CENTRE FOR STRATEGIC FUTURES

ANNUAL REPORT 2012

# FORE SIGHT

## About the Centre for Strategic Futures

The Centre for Strategic Futures (CSF) was established in early 2009, as part of the Strategic Policy Office in the Public Service Division of the Prime Minister's Office. This situates it at the heart of the government, with the ability to reach across agency stovepipes.

The Centre is very much like a think tank within government, with the freedom to focus on issues of strategic importance even if they are not perceived to be immediately urgent.

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# Contents


4 Foreword

5 Welcome Note

6 2012 in Brief

14 Humanity 2.0

28 The Future of Work

40 Futures Conversations

46 Global-Asia Confluence

62 Governing for the Future:
What Governments Can Do

74 Emerging Strategic Issues Project 2.0

82 Mapping and Navigating a Volatile, Complex Risk Environment through Networked National Risk Management

90 CSF's Overseas Visits in 2012

98 "What is Singapore's Dependency Ratio?" and Other Interesting Questions

102 Meet the Team

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## What if a drug could make you more productive?

# Enhancing Our Brains

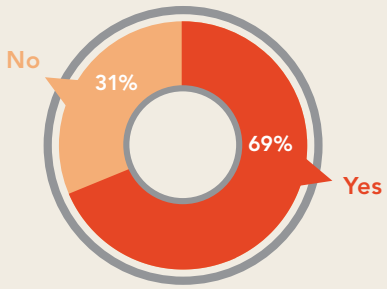
New technologies offer the possibility of enhancing human cognition.

Drugs that improve memory and cognition, such as Adderall to treat attention-deficit disorder and Provigil to treat narcolepsy, are being used "off-label" by students and professionals to boost performance.

In the future, cognition-enhancing drugs may become the norm, and may even be mandated by employers. The U.S. Air Force makes available Modafinil — a drug which enhances alertness — to pilots before long missions.

**Would you take cognition-enhancing drugs despite mild side effects?**

*(Survey by Nature, 2008)*




**"Caffeine is a cognitive enhancement. I don't think there's anything special about enhancing with drugs that makes it morally different."**
*– Prof. Hank Greely, Stanford Law School*

# Foreword

Good governance requires that we plan ahead, consider our options, and prepare ourselves for possible shocks rather than react to them *ex post*. With an accelerating pace of change and increasing complexity of issues that we are dealing with, this has become more difficult, but it has also made foresight even more important.

Studying the future does not eliminate surprises — it would be impossible to do so. But it helps us think early about the implications of certain trajectories, and what we might do to shape the future to achieve preferred outcomes, and avoid undesirable ones. In this regard, the Centre for Strategic Futures (CSF) plays an important role in developing anticipatory capacity in the Public Service, and identifying emerging issues that will be of relevance for Singapore. This publication contains a sampling of its work, which seeks to challenge assumptions, highlight possibilities and push the boundaries of our thinking about the future.

Studying the future does not eliminate surprises — it would be impossible to do so.

Beyond the CSF itself, I am also heartened by the maturing of the wider foresight community in the Public Service, as more and more agencies have taken a keen interest in thinking about the future and preparing ourselves for it. The complexity of our operating environment means that we cannot work in silos but must be coordinated in our approach. This is the reason we set up the Strategic Futures Network, where senior policy makers from across the Public Service come together to discuss issues related to the future. I always enjoy the conversations at these sessions, and find them extremely rich — from the future of Singapore society and development of mega-regions to drivers of crime and shifts in the energy landscape.

In my meetings with senior Government officials from other countries, they often point to this anticipatory capacity to explore the future as a significant strength of the Singapore system. We must seek to continue this effort, and Government agencies, even when faced with pressing day-to-day issues, should retain this capability and invest in long-term thinking. Ultimately, this contributes to better governance as we become better prepared for the challenges ahead, and creates a better future for Singaporeans.

I hope you enjoy the ideas and insights in this publication.

**Peter Ong**
Head, Civil Service
Chairman, CSF Advisory Board

# Welcome Note

In my one-and-a-half years as the Head of the Centre for Strategic Futures (CSF), I often find myself having to explain what this cryptic Centre does. My usual line — "we think about the future and help the Singapore government avoid surprise" — oversimplifies, and doesn't quite capture the breadth and depth of the work that we do in researching new topics of interest, drawing insights from conversations across our network, or building foresight capabilities. This publication will offer a peek into some of our efforts in the last year — the *what, how* and *why*.

