal control of pollution.

The great concern about the haze stems from the severe economic ramifications on both victim and perpetrator countries. Damages are incurred not only in terms of health, but also tourism, retail, environment, productivity, recreation, Foreign Direct Investments (FDIs), construction, education, and the list goes on. These costs amount to millions of dollars to Singapore, and billions to Indonesia.

Therefore, it is imperative for the region to address and resolve this pressing issue. Nevertheless, this transboundary pollution problem remains intractable despite seemingly increased efforts in recent years to mitigate it. What then can Singapore, Indonesia, or the region and the world do about the recurring haze?

What can Singapore do about the haze?

Penalising Haze-linked Singapore Firms

It is clear that Singapore has little transnational jurisdiction on the haze culprits apart from Singapore firms in Indonesia, which might or might not be a sizeable proportion of the total number of errant plantations. Holding Singapore firms accountable is justified on both moral and legal grounds, but without public information and disclosures of land ownership from Indonesia, whether this would reach fruition is very much debatable.

Besides, if Indonesia and other countries do not penalise their own culprit firms to an equivalent extent, Singapore firms will bear the burden unfairly in relative terms. To illustrate, if foreign firms were able to provide palm oil products at a much lower cost than Singapore firms using slash-and-burn practices to clear land, it would be increasingly difficult for Singapore firms to compete in the palm oil industry.

Last year, there had also been calls for consumers to boycott haze-linked products. This is an applaudable move, but is unlikely to bring any measure of success in reducing the fires. This is primarily because Singapore's consumption of paper or palm oil products constitutes a small portion of global demand. Additionally, it is unlikely that all local firms and consumers will comply as they can free-ride on others; hence the effect is further reduced.

Unless we can get most local firms and consumers, as well as our neighbouring countries, to practise the boycott, the likely outcome would be higher prices for a seemingly futile attempt. Moreover, pressures levied against Indonesian goods might result in trade retaliation from Singapore's third largest trading partner, which could potentially be detrimental for

Singapore's small open economy.

If these same boycotting measures were to be employed in the major consuming countries (namely China, India and even Indonesia), we could be more hopeful. Nevertheless, would China and India, who are not directly affected by the haze, boycott polluting products at their own expense? Would domestic consumers in Indonesia be willing to pay higher prices for palm oil and paper products in exchange for cleaner air?

In addition, a handful of firms in Singapore signed a declaration that their products are free of raw materials from suppliers being investigated for the Indonesian fires in 2015. But for all of the above, the facts must first be established. Who are the real perpetrators? The issue of boycotting products from plantations that are being investigated, but subsequently not proven guilty, also arises. As is often the case in law, the accused is not guilty until proven so.

An alternative would be to shift the onus of evidence to the companies, meaning that the defendant is presumed to be guilty until proven otherwise. But as with the case before, it is very difficult to prove either way. This idea of the alleged party having to clear its own name may result in too many convicted cases. For small suppliers and plantation owners, it may prejudice their market survivability, paving the way for the market to be dominated by a few suppliers. When competition is hindered, efficiency suffers.

> Unless we can get most local firms and consumers, as well as our neighbouring countries, to practise the boycott, the likely outcome would be higher prices for a seemingly futile attempt.

Subsidies to Polluters

There are incentives for victim countries to make side payments to polluters (to stop polluting) given that there are net ex-post benefits for both polluter and victim countries. Such redistribution of gains can minimise pollution and reduce future losses. The amount of side payment will have to depend on the calculated costs of alternative land-clearing methods. The share in the cost by victim countries, including Indonesia, should be in proportion to the damage suffered.

However, with this approach, the issue of moral hazard may arise, whereby polluters threaten to pollute in order to receive subsidies. It also removes the incentives for countries to improve on their technology and lower costs. The idea of a victim-pay principle instead of a polluter-pay principle might also be difficult for the general public to agree with.

Calculating the Damages of Haze

Damage costs must necessarily be computed for categories such as loss of life, physiological and psychological health impact in the short and long term, loss of productivity, impact on sectors such as tourism, retail, food and beverages, aviation, conferences and conventions and its mutiplier effect, loss of intangibles (such as scenic views), threats of land subsidence from forest clearing, contribution to global warming, and loss of goodwill and reputation.

Losses could also take the form of unwillingness of expats or foreign workers to work in Singapore, which may result in a tighter labour market, especially in the professional sectors. If the haze is a permanent recurring feature, it could also mean that more remuneration would have to be offered to attract future workers. All

these may result in higher costs of business, as well as cost of living.

The key is that damage estimates must be continually updated and convincing to all affected countries. A continual and systematic calculation of these costs could help Singapore better negotiate with haze-originating countries and estimate the costs of aid to be given to Indonesia. It can also help the government offer targeted assistance to the affected sectors.

Adapting to the Haze

Given these limited options, there is really not much Singapore can do to touch the root of the problem. But what Singapore can really do in the meantime, while waiting for mitigation efforts to take place in Indonesia, is to adapt. This is similar to the climate change issue, where adaptation becomes more important than ongoing mitigation. Mitigation occurs in a much longer timeframe, and requires more financial investment and coordination, than adaptation.

In this aspect, the Singaporean government has fared well in reporting the air pollution levels, distributing masks, disseminating information and educating the general public on how to handle the harmful air, and implementing the Haze Subsidy Scheme and the WeCare packs. However, there are still areas that could be better managed in the future.

For example, during the school closures in Singapore last year, some students reportedly still turned up for school. Some among them did not receive the notification; for others, their parents were unable to take time off work to look after them. In this aspect, there is definitely room for improvement in information dissemination, and in designing and encouraging work-from-home (telecommuting) and study-from-home (e-learning) arrangements.

The authorities could also impose a mandatory shutdown of outdoor sports facilities when needed, accompanied by a compensation scheme for affected businesses.

What can Indonesia do about the haze?

Penalising Haze-linked Indonesian Firms

The Indonesian authorities have begun arresting executives from firms accused of being responsible for the fires. The penalties for those found guilty are heavy, but convicting the culprits is easier said than done. The perpetrators first have to be accurately identified, which is already a daunting task, and they may include small farmers instead of just big corporations.

The lack of land ownership information adds to the challenge, not to mention the local and central government's vested interests in protecting the industries (worth an estimated US$18 billion); corruption and coordination and enforcement failures also figure in the mix. In addition, the time required to secure a hearing in court and thereafter, convicting the culprits, will likely be long. Hard evidence proving the sources of fires, required for litigation, would be difficult to collect.

As it appears, the punishment is severe — but neither swift nor certain. For example, in December 2015, an Indonesian government lawsuit that demanded a pulpwood plantation company (Bumi Mekar Hijau) to pay 7.8 trillion rupiah for clearing land by illegal burning was thrown out due to lack of evidence that the company had purposely started the fire.

Within Indonesia, which has a large consumer market (unlike Singapore), banning products from alleged culprit plantations would still be futile for the same reason that it is tedious to track down culprits and accord responsibilities. Moreover, palm oil and paper are intermediate goods, meaning they are inputs to the production of other goods and services. Should consumers then boycott other products that use materials from pollutive plantations, thus penalising firms not directly complicit with the act? Will this information even be available? Where should we draw the line down the supply chain?

Creating Water Canals

President Joko Widodo's idea of creating water canals might also work in reducing the dryness of peatland, and thus the chances of nature-caused fires, but this will not work where peatlands have been intentionally drained to make way for plantations.

Directing Resources, Coordinating Response, Allocating Land Concessions

On the local front, more resources and logistical support could have been diverted to empower the local communities for proactive fire prevention, or at least for a faster reactive response to fires.

Small fires are easier to contain. Responses should be prompt and coordinated with standard operating procedures, focused objectives, and non-overlapping responsibilities across institutions. Indonesia acceptance of, or request for, fire-fighting assistance from the region could also have been much quicker.

In addition, there should be more stringent requirements and greater scrutiny in granting and renewing concessions for plantations and for managing peatland use.

The Law of Strict Liability

Since it is almost impossible to accurately determine which plantations started the fires, Indonesia should implement the law of strict liability. Instead of allocating blame to fire-starters, plantations should be held liable for any fire (above a certain scale) occurring on their land, regardless of who started it.

This will create strong incentives for fire prevention and disincentives for clearing land with fire. Errant plantations should be fined or made to forfeit a liability deposit that they previously paid. The magnitude of this penalty has to be carefully set as a deterrent, and fires must be accurately pinpointed with remote sensing and satellite technologies.

Landowners should also be given grants, loans, training and logistical assistance to prevent or fight fires. If landowners are unable to fight the fires themselves, they must be able to notify the local government for help before the fire gets out of control.

Gifts in kind in the form of better roads, infrastructure, food vouchers and subsidies, or special funding for villages, could also be provided as incentives, if it can be shown that no fires above a prescribed size have occurred in a given area over a period of time.

Calculating the Damages of Haze

Similarly for Indonesia, it is important to calculate the damages of the haze. With this information, Indonesia can then determine whether the returns from such pollutive industries are substantially greater than the damages suffered. If the damage costs more than the amount of economic benefits reaped, a rethink is required in the further growth of these industries; perhaps Indonesia could then consider diversifying its exports away from goods closely related to the fires.

What can the Region or the World do about the haze?

Ultimately, this haze problem stemming from forest fires requires the involvement of multiple stakeholders, which include both culprits and victims. And since the daily greenhouse gas emissions from Indonesia's raging fires in 2015 had reportedly exceeded the US' daily emission levels from all uses, the whole world is a collectively affected victim through the implications on global warming. As such, other regional or international agencies or countries with similar transboundary pollution experiences should provide the relevant support and guidance to Indonesia, and also keep up the international pressure on Indonesia by mustering the collective influence of international and regional agencies.

Generally, a regional agreement is needed to resolve this issue. Game theory tells us that a regional agreement is possible through gain-sharing and the creation of binding agreements, which eventually leads to a cooperative outcome. However, a regional agreement is still susceptible to the problem of free riding, where some countries rely on others in the negotiation process and avert potential transaction costs. In the event of high transaction costs, or the absence of a bilateral relationship between countries, cooperation is theoretically impossible. Moreover, the ASEAN approach to diplomacy is largely based on consensus building and non-interference in the domestic affairs of member states. This could also constrain a quick and effective solution.

Going forward

Various solutions have been suggested and discussed above, but there are of course others that have been omitted. For instance, technological advancements leading to more efficient water-bombing aircraft and land-clearing machinery could directly diminish the problem.

In all, we must acknowledge that the Indonesian tranboundary haze pollution cannot be easily resolved due to the several limitations of the suggested solutions. We must also remember that the forest fires are both a man-made and nature-caused problem. The onsets of the forest fires are exacerbated by natural factors like the cyclical El Niño which prolongs the drought and intensifies the fires. With Indonesia being home to the world's largest area of tropical peatland, dousing its forest fires is also evidently a much harder task than it appears. The peat can continue to burn for months even after surface fires have been put out.

Besides, Indonesian laws and the system of governance are complex and will require time to change. Resources in terms of manpower and funds have to be budgeted. As a large and spatially distributed country — 34 provinces subdivided into regencies, cities, districts and administrative villages, each with its own set of laws and regulations — we should not expect results soon, even with sustained political will.

In the interim, we can only be optimistic about an eventual resolution, provided there is improved coordination among government institutions, weeding out of corruption, regional and international cooperation, technological advancements and, most importantly, a continued search for pragmatic solutions.

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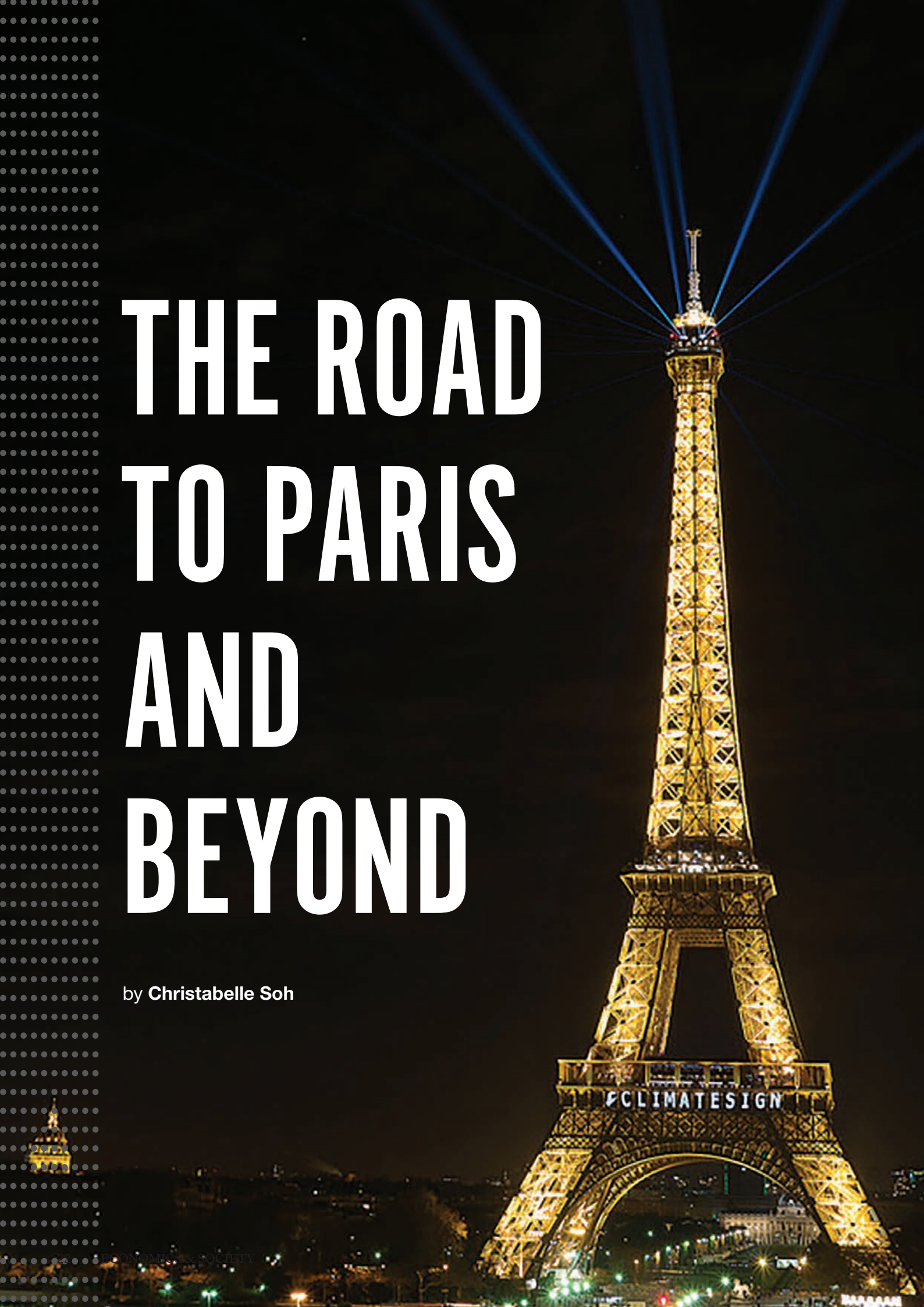
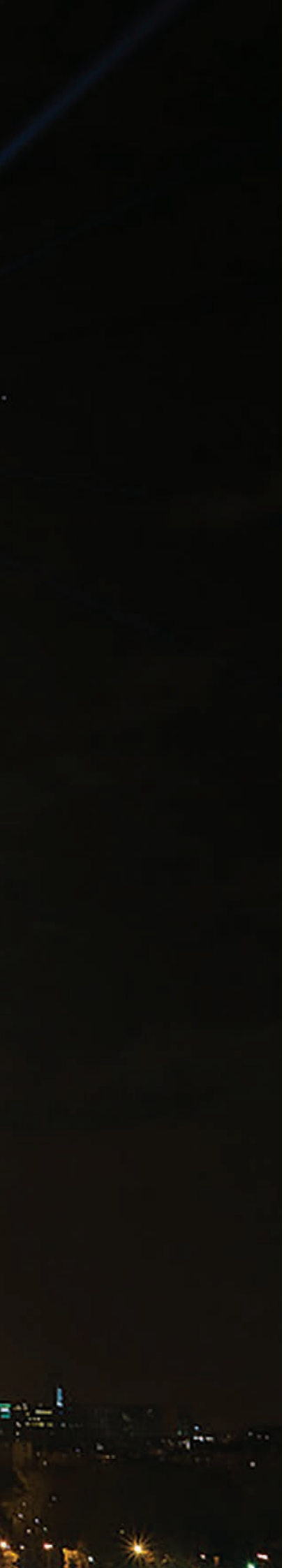
THE ROAD TO PARIS AND BEYOND

by **Christabelle Soh**





The road to climate change management is a long and winding one. Almost a quarter of a century ago, climate change entered the international consciousness with the 1992 United Nations Convention on Climate Change (UNCCC). Even at that early stage, it was recognised that a coordinated international effort to manage climate change would be a mammoth task as countries had varying priorities and abilities. These differences were officially acknowledged by the UNCCC adopting the principle of "common but differentiated responsibilities" for subsequent negotiations.

Fast forward 23 years with many rounds of talks in between, we arrive at the 2015 Paris agreement. However, to understand the significance of what was achieved at the Paris round of talks, we need to take a step back to trace the development of the climate change talks.

The Long Road to Paris

The earlier stages of the climate change talks focused on finding ways to operate the "common but differentiated responsibilities" principle. To differentiate responsibilities, the 1995 Berlin talks started the categorisation of countries into two groups – Annex I countries that had to commit to carbon emissions reductions and non-Annex I countries that didn't have to. The Annex I countries were generally countries from the Organisation for Economic Cooperation and Development (OECD) as the consensus then was that the more developed countries had achieved a higher level of material welfare and could afford to look into carbon emissions reduction. Developing countries, on the other hand, still had to grapple with generating growth and employment for their populations. The 1997 Kyoto protocol built on the Berlin talks by quantifying the emission reduction targets for the Annex I countries. Unsurprisingly, this approach faced a number of challenges.

The fundamental challenge was a conflict between effective action and historical responsibility. Annex I countries alone could not reduce global emissions as increases in carbon emissions were largely in the developing world. Meaningful reductions in carbon emissions could only be achieved by including non-Annex I countries in the carbon reduction targets. However, attempts to include non-Annex I countries such as China and India were rebuffed as these countries wanted the developed world to take historical responsibility for the existing carbon emissions. Additionally, the per capita income of a number of non-Annex I countries exceeded those of some of the Annex I countries. This created a sense of unfairness as the distinction between Annex I and non-Annex I countries did not seem to reflect the differences in the state of development.

The perceived unfairness was

compounded by the fact that carbon emissions reduction suffers from a 'free-rider' effect – the benefits of averted climate change caused by the carbon emissions reduction of one country are also enjoyed by other countries that did not reduce their carbon emissions. As such, whether developed or developing, nations would rather lay low and have others bear the brunt of emissions reduction while enjoying the benefits of averted climate change.

The stalemate in the negotiations was only broken a decade later when the 2007 round of talks in Bali produced a structure for actions by the non-Annex I countries. The explicit acknowledgement that non-Annex I countries had a concrete role in carbon emissions reduction opened the way for the 2009 Copenhagen accord and 2010 Cancun agreement to blur the distinction between Annex I and non-Annex I countries. This blurring in turn allowed for the 2011 round of talks in Durban to break with the approach adopted in Berlin of categorising countries into two broad groups with a different set of expectations for each group. Instead, at Durban, it was agreed that a new approach that included all countries would be adopted by 2020. With that, the ground for the 2015 Paris talks was set.

Paris, La Ville Lumière

In some ways, it was most apt that the 2015 round of talks were held in Paris. One of the reasons Paris is known as the City of Light (La Ville Lumière) is the fact that she played a leading role in the Age of Enlightenment. And, the Paris climate change agreement is testament to the good that can be done by enlightened men and women.

The agreement is a short 12-page read but contains three important departures from previous documents. First, this is the first agreement that has set a concrete target of not letting temperatures rise above 2 degrees Celsius (with an aspirational target of 1.5 degrees Celsius). With this, it becomes possible to evaluate the success of the agreement in the future. Second, the scope of participation is the broadest thus far. 187 countries representing 96% of global carbon emissions have agreed to produce their individual countries' carbon emissions targets (termed intended nationally determined contributions (INDC)) and report on them annually. These targets will be reviewed and revised to be more ambitious every 5 years. This signals a fundamental break from the past as most countries now recognise their responsibility to reduce carbon emissions. The reporting requirements also usher

in a new age of transparency. Third, this is a legally binding agreement. In more layman terms, this is the first climate change agreement that has actual teeth.