The big project for the CSF in 2012 was to identify Emerging Strategic Issues (ESIs) that were relevant for Singapore, to build a better appreciation of weak signals on the horizon, and mitigate institutional surprise.

I would also characterise 2012 as a year of capability-building. In many of the projects mentioned above, we had experimented with new methodologies applied to policy areas, engaged our partners in new ways, and tried different forms of communicating our insights. We opted to do the ESI project within the Government to enhance our own scanning processes and capabilities, and set up the Future of Work project as an inter-agency exercise to give our partners an opportunity to practise a range of foresight methodologies. We have also added to our FutureCraft curriculum, a series of workshops we run for public officers, to include an introductory course to foresight for non-futurists, and a practical "hitch-hiker's guide" for advanced practitioners.

There will undoubtedly be more provocative ideas and inevitable surprises to grapple with, but we are — as ever — excited to meet the challenges of the future.

2013 promises to be just as eventful. There will undoubtedly be more provocative ideas and inevitable surprises to grapple with, but we are — as ever — excited to meet the challenges of the future. We look forward to your comments and thoughts on this publication.

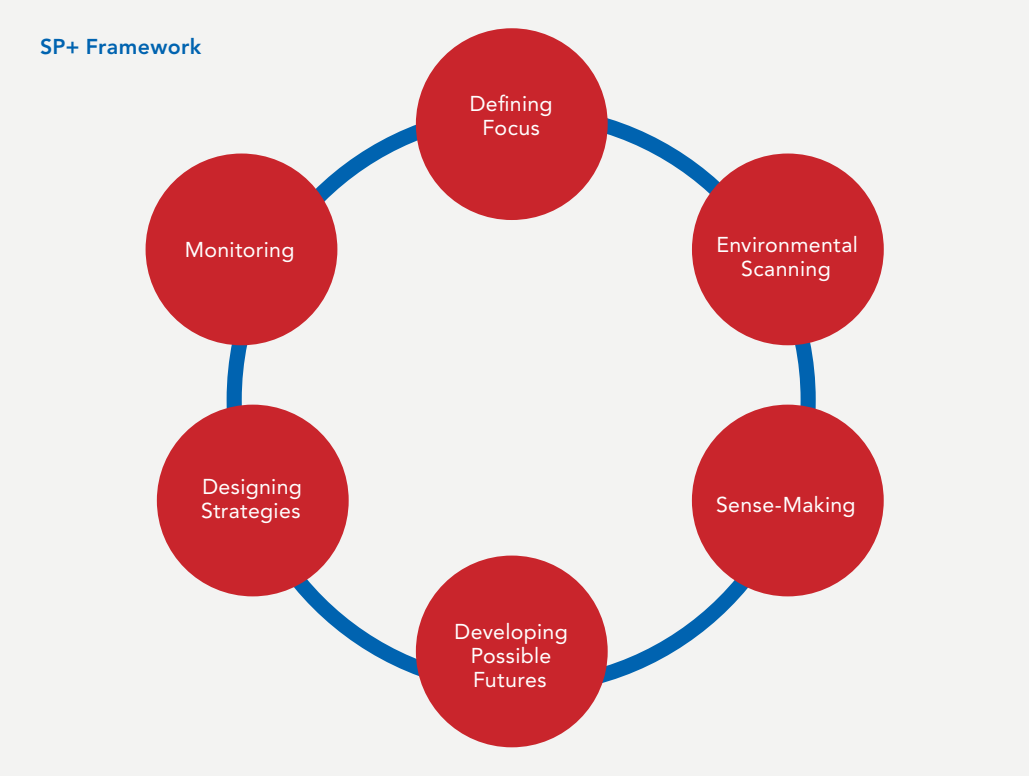
**Kwa Chin Lum**
Head, CSF

# 2012 in Brief

## Research and Analysis

**Scenario Planning Plus**

The Scenario Planning Plus (SP+) toolkit was put together by the CSF in 2009 to complement and enhance the use of scenario planning methodology in the Government, and is targeted at six key areas.




In 2012, we set up an inter-agency project on the Future of Work (pages 28 to 37), to apply foresight methodology in the toolkit to policy areas related to work, such as education and training, economic structure and workforce planning, and labour relations and the social compact. There were also specific research projects that the CSF completed, for instance, on human augmentation (pages 14 to 25).