To Infinity, and Beyond

Is the day saved then? Unfortunately, while the Paris talks were very successful in producing an agreement that lays the foundation for a new era of international cooperation in climate change management, the day will only be saved with successful implementation of the agreement. This raises the question – what next?

The agreement leaves open the question of how countries can reach their carbon emission reduction targets. At the moment, the tool of choice appears to be the cap-and-trade system where a cap on carbon emissions is achieved by introducing a limited number of carbon emissions permits without which, it would be illegal to emit carbon dioxide. Efficient firms that manage to reduce their carbon emissions (and hence have surplus permits) can then sell these permits to less efficient firms. This approach has been adopted by the European Union, New Zealand, the US, and South Korea, with China's scheme kicking in in 2017. Other options include imposing carbon taxes and adopting performance standards such as only allowing electrical appliances of a certain energy efficiency rating to be sold on the market.

One of the reasons Paris is known as the City of Light (La Ville Lumière) is the fact that she played a leading role in the Age of Enlightenment. And, the Paris climate change agreement is testament to the good that can be done by enlightened men and women.

There is reason to be optimistic about these measures. Even prior to the talks in Paris, there were signs that countries were beginning to take action to mitigate climate change even in the absence of an international agreement. The 2015 Climate Vulnerable Forum held in Bonn, Germany, showed that even Less Developed Countries (LDCs) had taken action to prevent climate change. Additionally, a global survey completed in the same year showed that at least the majority of people were concerned about climate change ("Very concerned? Yes. Carbon tax? No"; Straits Times, 9 June 2015). Most telling were the behaviours of the US and China, bellwethers of the developed and developing countries' behaviours respectively. In the lead up to the Paris talks, China and US released joint announcements on pledges to reduce their carbon emissions. This was a strong signal that the world was going to take climate change seriously, which gives economists everywhere grounds to not be dismal scientists despite being students of a dismal science.

In conclusion, the road to Paris was not an easy one but what was achieved in Paris was definitely commendable. Going forward, the evidence of ground support for tackling climate change gives us reason to be hopeful of successfully averting the worst of climate change. Countries like Singapore will have a big role to play in the post-Paris stage where countries figure out the 'how' in response to the carbon emissions reduction targets they have set. Singapore could show the world, especially to developing urban metropolises, what can be done to reduce carbon emissions (e.g., conversion to LNG, a less carbon-intensive fuel; and achieving 60% recycling rate) to help to build capacity in those regard.

Christabelle's passion lies in Economics and Education. She believes in making the world a better place through raising rational and compassionate students of Economics.

Teaching Economics in 2020 What It Means for 2040

by **Poon King Wang, Dr. Youngjin Chae, Gayathri Balasubramanian, Aaron Yong** and **Eileen Tay**

We are not just guardians of the environment. We are also its stewards.

We are charged by our future generations, to leave it greener and more sustainable than when we first inherited it. We have to tackle the great challenges that climate change poses today (the Paris Agreement is a great start). We also have to nurture future generations to find solutions to the grand challenges of tomorrow.

Fortunately, the battle is already half won: our students care about the environment. They treasure it. They want to protect it. And they champion causes for it.

All we need to do is to help them on their mission.

One good place to start is in the classroom. What happens in the classroom is seminal in seeding ideas, shaping values and setting aspirations. In the classroom, we can help them develop an appreciation of the multi-faceted nature of climate change. Climate change is about Science, but it is also not just about the science. It is about Economics, but it is also more than that. And it is about Geography, and so much more. **The earlier we help students understand these connections, the greater their capacity to tackle the challenges of climate change 5, 10, 20 years later**.

Seeing connections is also important for another reason. In climate change and other major trends of the future, a flexible mind comfortable with multiple disciplines is essential, even fundamental. As Harvard professor Howard Gardner writes in his book *Five Minds for the Future*,

"the synthesizing mind… takes information from disparate sources… and puts it together in ways that make sense… [and] the capacity to synthesize becomes ever more crucial as information continues to mount at dizzying rates."

Artifact of the Near Future (see insert): Lesson Design Map for a Synthesizing Mind

With these in mind, we have designed this prototype of a future lesson plan which we call "Lesson Design Map for a Synthesizing Mind". It is designed by teachers, parents, and students together with a team at the Lee Kuan Yew Centre for Innovative Cities (Singapore University of Technology and Design) who are studying the future of education.

It answers the question "how could we nurture an inter-disciplinary mind in the teaching of economics?". It connects existing curriculum concepts and topics across current subjects. It ensures rigor through the same. Through fast fashion, it also makes climate change highly relevant to daily living. And it nurtures global citizenship and personal responsibility in equal measures.

We hope this Lesson Design Map serves as an example (even inspiration) for others to explore how lessons in different topics and subjects could be conducted in future. The team has intentionally chosen not to introduce the need for any new technological tools when putting together such a Lesson Design Map. All it takes is for a community of like-minded educators and practitioners to come together (either for profit or not-for-profit) to synthesize what already exists, and create a school-, cluster-, and/or city-wide resource to be used by teachers.

Through a dedicated effort, we believe a comprehensive resource can be built by 2020. This can be used by teachers to nurture ideas, values and aspirations in students that will steer their choices, decisions and actions towards making an impact in 2040.

Write-up to Question 05: What Can Be Done? (see insert)

Technology Solutions

The solutions to tackling the challenges of climate change are multi-pronged. They tackle it at different scales in the city: from the individual, to building-scale, to city-wide. They also use design and technology innovations in many fields such as materials, information technology, alternative energy, industrial processes, and urban design.

Here are a few examples:

Individuals and Wearables

At the individual level, we can be more sustainable in the way we live. Wearable technologies can help. For example, the United States Department of Energy's Advanced Research Project Agency – Energy (ARPA-E) has funded a project at the University of California, San Diego to develop a smart fabric. This smart fabric cools or warms an individual directly, instead of the space or room around the individual. This will reduce energy use and wastage, and could cut cooling and heating costs for homes.

Called ATTACH (Adaptive Textiles Technology with Active Cooling and Heating), the smart fabric maintains a comfortable temperature by expanding to become thicker and warmer when it is cold outside. When it is hot outside instead, it contracts to become thinner and cooler. The smart fabric will also be designed to have its own power such as rechargeable batteries that are printed onto the fabric.

Buildings, Materials and Renewable Energy

Buildings could tap into renewable energy sources such as solar energy. For example, in the coming year, Apple will be the first company in Singapore to power all its local operations from solar energy. Working with Sunseap, a major provider of solar energy in Singapore, Apple will install solar panels on its buildings here and purchase solar energy collected from other buildings' solar panels.

Looking further into the future, Stanford University researchers hope to take advantage of the extreme cold of outer space to cool buildings on Earth. They are developing a new material that is two microns (micro-metres) thick. This material can do two things:

- it reflects 97% of the sunlight that falls on it back into outer space; and
- it radiates heat at a wavelength and frequency "which can most easily escape from Earth into outer space".

If this material is used to clad building exteriors (or at least the roofs), the buildings can be cooled without any expensive air-conditioning. Energy requirements and electricity bills are both reduced.

Companies, Circular Economy and Cities

Today, we use "large quantities of cheap, easily accessible materials and energy" for our industrial activities. It is a linear model of "take-make-use-throw". In the future, cities and companies can explore building a "circular economy". In this circular model, we will "take-make-use-reuse/refurbish/restore/recycle/regenerate/restore" instead. We will choose to close the loops for materials, resources and energy instead of disposing of them.

Cities can also use design and technology to tackle the challenges of climate change. Writing on the World Economic Forum website, the President and CEO for Ericsson outlines how smart cities can play a significant role. According to him, by 2030, information communication technologies could reduce global greenhouse gas emissions by 15%. That is significant as it would be "equal to more than the combined carbon footprint of the European Union and United States".

Another strategy is sustainable urban design and planning. Cities for example have developed and continue to develop green typologies for entire developments and districts. From the Garden City to Ecological Cities to Green Cities, the motivations are the same: to address the environmental and resource challenges of their times.

Write-up to Fast Fashion [A Case Study] (see insert)

Q1: What is Climate Change?

What does fast fashion have to do with climate change?

In fast fashion, trendy and affordable clothes are found in the retail shops very soon after their designs are first seen on the fashion runways.

Fast fashion can have an impact on climate change because its activities can cause serious environmental pollution. This comes in the form of textile waste; use of vast amounts of land, energy and water; and the release of many harmful chemicals. According to Forbes, the "apparel industry accounts for 10% of global carbon emissions and remains the second largest industrial polluter, second only to oil".

Q2: Who is responsible?

We are all responsible. For example, do we as consumers take the effort to find out how our clothes are made? Do companies in turn provide that information readily to us? Do companies also choose to produce using environmentally-friendly or environmentally-harmful processes? Lastly, do governments regulate these activities?

Q3: Why is it happening?

Fast fashion relies on rapid production and consumption cycles to keep up with the latest trends. These cycles will shorten further as production is ramped up to meet growing consumer demand from increasing globalisation, population and urbanisation.

At the same time, the economies of scale of expanded production usually mean lower costs for producers. This is especially so when the costs to the environment are not factored into the prices charged to consumers. The lower prices drive up demand further, shortening the cycles even more.

All these will accelerate the environmental impact that we discussed earlier: more waste, more energy used, and more harmful chemicals released.

Q4: What is the impact to the economy and society?

The following could happen:

- textile waste builds up;
- water and energy shortages become more severe; and
- waterways, land, and air become more polluted with toxic chemicals.

As a result, there is welfare loss to society. The environment becomes less liveable and more unpleasant for people. It could also cause health problems and illnesses in the population.

Q5: What can be done?

Governments can enact environmental standards and regulations on the use and disposal of chemicals. Companies can invest in environmentally-friendly production, and provide information about their production to help consumers make better choices. Governments and companies can also work with designers and scientists to develop eco-friendly innovations. Consumers can choose to be more sustainable in what they buy; they can also demand to know more about how their clothes are produced.

Q6: Why should we care?

This Earth we live on is all we have, for this generation and for generations to come. We are its guardian and also its steward, and we all must play a part.

Links for Lesson Design Map for A Synthesizing Mind

1) http://environment.yale.edu/climate-communication-OFF/files/ClimateNote_Consensus_Gap_May2013_FINAL6.pdf
2) http://www.actionbioscience.org/environment/hinrichsen_robey.html#primer
3) http://www.lse.ac.uk/CPNSS/events/Abstracts/HIstoryofPoswarScience/dickens.doc
4) http://www.triplepundit.com/2015/09/cotton-production-consumption-cry-sustainability/#
5) https://www.nrdc.org/issues/increase-renewable-energy
6) http://science.time.com/2013/08/19/in-denial-about-the-climate-the-psychological-battle-over-global-warming/
7) http://www.theatlantic.com/video/index/402313/earth-in-100-years/
8) http://sustainability.hm.com/en/sustainability/commitments/reduce-reuse-recycle/about.html

Links for What Can Be Done?

1) http://textile-future.com/textile-manufacturing.php?t=Smart%2Bclothes%2Bfor%2Bpersonalised%2Bcooling%2Band%2Bheating&read_article=3519
2) http://www.straitstimes.com/tech/apple-plugs-into-solar-power-in-singapore
3) http://www.economist.com/news/science-and-technology/21634992-new-materials-may-change-way-temperatures-are-regulated-cool-idea
4) http://www.nature.com/nature/journal/v515/n7528/full/nature13883.html
5) http://www.ellenmacarthurfoundation.org/circular-economy/overview/concept
6) http://www.ellenmacarthurfoundation.org/circular-economy/interactive-diagram
7) https://www.weforum.org/agenda/2015/12/how-technology-and-smart-cities-can-help-us-overcome-climate-change/
8) https://lkycic.sutd.edu.sg/events/other-events/book-launch-dense-green-innovative-building-types-for-sustainable-urban-architecture/
9) https://futureofcities.blog.gov.uk/2014/10/29/yesterdays-tomorrows/
10) https://www.gov.uk/government/publications/future-cities-a-visual-history-of-the-future
11) http://www.adb.org/publications/green-cities

Links for Fast Fashion [A Case Study]

1) http://www.forbes.com/sites/jamesconca/2015/12/03/making-climate-change-fashionable-the-garment-industry-takes-on-global-warming/#6371ef2d778a
2) http://www.ecochicdesignaward.com/wp-content/blogs.dir/3/files/2013/04/LEARN2014_LEARN2014_FashionEnvironment_ENG_FINAL.pdf
3) http://www.solvay.com/en/asking-more/biodegradable-fibers-become-fashionable.html
4) http://sustainability.hm.com/en/sustainability/about/hm-conscious/the-textile-industry-and-hm.html#cm-menu
5) http://waterfootprint.org/media/downloads/Report18.pdf
6) http://www.columbia.edu/~tmt2120/impacts%20to%20life%20in%20the%20region.htm
7) http://www.theguardian.com/sustainable-business/sustainable-fashion-blog/2014/oct/01/cotton-production-linked-to-images-of-the-dried-up-aral-sea-basin

Contributed By

The **Lee Kuan Yew Centre for Innovative Cities (LKY CIC)** at the Singapore University of Technology and Design focuses on the integrated use of technology, design and policy to study solutions for cities. The LKY CIC works with architects, designers, engineers, social scientists, and urban planners to understand the complex and critical issues of urbanisation, and to explore sustainable and innovative urban solutions.

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Dr. Youngjin (Marie) Chae is a research fellow of the Lee Kuan Yew Centre for Innovative Cities (LKYCIC) at the Singapore University of Technology and Design (SUTD). Her research covers the field of technologically-intensive design for functional garment, smart clothing and E textiles. Youngjin received her doctorate in Clothing and Textile from Department of Human Ecology, Yonsei University, Korea (2014).

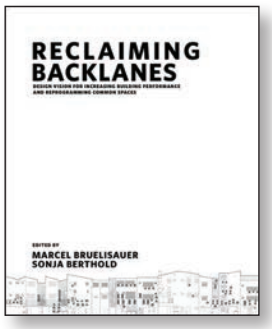
Aaron Yong is a Senior Industrial Designer at the Lee Kuan Yew Centre for Innovative Cities (LKYCIC) at the Singapore University of Technology and Design (SUTD). His designs make some of the greatest pleasures in life more enjoyable and some of the chores in life easier. His designs are widely used by different age groups across various international markets. He holds patents in products he developed and strongly believes in grounding his designs in great user experience and thorough research. Staying true to his belief, this Lesson Design Map for a Synthesizing Mind demonstrates how design can play an important part in the future of education.

Eileen Tay is a former educator who has adopted a different approach to the teaching of economics. As economics has become a key field of explaining and changing the world today, she hopes to broaden students' perspective through the use of an interdisciplinary approach.

Gordon Koh Qian Siang enjoys reading and learning more about Economics. He believes that Economics can be made more approachable to students by associating it with global issues. He hopes that the article will enable students to understand the greater relevance of Economics. He will be reading Business Administration at National University of Singapore.

Charis Tham Yin Yen has always been fascinated by how economics puts into perspective the way we, as humans, along with society, behave. Although she can no longer tell MPCs from MCs, she believes all students should have the privilege of studying economics as it provides the basis for many social actions. She will be reading Occupational Therapy at Singapore Institute of Technology.

Shiv Kumar Singh has always had an appreciation for establishing real life applications based on the theoretical knowledge that he garners from different subjects. He is intrigued by the links that can be drawn between subjects of different fields and how they influence one another. He thinks the move to highlight the interplay of concepts between Economics and other subjects to underscore the relevance of Economics in our world is an idea whose time has come. He will be reading law at the Singapore Management University.



Reclaiming Backlanes

Design Vision for Increasing Building Performance and Reprogramming Common Spaces

Edited by: **Marcel Bruelisauer** (*Future Cities Laboratory, Singapore ETH-Centre, Singapore*), **Sonja Berthold** (*Future Cities Laboratory, Singapore ETH-Centre, Singapore*)

Take a shortcut! Explore the pop-up market! Breathe the fresh scents of flowers in a secret garden! What if backlanes were far from the state they are in today — lively chatter and laughter replacing the heat and noise of air-conditioning condensers and foul smells from trash bins?

Reclaiming Backlanes presents design visions for future development of shophouse neighbourhoods, reprogramming backlanes into viable and high-quality common spaces, while improving energy efficiency of shophouses by up to 50%. These visions mark the convergence of studies in energy efficiency, pedestrian movement, historic building stock analysis and urban diversity by a multidisciplinary team.

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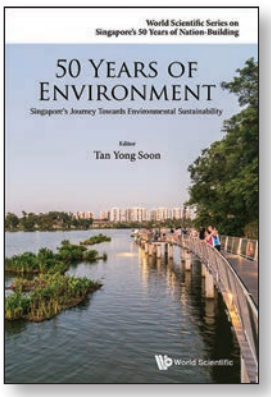

50 Years of Environment

Singapore's Journey Towards Environmental Sustainability

Edited by: **Yong Soon Tan** (*Former Permanent Secretary of the Ministry of the Environment and Water Resources, Singapore & Former Permanent Secretary in the National Climate Change Secretariat in the Prime Minister's Office, Singapore*)

In conjunction with Singapore's 50th birthday in August 2015, *50 Years of Environment: Singapore's Journey Towards Environmental Sustainability* takes the reader through Singapore's environmental journey over the past 50 years, to its present day challenges and solutions, and seeks to explore what lies ahead for Singapore's environmental future. This book is divided into three parts. The first, drawn largely from the book *Clean, Green and Blue: Singapore's Journey Towards Environmental and Water Sustainability*, will explore the historical developments in Singapore's environmental journey and the development of NEWater. The second part will be a collection of essays that examine the present environmental challenges that Singapore faces and the ways in which it is addressing those issues through community engagement, international engagement, research and technology, and industry solutions in order to develop sustainable strategies and solutions. Part Three will bring the book to a close by tying the historical and contemporary threads together and discusses the future challenges for Singapore's environment.

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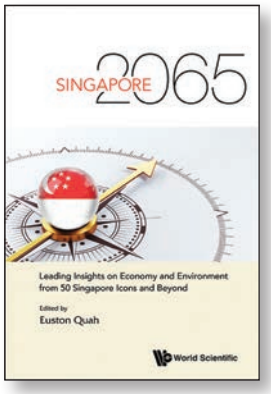

Singapore 2065

Leading Insights on Economy and Environment from 50 Singapore Icons and Beyond

Edited by: **Euston Quah** (*NTU, Singapore & Economic Society of Singapore, Singapore*)

As Singapore enters its 50th year of independence, it is a time for introspection to look back at the successes and challenges of the past, but is also a crucial time to consider what the future holds for the nation.

Singapore 2065: Leading Insights on Economy and Environment from 50 Singapore Icons and Beyond is one such key contribution to the endeavour of thinking about what lies ahead. While many forthcoming projects and books take a more retrospective approach reflecting upon Singapore's past, this book adopts a forward-looking perspective, contemplating Singapore's distant future, which is important for posterity. This book is a collection of key insights from 50 iconic individuals of Singapore and beyond, and contains reasoned arguments, speculations and visionary expectations of Singapore's future in 50 years' time.

The book discusses the distant future of Singapore's economy and the environment. What will Singapore's economic and environment landscape be like 50 years from now? Are there trends or scenarios common to the various discussions contained in this book? If there are, how big would be the impact of some of these trends? What and how should the government respond to these projections, expectations and informed visions of tomorrow? In sum, what would Singapore's economy and environment be like in 2065? The book explores a range of possible answers to these questions and more.