**Emerging Strategic Issues and Wildcards**

A key part of the CSF's work involves identifying, filtering and prioritising strategic issues that have not yet surfaced as critical but could have significant impact if they occur. We refer to these as Emerging Strategic Issues (ESIs) and Wildcards. Considering these weak signals allows us to better prepare ourselves for the future, reducing the likelihood of institutional surprise.

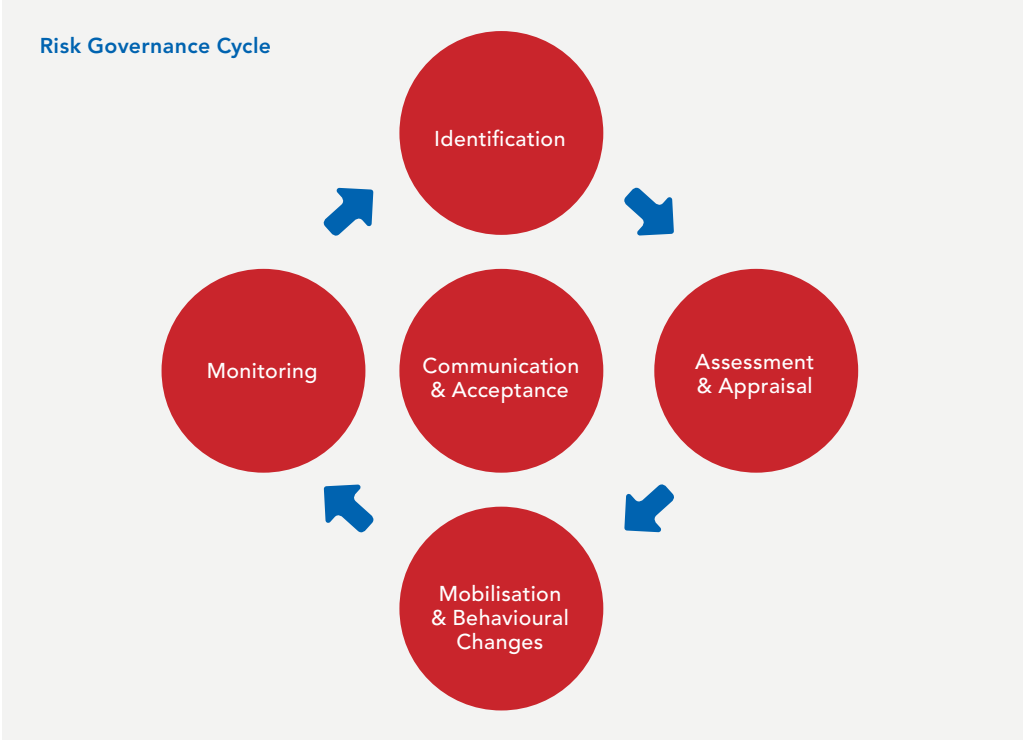
Following the first ESI exercise in 2010, the CSF began a year-long exercise in 2012 to refresh the list of ESIs and wildcards, to ensure that we are constantly seeking out potential surprises. The process involved interviews and conversations with a range of personalities from different backgrounds, both local and international. In turn, we consolidated the ideas into a set of Future Deck cards, which we used in our subsequent engagements with senior policy-makers, government agencies and our network partners. One of the tools in the SP+ suite which worked particularly well in discussions of the ESIs was the Futures Wheel. Using this tool, participants at our workshops discussed the knock-on impacts of particular issues, which might not have been obvious at a first glance.

A key part of the CSF's work involves identifying, filtering and prioritising strategic issues that have not yet surfaced as critical but could have significant impact if they occur.

A write-up about the 2012 ESI process can be found at pages 74 to 79. Some of our favourite ESIs are also featured in this publication.

**Whole-of-Government Integrated Risk Management**

Foresight tools provide anticipatory but not predictive capability, and cannot eliminate uncertainty



from an increasingly complex environment. The Singapore Government therefore adopts a Whole-of-Government Integrated Risk Management (WOG-IRM) approach to address strategic risks facing Singapore in a holistic and coordinated manner, focusing on risks that are complex and cross-domain, and seeking to understand the inter-connections between risks.

Building on our earlier work on the WOG-IRM framework, the CSF has begun work in 2012 on a risk report that seeks to update our understanding of Whole-of-Government strategic risks, and how these come together in risk clusters. We have also worked with the Civil Service College to develop a course on Strategic Risk Management. The course aims to develop a common understanding and framework for strategic risk management amongst public officers, and serves as a platform for knowledge- and experience-sharing across government agencies. Finally, to constantly improve the way we manage risk in the public sector, the CSF is also participating in a multi-country effort coordinated by the International Risk Governance Council to explore the hallmarks and drivers of emerging risk management efforts by various governments.

## Connections

**Conversations**

The nature of the CSF's work necessitates that we take our networking seriously, to help push the boundaries of our own thinking in terms of both methodology and content. In addition to overseas visits, we host a number of international visitors each year, facilitating meetings with senior decision-makers in government and the wider futures community.

In 2012, we had the privilege of working and exchanging perspectives with several of our key contacts, including:

- **Chris Luebkeman**, **Arup Foresight's Director for Global Foresight and Innovation**, who ran a workshop for the Singapore futures community on using the Drivers of Change cards to facilitate strategic conversations (pages 98 to 101)
- **Michael Oborne**, **former Director of the OECD International Futures Programme**, who led futures- and risk-related discussions with the CSF and other government agencies such as the National Security Coordination Secretariat, the Ministry of Environment & Water Resources and the Civil Aviation Authority of Singapore
- **The World Economic Forum's Strategic Foresight team**, which invited the CSF to co-facilitate at its workshop on the Scenarios for the Russian Federation, held in Moscow in October 2012
- **William Halal, President of TechCast**, who discussed technology forecasting with the CSF, Ministries of Trade & Industry and Environment & Water Resources, National Research Foundation, the Agency for Science, Technology & Research, the Infocomm Development Authority and Centre for Liveable Cities
- **Dick O' Neill, President of the Highlands Group**, on the second run of the Foresight Conference in 2013, centred on the topic of Foresight and Public Policy

We also continued to engage our partners in the local community, holding ESI discussions involving both academics and policy-makers.

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**Publications and Speeches**

The CSF regularly presents its work on foresight and strategy at several platforms, with the objective of sharing our experience, generating strategic conversations and gathering additional perspectives on our work. Examples include:

- **"Governing for the Future: What Governments can do"**
  Speech delivered at the Australia and New Zealand School of Government Annual Conference in July 2012 (pages 62 to 73)

- **"Mapping and navigating a volatile, complex risk environment through networked national risk management"**
  Article published in *Integrative Risk Management: Fostering Infrastructure Resilience*, a Dialogue Series published by the Swiss Re Centre for Global Dialogue in 2012 (pages 82 to 87)

- **"Foresight and Public Policy: The Singapore Experience"**
  Presentation at the APEC Centre for Technology Foresight Board Meeting in June 2012

**Overseas Conferences and Trips**

In 2012, we undertook study trips to a number of different countries, from the US and Europe to other parts of Asia and New Zealand. This allowed us to deepen our relationships with existing contacts, and establish new ones. In particular, our visits to countries that the CSF had not previously visited allowed us to better understand the strategic foresight landscapes in these countries. On the whole, our trips have also provided us with valuable insights, and introduced us to new frameworks and methods through which we can better understand the future (pages 90 to 95).

## Capacity Building

**FutureCraft**
One of the key roles of the CSF is to promulgate the SP+ framework of tools across Government. One of the main vehicles for this has been through a series of workshops dubbed "FutureCraft", which aims to introduce key skills and tools relevant to government foresight work.

In 2012, we revised the FutureCraft curriculum to include an introductory course to foresight for new and non-futurists, and a practical hitch-hiker's guide for advanced practitioners. This brings our FutureCraft suite to five courses, as follows:

- **FutureCraft 101: Introduction to Foresight**
  This introductory course provides a "taster" of the different aspects of foresight work in Government, and exposes budding futurists to a range of basic tools.

- **FutureCraft 102: SP+ Tools and Facilitation**
  FutureCraft 102 focuses on various tools from our SP+ suite. Participants discuss possible trajectories of a given public policy issue with the help of these tools, and also learn how to facilitate conversations using these tools.
  *[FutureCraft 103, on Facilitating for Foresight, has been merged with FutureCraft 102.]*

- **FutureCraft 104: Communicating Foresight**
  FutureCraft 104 focuses on discussing the various ways facilitators can curate foresight platforms and products, through the use of different communication and presentation methods.

- **FutureCraft 200: A Hitch-Hiker's Guide to Foresight**
  Targeted at officers with at least one year of working experience in foresight, the course is very much a practitioner-led sharing about challenges and the best practices to tackle them. Topics discussed include overcoming obstacles to foresight, measuring the impact of foresight and generating impactful research.