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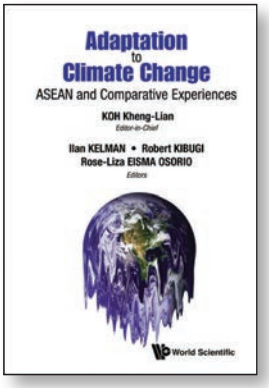

Adaptation to Climate Change

ASEAN and Comparative Experiences

Edited by: **Kheng-Lian Koh** (*NUS, Singapore*), **Ilan Kelman** (*University College London, UK*), **Robert Kibugi** (*University of Nairobi, Kenya*), **Rose-Liza Eisma Osorio** (*University of Cebu, Philippines*)

Adaptation to Climate Change: ASEAN and Comparative Experiences presents a dynamic and comprehensive collection of works from legal scholars around the world that delves into a relatively new frontier on legal aspects of climate change adaptation with focus on the ASEAN region, both at the regional level as well as at the national level in some ASEAN countries — such as Malaysia, Philippines, and Thailand. Other countries not within ASEAN are also represented, such as Bangladesh, People's Republic of China, Sri Lanka, and the Republic of Taiwan. In doing so, it surveys one of the most important issues confronting developing countries today, and the challenges to building resilient societies. It is an essential source of reference for policy-makers, administrators, the private sector officials, scientists, academic scholars, climatologists, NGOs, and CSOs in ASEAN and the world.

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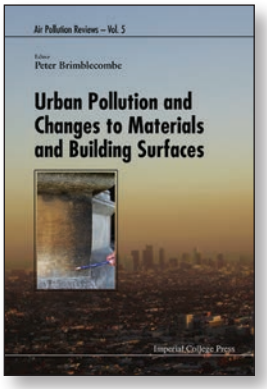

Urban Pollution and Changes to Materials and Building Surfaces

Edited by: **Peter Brimblecombe** (*City University of Hong Kong, Hong Kong*)

Pollution damages materials, but it has changed dramatically in the past century, with a reduction in the concentration of corrosive primary pollutants in urban atmospheres. At the same time, architectural styles and types of materials have changed, as we have moved to more organically rich, photochemically active atmospheres. Contemporary pollutants have a greater potential to degrade organic coatings and polymers, which are of great importance to modern structures.

Urban Pollution and Changes to Materials and Building Surfaces examines a range of materials, discussing the ways in which they are likely to be damaged by contemporary urban pollutants, with an emphasis on the effects of air pollution. A chapter on graffiti is also included.

The wide scope covered means that this volume is suitable for readers from a broad background. It should be of interest to scientists and policymakers dealing with the effects of urban pollution, as well as undergraduate and graduate students working in this area.

This book, with its wealth of information, is of exceedingly good value for readers who seek to understand more on the changes of materials and building surfaces by urban pollution.

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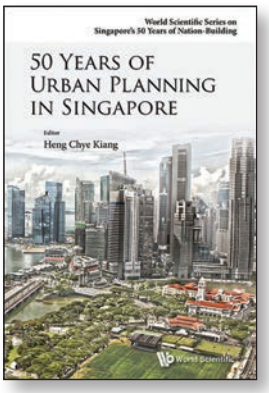

50 Years of Urban Planning in Singapore

Edited by: **Chye Kiang Heng** (*NUS, Singapore*)

50 Years of Urban Planning in Singapore is an accessible and comprehensive volume on Singapore's planning approach to urbanization. Organized into three parts, the first section of the volume, 'Paradigms, Policies, and Processes', provides an overview of the ideologies and strategies underpinning urban planning in Singapore; the second section, 'The Built Environment as a Sum of Parts', delves into the key land use sectors of Singapore's urban planning system; and the third section, 'Urban Complexities and Creative Solutions', examines the challenges and considerations of planning for the Singapore of tomorrow. The volume brings together the diverse perspectives of practitioners and academics in the professional and research fields of planning, architecture, urbanism, and city-making.

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Southeast Asia and the Transboundary Haze

An Inquiry and a Discourse

Edited by: **Euston Quah**
(*NTU, Singapore & Economic Society of Singapore, Singapore*)

Edited by Professor Euston Quah, a recognised authority on environmental economics, *Southeast Asia and the Transboundary Haze: An Inquiry and a Discourse* pulls together a collection of articles by members of the academia, the media, the non-governmental and private sectors in examining the multiple facets of the transboundary haze problem. Topics range from theoretical discussions such as responsible corporate behaviour, cooperative game theory, and free-riding issues, to analyses of actual policies such as Singapore's Transboundary Pollution Act 2014, the ASEAN Political-Security Community Blueprint and the ASEAN Agreement on Disaster Management and Emergency Response. A recommended read for those seeking to understand the complexities of the perennial haze.

400pp | May 2017
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Advocates of the Environment
Waterway Watch Society

Environmental Education plays an important role in shaping the future physical and economic landscape of Singapore. To ensure sustainable economic development, individuals would need to be educated to plug this imperfect information in our society. Even though it is arguably still in a nascent stage, we are fortunate to have promising environmental champions amongst us. Waterway Watch Society is a case in point.

Founded in 1998, Waterway Watch Society is a Non Government Organization that seeks to bring like-minded volunteers to monitor and restore our waterways. The Society regularly conducts bike and boat patrols along the Singapore River, and provides outreach programs for both companies and schools. To gather more insights about their motivation and aspiration, we managed to have a conversation with Mr Eugene Heng and Mr Ding Kian Seng from the Society.

Founder and current Chairman of Waterway Watch Society, Mr Eugene Heng was conferred the President's Award for the Environment — Singapore's highest environmental accolade in 2014. A banking veteran over 30 years, he was once the country operations head of the Bank of America and was actively involved in environmental work while working in the banking industry.

Eugene, what does the environment mean to you? What are your views about economic development and environmental conservation?

Eugene Heng: Environment to me means Life. It is a place for us to progress, enjoy, live in and be safe. While economic development is important, there must always be a balance with environmental conservation. One cannot sustain without the other in the long run.

How has the environmental conservation and education landscape transformed for the past 10 years? Looking forward 10 years down the road, how would you foresee them to be like?

Eugene Heng: In Singapore, I think we have done very well in this area. However going forward with the ever increasing population and the demand for more open space versus economic needs, it would require much more innovative and creative solutions to meet this balance.

We can only go up or go down in our landscape development but still need some balance in environment conservation to ensure sustainability for our future generations. We need a paradigm shift in our approach as we work within this little red dot to meet our future challenges. This includes multi-purpose design landscapes.

What advice would you like to give to Economic students with regard to environmental conservation?

Eugene Heng: Students need to understand the importance of environmental conservation and learn to work within the framework of economic progress and sustainability. It is important to look for the most appropriate practical solutions while not sacrificing environmental conservation as much as possible.

Mr Ding Kian Seng is an elected Committee Member and holds office in the Education Sub-Committee of Waterway Watch Society. A kayaking and dragon boating coach; he founded the water sports company Splashaxis, seeking to integrate paddle sports and outdoor journey in an environmentally responsible manner. He is also an active volunteer with the Scout Movement.

Kian Seng, what made you join Waterways Watch Society as a volunteer? What is the motivating force behind it?

Kian Seng: I have great interest in contributing towards environment conservation and Waterways Watch Society seemed

An observation made during interactions with student groups is that most students choose not to do anything or will pick up the litter created by others if they witness someone litter in front of them. Most do not have the moral courage to engage the litterbug.

to me as a suitable platform for integrating my passion for paddling and protection towards water resources and environment.

There are many encouraging moments that inspire me further. This includes engaging participants during the Kayaking River Cleanup Program. It is heartening to see the group making effort to clean up the river and share their thoughts about the experiences.

What is a day in the life of a volunteer with Waterways Watch Society like?

Kian Seng: Members can commit to either facilitating education programs or going for environmental patrols on bicycles, boats or kayaks. Regardless of the choice of activity, members would gather for a friendly chat (usually over a meal) before the start of the session and conclude with sharing about how the day did go by. There is strong team dynamics among us.

Are there interesting, little known fact about the water bodies in Singapore? Are interesting things to share with students in Singapore?

Kian Seng: Many participants of the Kayaking River Cleanup program are surprised to be able to see and pick up vast amount of litter from the rivers. A group of 30 kayakers can retrieve about 25kg of litter floating in the river within an hour of active effort.

An observation made during interactions with student groups is that most students choose not to do anything or will pick up the litter created by others if they witness someone litter in front of them. Most do not have the moral courage to engage the litterbug.

As a kayaking coach, how do you complement your teaching with environmental conservation?

Kian Seng: I will look out for teachable moments to relate what they can see to environmental conservation.

For example, sighting of otters during kayaking lessons can bring about discussions of wildlife in the reservoir which they paddle in. Subsequently, we would examine the possible impacts of litter to these animals.

A NEW ECONOMIC MODEL FOR SINGAPORE'S NEXT 50 YEARS

Tan Yi Ying
Hwa Chong Institution

Summary

The key challenge for Singapore, is to be sustainable- socially, environmentally and economically. In proposing a new economic model forward, this essay proposes strategies under the broad growth-drivers of productivity and innovation. This is considering changing conditions- future Singapore faces an increasingly unpredictable global environment, in the flux of rapid technological advancement, demographic change, resource depletion and climate change; Singapore is also changing internally, as its population matures and demands the more intangible things in life, and with non-material welfare becomes increasingly interlinked with economic goals. With limits to quantity, growth needs to be more quality driven.

Human capital should be secured for continued potential growth and improvement in welfare: a model of *efficiency, empathy and engagement* is applied to labour development, embracing automation and providing career advancement pathways in which unique human-input is key, while using technology to maximise human utility, and overcome physical decay. Galvanising this the development of a new system of meritocracy to maximise the potential and performance of the future workforce. Singapore's growth ultimately depends on relevance and

value-creation through innovation- but what, and how? Environmental-innovation is a key direction forward; a broad entrepreneurial base is also needed for adaptability. Policies focus on networks and linkages: creating a secure idea/knowledge-sharing platform to maximise the quality and quantity of ideas, facilitating inter-industry collaboration to facilitate the materialisation of environmental innovation, and establishing regional and global linkages to sow the seeds for expansion in future growth areas. Singapore can also ride on technologies of the 3rd industrial revolution to claim a bigger role in global manufacturing- the future could be in a 'digital-port' that capitalises on the paradigm shifts of additive manufacturing. Finally, the essay addresses the world's characteristic unpredictability that can undermine security and growth, calling for external and internal defences, and human resilience.

~

"Will Singapore be around in 100 years? I am not so sure".[1] A classic quote from our ever-realistic late founding father epitomises the key challenge we face moving forward. While we certainly have flourished into one of the world's finest nations, the next 50 years demands us to navigate greater challenges ahead in the increasingly vertiginous tides of the global economy. Our destination has also shifted, as intangibles have become increasingly relevant to our happiness. Therein lies our key challenge: keeping ourselves relevant to the world, while developing sustainably- economically, socially and environmentally.

Singapore today- Re-thinking progress

Income growth no longer drives the elevation of non-material factors even as they increasingly determine Singaporeans' overall sense of welfare[2]. Significantly too, non-material factors are increasingly integral to sustaining strong economic growth. In a people-centred knowledge economy, a liveable environment and social equality are critical to securing and developing valuable human capital[3]. It would serve us well to incorporate non-material goals into economic policy, rather than seeing progress as simply a balance of trade-offs.

Furthermore, output growth has to be increasingly driven by quality and not quantity as the population peaks and resource exploitation reaches its limits all over the world, particularly affecting small Singapore[4]. Cost lowering and value creation should increasingly come in the form of improving the quality of people and output.

This essay suggests strategies forward in a new economic model for our next 50 years, focusing on innovation and productivity in maintaining relevance, growth, as well as sustaining long-run productive capacities. It takes into account the abovementioned paradigm shifts, as well as analyses our critical challenges and key advantages moving forward.`

Securing our Core Resource- People and Productivity

How have we come thus far? Singapore's key resource has always been human capital, people who worked hard and smart to build up this nation; who settled down, generations ago or much recently, and who made contributions.

Yet, we can no longer rely on quantity. Even as we try to increase urban capacities, there will be a physical limit to how many more Singapore can accommodate. It is also unwise to assume that either

[1] Lee, Kuan Yew. One Man's View of the World. Straits Times Press Pte, 2013.

[2] These include equality of income and opportunity, social cohesion, work life balance, and environmental preservation. Refer to Appendix A for some details on areas of concern for non-material welfare in Singapore.

[3] The equality of opportunity, regardless of age, gender or background, for example, is helpful in ensuring that no talent is squandered and that productivity is maximised. Factors such as cultural vibrancy and work-life balance are necessary to create a stimulating and comfortable environment for creative people to lead pleasant lives, and innovative output to occur. A stable society and sustainable environment remain important in signalling a secure space for people and business to develop.

Insert evidence of people leaving

[4] Considering our import dependency and land scarcity. Refer to Appendix B and C for details on resource insecurity and urban constraints respectively.

Continually improving the quality of our workforce is necessary for sustainable potential growth, and by extension, sustained economic advancement.

natural increase or immigration will remain viable in the long run, considering demographic trends[5]. Along with declining numbers is increasing life-expectancy, and the prospect of an ever-increasing age-ratio[6] with negative implications for labour-participation.

We should continue to embrace globalisation[7], aim for replacement-level fertility, and maximise living space. Yet we must eventually make the best of a stagnant or even declining workforce[8]. Continually improving the quality of our workforce is necessary for sustainable potential growth, and by extension, sustained economic advancement. Success would give our nation a lead in adapting to an inevitable future trend.

a) It's about doing the Right Job[9]

"Productivity isn't everything, but in the long run it is almost everything", says Paul Krugman.

Ultimately, improving quality relates to improving productivity, something the government has already identified as a key growth driver although success has remained elusive[10].

As we proceed to improve productivity in a world of rapid technological advancement, the core values of our labour model could be efficiency, empathy and engagement. A technological council could be put in charge of helping Singapore stay ahead of evolution, identifying opportunities for streamlining as technology evolves and promptly implementing gradual transition processes[11] to buy Singapore time for adaptation.

In jobs that are highly structured, repetitive and easily segmented, such as low-level legal-writing, accountancy[12] or manufacturing, machines have humans beat. Embracing future-technologies here would be best for productive efficiency.

What happens to empathy then? Again, early transition buys time for training and retraining. To reduce future technological unemployment, however, this should be directed towards jobs and industries where unique human input – from complex judgement to just interpersonal contact— remains indispensable[13].

---

5 Fertility rates are falling across the globe, not just in Singapore. Refer to Appendix A for a more detailed analysis of population trends affecting Singapore.

6 More than 20% of Singapore's population will be over 65 by 2030. Longevity has increased almost linearly in the past century and predictions on future life expectancy range widely up to way beyond a century. The working age population in Singapore is likely to decline by 16% by 2050, reducing the share of 15- to 64-year-olds from 72% to 56%. Ceteris paribus, this would lower Singapore's growth potential by half a percentage point.

7 The increased interconnectedness of national economies, with the unique characteristic of increased international flows of labour and capital especially in a knowledge economy makes the transfer of talent and knowledge important- we should continue to accept the best in the world.

8 The UN estimates that Singapore's population would have decreased by 2% by 2050.

9 Kelvin Kelly in his book, 'New Rules for the New Economy: 10 Radical Strategies for A Connected World', states: "The task for each worker in the industrial age was to discover how to do his job better: that's productivity...but in the network economy, the question for each worker is not 'how do I do this job right?' but 'what is the right job to do?'"

10 Productivity fell for three quarters in 2014, and has barely increased since 2010 when efforts were announced to raise productivity. (Singstat)

11 Enterprises can be assisted in re-developing their processes, incorporating automation and technological aid for workers where appropriate. Collaboration with entrepreneurs and businesses can focus on making relevant technology viable on a large scale in a transition toward productivity.

12 Affected occupations include product manufacturing, construction, logistics, table-waiting and even advanced services such as accounting or lower-level jobs in the legal service and finance industry. In 'The Future of Employment' by economists Carl Bendikt Frey and Michael A Osborne jobs in accountancy, for example, had a 0.94 probability of becoming computerised in the coming decades.

13 These industries include the culinary arts, care-taking, health-care aides, physical therapy, and recreation instructors, creative industries such as the arts and media and tourism. Complex judgement that takes into account human factors- economists, editors, judges, etc., also cannot be replaced. Again from 'The Future of Employment', recreational therapists, dentists, and editors (media) had just a 0.003 and 0.004 and 0.06 probability of computerisation.

Such careers can offer greater scope for skills-improvement (and subsequently labour-productivity and wage increases) as the value of products and services lie more directly with individualistic quality[14]. As a number of such jobs depend more on crystallised wisdom and soft-skills than highly technical training[15], they could also cater well to the 'lower-skilled', an important factor for shrinking income inequality[16].

Technology can also apply here. Robotic exoskeletons, for example, have huge potential in improving physical strength and alleviating strain. To name just one beneficiary[17] , the increasingly important caretaking industry could really use improved physical-efficiency of its most experienced workers.

Rather than making redundant workers, technology could be targeted to loosen physical limits and retain human value, making viable a strategy of longer working-lives[18] and increased participation rates among the less-able. Developing jobs in which continual improvement is possible and personal input is primary could also make for more engaging careers with greater job-security[19].

b) A Culture of Productivity

Meritocracy as a core national philosophy has been one key driver of success for the nation[20]. Pursuing a new style of Singaporean meritocracy can be part of economic strategy- building up the mettle in Singaporeans to continually push for relevance and competitiveness.

Singapore has recently been working towards a performance-based instead of credential-based meritocracy to encourage relevant skills-development[21]. Yet, change is perhaps best achieved if we start early- students need to become, and come across as the right people. Perhaps following in Finland's footsteps[22], the streaming process can be made more flexible to build up a

> Identifying and developing students' unique strengths, we continually maximise fulfilment, human quality, and future productivity.

[14] As opposed to technical efficiency. While we can train workers in their knowledge of how to better engage people, be more creative or analytical, et cetera, there is a limit when it comes to improving physical productivity (such as the speed of walking, typing, the ability to carry patients or children etc.).

[15] Such as in the hard sciences or engineering. This is however, not to say that we should move away from technical training in the hard and soft sciences and applied science- valuable knowledge and a good background for technological innovation, another unique human quality (for the foreseeable future). Rather, this is an attempt to cater to each individuals' strengths and maximise their value/ scope for improvement.

[16] Refer to Appendix A for details of the state of non-material welfare in Singapore.

[17] Other examples exist. Robots are in development to work alongside humans- carrying parts, holding things, sorting items, cleaning up et cetera and capable of understanding simple instructions, including voice commands. "Making the Future." The Economist. April 21, 2012. Accessed April 8, 2015. The future is yet unknown, and technology can bring us new surprises.

[18] A necessary step in our ageing population. Refer to Appendix D for population trends.

[19] As demand for human input here is unlikely to wane because a machine is likely not capable of a particular human function necessary for the job, in areas such as eldercare, childcare, food service, or 'higher-flying' careers such as editors, media personalities, managers or strategist, machines might lack in human empathy, the ability to factor in human nuances to make complex judgements. Also, people might simply want human contact, especially in care services.

[20] Our focus on merit based reward and promotion has pushed Singaporeans to become one of the world's most competitive workforces, as people are put in the right environments and are incentivised to perform.

[21] Productivity Innovation and Credit Schemes providing grants and tax cuts for raising productivity, and focus on encouraging workers to continually upgrade themselves as well as employers to recognise and support upgrading efforts, rewarding and promoting based on performance and not purely credentials. People are also encouraged to pursue relevant skills and not just 'practical' degrees by politicians.

[22] Refer to Appendix E for a more detailed discussion of how Finland's lack of tracking/ streaming can be modified for Singapore, and the benefits of a less rigid system. Essentially, Singapore needs to have a higher level of control and accountability giving its smaller talent pool; a transcript system affecting annual placement can spur students to work hard to develop their best skills, even if it is not in academics, to secure the right opportunities. At the same time tracking competencies in different areas can help identify a students' inclinations and allow for a more customised course structure, while yearly placement accords flexibility.

culture of consistent self-development instead of 'end-all' assessments. Modified for Singapore, annual transcripts covering achievement or activity in continual academic-assessment and a range of other skills can be the future of substantiating applications and yearly placement, in a new brand of individualised, strengths-based meritocracy that still retains our mechanism for 'quality-control'.

When everyday progress matters more, the 21st century worker develops an attitude of resilience and drive. Moving on from a strategy of pure academic-streaming and 'focusing on the best' refines the allocative efficiency of educational-resources for students at every academic and socio-economic level. Identifying and developing students' unique strengths, we continually maximise fulfilment, human quality, and future productivity.

So this could be how we can continue moving forward; but what do we actually move towards? This brings us to my next point, as we move—

Towards an innovation-driven economy

Already, innovation has been identified by leaders around the globe as the ultimate driver of the 21st century economy. However, innovation-driven growth is especially applicable for Singapore's future.

Singapore has needed to continually move up the industrial hierarchy as our acquired comparative advantages will just as easily be eroded. This will remain a future reality as our neighbours develop. The threat of lost output and structural unemployment is further heightened today due to climate change[23] and disruptive innovation[24]. Environmental issues resurface our concerns about being small and resource-poor[25].

Innovation at the cutting edge of technology and consumer demand, however, can put us in the favourable position of being able to drive new growth opportunities as well as respond to global trends more flexibly to stay relevant. Innovativeness generates greater value from the same inputs[26]- in resource-scarce conditions, such products and processes are important for securing growth sustainably.

So, innovation. The question now: What? And How?

a) What: Innovation for the Future- Relevance and Sustainability

(i) Environmental innovation

Our key export in the future could be a Singapore-brand of environmental-innovation, a niche to cultivate in the next 50 years. Resource development and urban innovation such as by Hyflux and URA have already been exportable Singaporean brands[27] - as sustainable development moves up the world's agenda[28], this is a unique way for Singapore to remain relevant.

Moreover, environmental-innovation doubles-up to facilitate both actual and potential growth as our earliest constraints might be aggravated in the next 50 years. Economic policy forward should focus on the main thrusts of energy, water, food, and urban systems to give us

[23] For example, the Arctic ice-shelf is likely to disappear by 2030, which opens up dramatically shorter trade-routes between Europe and East Asia. For instance, the Northwest Passage could cut 2000 miles from shipping routes. Sea level rise could also submerge key port areas into the far future if no measures are taken, with about 30% of our island being less than 5 m above the mean sea level. Our advantages as a sea port could be lost.

[24] The new economy of creative destruction makes it much harder to anticipate just which industries will remain competitive and which will fade away, threatening our ability to cope with structural unemployment.

[25] Key threats identified by the NCCS are sea level rise that could engulf significant tracks of land, temperature increases leading to a loss of biodiversity and threat to public health, as well as water and food insecurity due to global shortages. Refer to Appendix B and C for further discussion of environmental constraints we face.

[26] This is exactly the 'quality over quantity' Singapore should head towards. As pointed out by Nathan Rosenberg, Emeritus Professor of Economics at Stanford, innovation has been found to be responsible for up to 85% of the growth of the American economy from 1870 to 1950, a period of America's development into a superpower; furthermore, innovation has been pointed out as a process in which people 'think of new ways in which you can get more output from the same number of inputs' 'if you are clever', and alternative to putting in more input (raw materials and capital)- Rosenberg, Nathan. "Innovation and Economic Growth." OECD.

[27] In the past, innovations such as NEWater and urban design have created many opportunities as countries and cities look to import Singapore's expertise in replicating solutions.

[28] Environmental problems are forcing world leaders to increasingly recognise the need for sustainable development and the economic and environmental unviability of current processes has spurred the development of alternatives. Refer to Appendix B for more details.

resource efficiency and self-sufficiency, the latter presently accepted as an impossibility. Developments in biotechnology produced the green-revolution, and could produce landless agriculture; efficient energy-grids, and synchronised driverless roadways could become concretised realities[29].

(ii) Insurance for Relevance- Seed Bank

While focusing on key industries of the future, we should also look at building up a strong entrepreneurial base of start-ups as innovation can come from anyone, anywhere, and could be anything. Evolving from state-entrepreneurship is future necessity. Galvanising our start-up industry is a way to remain flexible as these enterprises can develop in quick reaction to new trends or knowledge[30]. We could in fact be the disruptive-innovators of the-next-big-thing, though we don't yet know what it is.

The easy exchange of a large pool ideas also facilitates open innovation[31], something that is attractive to sustainability industries, large corporations, and small companies alike. Becoming a global hub of innovation through start-ups and networks is a way we remain relevant.

As Meg Whitman asserts: '*Innovation is all about planting acorns with less than complete confidence that each will grow into something meaningful. The alternative, however, is little or no growth when no acorns emerge as trees.*' We need to keep planting acorns as well as nurture them, for as many as possible grow to become impressive oaks.

b) How: Sowing the Seeds, Nourishing the Land

(i) Network Economy- Knowledge and Ideas

Knowledge, diversity and minds are key commodities of the innovative economy. While Singapore's leaders have made laudable efforts in engineering conditions for ground-up innovation[32], networks that facilitate the transfer and exchange of knowledge and ideas could be furthered to maximise our innovative 'seed-pool'.

Programmes currently open up start-up resources to local universities[33]; this could extend to other top researchers or professionals based here. Into the future, critical infrastructure can be developed- possibly a national knowledge 'ideas-base'[34] from thought-leaders, who might not personally want to veer into entrepreneurship. This takes a page off Google's 'Moderator'[35].

On a large scale, and incorporating the right legal frameworks and secure data systems[36], such a large platform for exchange and potential-collaboration contain great utility. Good ideas are seized, given a chance

[29] In fact, the NRF (National Research Foundation) had come up with a list of potential solutions into what areas of research were viable for 2020; for 2065, further-seeing future projection and research is necessary. Infrastructure, as proposed later, also has to be in place to support the development of viable systems to put into Singapore's context.

[30] Our start-ups at JTC are currently focused on the biomedical sciences, infocomm, media, electronics and engineering industries; cutting-edge sectors in which change is truly the only constant, and which can also have wide-ranging applications for consumers and sustainability related industries.

[31] "Open innovation" has come to imply two distinct models for organizing innovation. The first perspective considers markets for intellectual property, in which companies trade patents and other assets in a bilateral fashion. The second perspective is focused on the rise of distributed innovation systems that allow individuals from around the world to participate in innovation processes through voluntary self-selection and decentralized knowledge flows. From: R. Lakhani, Karim, and Andrew King. "Using Open Innovation to Identify the Best Ideas | MIT Sloan Management Review." MIT Sloan Management Review RSS. September 11, 2013. Accessed April 3, 2015. http://sloanreview.mit.edu/article/using-open-innovation-to-identify-the-best-ideas/.

[32] The start-up ecosystem set up at cluster locations such as JTC Launchpad @ one-north as well as various schemes providing financial grants for innovation and entrepreneurial support networks providing knowledge, consultation and linkages incentivise and reduce costs of starting innovative businesses by nurturing creative people and their ideas. Technopreneurship Investment Fund (TIF), wholly owned by EDBI, has also helped to draw more venture capital activities to develop a venture financing industry in Singapore, and grow locally based companies with high growth potential, inter alia.

[33] JTC has set up the SUTD-JTC-I3 centre as well as a NTU-JTC-research centre, 'To carry out research, development and demonstration (RD&D) projects to support Singapore's dynamic industrial landscape' (in SUTD's case). This engages both faculty and students

[34] As opposed to 'database', this would contain unique insight and cutting edge breakthroughs, as well as progressive ideas based on this knowledge- ultimately, good ideas in every stage of their development are made available for refinement or execution.

[35] Refer to Appendix F for details about the Google 'Moderator' and its points of applicability.

[36] This is important. To ensure that both those who bring ideas to fruition and those who put in good ideas (if they are separate people) can be compensated fairly has and will be necessary to maintain the incentive to innovate.

to come into fruition. Non-entrepreneurs gain the incentive to actively educate and innovate[37]. Imperfect information is minimised, while our existing advantages in research and higher-education are maximised. "*(Innovation) is about encouraging diversity and different ways of thinking.*"[38] A virtual platform could make it much easier for ideas from diverse disciplines to meet and for entrepreneurs to encounter new perspectives, beyond chance coffee-shop encounters[39].

Networks are also necessary in environmental innovation, which requires the transfer of knowledge into applied systems. Plenty of effort and investment has already gone into research-and-development to develop relevant industries[40]. A *National Centre for Capacity Development (NCCD)* can perhaps be created to coordinate efforts to develop end-user solutions that better consider the capacities of related industries[41] and socio-political context[42], and perhaps facilitate the early-trials in select-neighbourhoods before nationwide application. Inter-industry linkages, collaborating with the public sector, could hasten the development of feasible systems.

Regional linkages can also be strengthened to facilitate the expansion of these industries to rapidly developing neighbouring countries. We can perhaps take a leaf out of the book of previous partnerships such as the ITPB or VSIP[43] in formulating agreements to facilitate the expansion of industries and develop the Singapore brand. This opens up future access to support, research and data in overseas contexts, important advantages for developing viable solutions.

Our sights should also be set beyond the region- Africa, in desperate demand of sustainable development, is set to become the fastest growing region in the 21st century[44]. Early investment and assistance in their development could facilitate future collaboration and help us remain relevant to global-growth, reaping returns if African nations find success.

All this builds on Singapore's existing advantages as a fertile ground for innovation[45]. We are well placed to facilitate the exchange of global expertise as an alpha+ global city[46] with sophisticated human networks, connections and institutions of

[37] Again, this lies on secure data and legal networks that compensate contributors. Beyond economic gains however, the realisation of visions and concretisation of research breakthroughs could in itself be immensely rewarding.

[38] To quote Mr Bruno Lanvin, Executive Director of INSEAD, one of the world's leading and largest graduate business schools

[39] JTC Launchpad's website states that 'The diverse start-ups in the LaunchPad forms a community that generates ample opportunities for knowledge sharing and collaboration, which helps accelerate their growth and facilitate success in the marketplace.' Physical spaces that allow for mixing and interaction has been said to facilitate cross-fertilisation through conversation and the exchange of ideas. Perhaps, such a process could become more convenient, and conversation could be less serendipitous and more active.

[40] Since 2011, Singapore has announced more than S$800 million of new public sector R&D funding for energy, water, green buildings and addressing land scarcity. Singapore has also set aside S$140 million for research into clean energy under the banner of the Energy Innovation Programme Office (EIPO). Research institutes such as SERIS (Solar Energy Research Institute Singapore) and Energy Research Institute @ NTU have also been set up. Along with its R&D investments, the government is committed to groom research talent in urban sustainability through postgraduate scholarships and specialised courses. (As stated on EDB's website)

[41] Refer to Appendix G for more detailed explanation of the need for inter-industry collaboration such as between water, energy, agriculture, and urban engineering/planning etc. For example, the development of efficient energy grids need to combine clean energy technologies with urban planning.

[42] Social-political context, such as taking into account current policies and social norms, which factor into feasibility and usability/ can spur necessary re-evaluations of current policies and more flexible government.

[43] International Tech Park Bangalore and the Vietnam Singapore Industrial Park, flagship projects between Singapore and foreign governments and businesses. Other examples of collaboration include the Tianjin Ecocity

[44] Refer to Appendix D, which includes some data on population trends in Africa.

[45] Experts all over the world have repeatedly put innovation down to factors such as advanced knowledge and continued support science and research activities and education, financial and legal frameworks for innovation (such as grants, infrastructure and patents), support for the development of high-tech industries, higher education, global connectivity and attractiveness to innovative talent, and more elusive factors such as a culture for innovation that rewards diversity, collaboration, and risk taking, as cited by establishments such as the Global Entrepreneurship Monitor (GEM), Bloomberg's innovation Index and GE's Global Innovation Barometer. Singapore is ranked highly in many lists for innovation, including the latter two's lists, which cite our high tech exports, research personnel, education, as well as business environment and governmental support.

[46] As identified by Sakkia Sassen in her ground-breaking work on the phenomenon of global cities and international economic networks. Locality still matters even as distances shrink, as advanced economic activities usually require the network and connectivity of cities to facilitate the exchange of knowledge and ideas.

Singapore could transform itself into a key player of tomorrow's manufacturing by establishing a new kind of 'digital-goods port'- with centralised additive-manufacturing facilities which receive orders and compatible blueprints from consumers and headquarters, close to our physical ports.

knowledge. Further advantages include Singapore's stable politics and superb info-communications infrastructure set to improve[47], as well as our position as a multicultural, English-speaking city in the heart of Asia-distinguishing us from other top cities[48]. In that respect, building up a reputation as a hub of innovation is within our reach, and maximising our advantages could reap great rewards indeed.

It's time to sow the seeds.

(ii) Revolution and Reality- the Growth Formula

The '3rd Industrial Revolution'[49] could be our catalyst for success.

A salient feature, 3D-printing, is already a burgeoning game-changer; potentially trading-in subtractive mass-manufacturing[50] for a design-centric, just-in-time, just enough model[51]. Customised goods printed on demand with optimal resources increases adaptability to consumer demand as well as cuts costs- something global manufacturers will likely catch on to.

Singapore could transform itself into a key player of tomorrow's manufacturing by establishing a new kind of 'digital-goods port'- with centralised additive-manufacturing facilities which receive orders and compatible blueprints from consumers and headquarters, close to our physical ports. Materialised-goods can then be exported. The Singapore port remains competitive by doing more to cut shipping costs even as climate change is warming our lunchfor the Arctic- as products travel digitally most of the way[52], and then a much shorter distance physically[53].

Why would companies pick us? For all of 3D-printing's decentralising, centrality still factors.

The least-cost location[54] in the future would be proximate to consumer markets as well as headquarters that analyse consumer data, churn out the final-blueprints and manage the network. All this is advantageous to Singapore, proximate to large emerging markets[55] and already home to numerous multinational-headquarters.

Innovation can increasingly come from anyone, anywhere. Our digital-port can engage small businesses or even individuals – our own SMEs and start-ups included – by having in-house logistics teams that oversee the production and shipping of their inventions. Entrepreneurs benefit from economies of scale and can compete with larger corporations without huge capital outlays[56]. Meanwhile, Singapore could capture the significant business if successful ventures continue to find services commendable and cheaper than establishing their own infrastructure.

[47] We have already taken our first step on path towards becoming a Smart Nation, which will entails investment in the upgrading of info-communications infrastructure and the availability of cutting edge technology.

[48] Other Alpha+/ Alpha ++ cities are New York, London and Tokyo. We are closer geographically and culturally to emerging Asia, as well as more open to foreign professionals both in policy and the predominant use of an international language in daily living, as opposed to in homogenous Japan.

[49] As coined by the economist Jeremy Rifkin

[50] Large quantities of raw materials reduced into components of manufactured products

[51] Individual components are printed from pre-determined quantities of raw materials in the printer- this reduces the need to 'mass-produce' identical goods with pre-ordered bulks of raw material optimally divided amongst products, facilitating customisation and reducing materials used to as much as 10% of the original.

[52] In the form of digital blueprints, that can be designed anywhere in the world.

[53] At a speed of 20 knots, the trip from Shanghai to Rotterdam through the Northwest Passage in the Arctic would take about 482 hours, or 20 days, covering 17 853km; conversely, the starting from Singapore, the distance to be covered would roughly be 4000km to Shanghai, about 2900km to Kolkata, and slightly more than 900km to Jakarta. From: "Shipping through the Northwest Passage – Sooner than You Think." Global News Shipping through the Northwest Passage Sooner than You Think. August 21, 2013. Accessed March 8, 2015 and Google Maps

[54] Referencing Alfred Weber's Theory of Least Cost Location

[55] Such as China, India and Indonesia

[56] Expenditure in middle-management, administrative processes and machinery can be reduced or redundant.

While we were never expected to become too important to manufacturing as a small, resource-poor nation, the diminished need for ubiquitous cheap labour and raw-materials in favour of smart minds and great designs boosts our comparative advantages in this area.

Success would set-off multiplier effects for local industries[57]. While we were never expected to become too important to manufacturing as a small, resource-poor nation, the diminished need for ubiquitous cheap labour and raw-materials in favour of smart minds and great designs boosts our comparative advantages in this area. While prospects are already attractive, incentives, consultation and developed facilities could encourage companies to start the change and turn the tides in our favour. Complementing this with a strong local innovators, we could propel ourselves to much greater heights.

Conclusion- Risk and Opportunity

In the turbulent tides of the 21st century, we cannot know what to expect. This essay identifies a few key trends likely to be dominant forces in the following decades- however, anything can happen. Policies of innovation and capacity building as suggested aim to mitigate external volatility by making Singapore more adaptable. Underlying stability is, however, also rooted in being vigilant and developing security measures against 'black swan' events such as sudden pandemics, natural disasters, cyber-attacks and other geopolitical threats.

A key aspect of remaining adaptable and relevant is also in countering internal threats- social cohesion and political stability are important in maintaining our competitiveness as city and people, necessary for the above strategies. As the Singaporean society matures, efforts have to be made in engaging the public in social and political processes- an avenue for self-determination, creativity, and having a stake in the nation.

We stand on the shoulders of giants, and the risks, as well as possibilities are endless. We have the right advantages to propel ourselves further to become a more prominent global force and attain never-before-seen levels of prosperity; we also risk the narrative of going from clogs to clogs. What is our destiny?

Personally, I believe that destiny lies in ourselves and our qualities- the same industriousness, ingenuity, courage and loyalty that pushed us thus far, and still exists in our people.

We are not the kind to become part of history; we are the kind to continue making it.

[57] There are enormous benefits: Keeping the competitive advantage of our ports would enable us to also further our most important industries, including logistics and supply chain management as well as marine and offshore-engineering, as well as harness the capabilities of our consumer business and professional services, generating multiplier effects. More headquarters might be attracted to set-up in Singapore due to existing infrastructure and locational advantage, and developing relevant infrastructure for the future locally would cut costs for Singaporean companies first.

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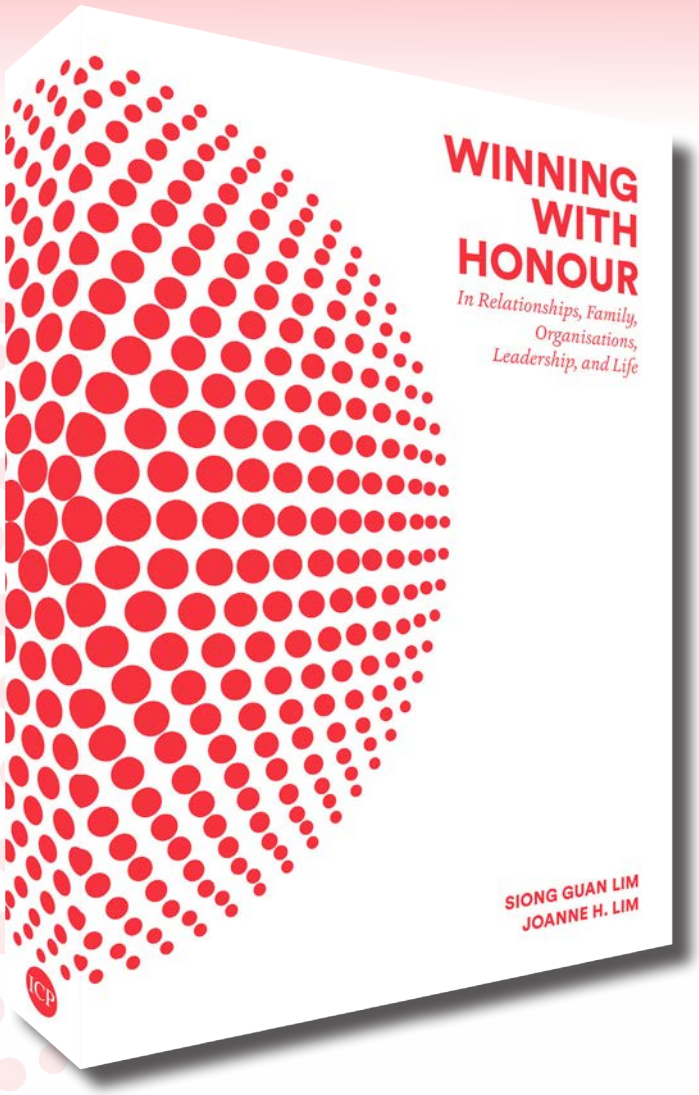

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The ESS Young Career Professionals Wing is a network of professionals under 35 working in fields related to Economics. Members include economists working in both the private and public sectors as well as economics-trained professionals working in related industries such as banking and finance. Besides enjoying activities organised for and by the ESS Young Career Professionals Wing such as networking sessions with successful economists, members also contribute back to society by working on papers analysing the issues faced by young Singaporeans and how they may be addressed. To find out more, please contact Mr Jeryle Yong at jeryleyong@gmail.com.