- **FutureCraft 201: Scenario Planning**
  FutureCraft 201 is centred on the scenario planning methodology, from defining the focal concern and driving force analysis to constructing scenario frameworks, scenario-writing and translating scenarios to strategies.

**Futures Conversations**

In 2012, the CSF introduced the Futures Conversations, a series of dialogues chaired by Mr Peter Ho, Senior Advisor to the CSF, that brings together Directors and Deputy Directors from across the Public Service to discuss emerging issues and latest developments that may have significant implications for Singapore. The objective of the Futures Conversations is to sharpen public officers' instinct for futures thinking, and develop the ability to pick up and interpret weak signals. A snapshot of one of the conversations, centred on the topic of innovation, can be found at pages 40 to 43.

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# IDEAS AND INSIGHTS

Public health and therapeutic advances such as vaccines, anaesthesia, surgery, pharmaceuticals and biologics have vastly reduced mortality and morbidity in almost every population group. This has been brought about by an increase in our knowledge of the human body and diseases, accompanied by improvements in the delivery of healthcare.

Research will continue pushing the frontiers of therapeutic treatment. The question is whether new technologies can substantially and systematically enhance Singapore's human resources, beyond adoption and application in a minority of cases. An important and emergent group of technologies is converging beyond therapeutic treatment, into what is loosely known as human enhancement technology.

## What is Human Enhancement?

Human enhancement, or augmentation, involves supplementing or enhancing human capability or appearance, beyond what is considered normal or healthy, through a variety of methods that use technology or drugs. Human enhancement can take the form of physical enhancement (e.g. surgery to enhance facial features, or the use of exoskeletons to improve strength), life extension, mood enhancement (e.g. the ability to remain cheerful or "fearless" through medication), cognitive enhancement (e.g. better memory and alertness), and gene therapy (the ability to "turn on" or "off" certain genes to prevent certain diseases or alter basic qualities like eye colour).

Today, the convergence of advanced knowledge in nanotechnology, biotechnology, information technology and cognitive science (collectively known as NBIC) has led to many pilot projects and laboratory trials that are rapidly bridging the gap between science fiction and reality.

## Why is this important?

Human enhancement technologies have the potential to fundamentally alter our lives and re-shape the notion of what it means to be a "normal" person. The availability of technology that can, for instance, allow us to communicate with other people without speaking, or to choose our physical, mental and emotional states at will, might mean fundamental shifts in the way governments all over the world formulate policy and legislation on a variety of issues, ranging from health, retirement adequacy, education and human resources, to larger questions of societal equality.

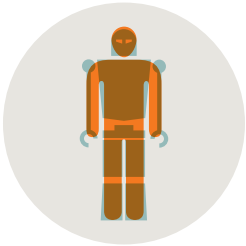
Human enhancement technologies have the potential to fundamentally alter our lives and re-shape the notion of what it means to be a "normal" person.

Already, as techniques improve and costs become lower, we observe that cutting-edge technology is increasingly being used not just to combat disease, injury and medical disorders, but also in applications that lie at the boundaries between health needs and socially-constructed choices. The latest medical advances are being used for aesthetic, individually-preferred lifestyle needs that do not involve actual illness or material physical impairment. Examples include drugs that treat male-pattern baldness and prevent skin ageing, enhancements in cosmetic surgery such as liposuction, and even gene therapy to enhance mental and physical performance for sports.

## Notable Developments

Many prototypes of human enhancement technologies have been featured in the media. Some of the more interesting ones are profiled as follows. (You can refer to the Quick Reference Sheet for a snapshot of other technologies available and being developed.)

**Technologies to enable brain-to-brain communication are in trials today.** Several studies have shown that moods and memories can be manipulated through neural implants. They are more efficient than drugs or gene therapy that may result in side effects or enable limited control by an individual. Sensations like pain can be lessened, while euphoria can be prolonged. Researchers have successfully implanted a microarray into the arm of an individual, allowing him to have motor control and receive sensory inputs from a robotic arm through the Internet, and providing him with an extra remote arm in a different continent. Communication was also achieved by two individuals using the same method (implants).



**Real-life "Iron Men": Mechanical enhancement has become reality.** Sarcos XOS 2, designed for the U.S. military and named one of the 50 Best Inventions of 2010 by Time magazine, is a robotics suit that helps its user lift heavy weights and work faster. Apart from military uses, exoskeletons offer hope for paralysed patients. In Japan, the company Cybergyne has developed and manufactured powered exoskeletons designed for paralysed patients, and will begin clinical trials in 2012 in five Japanese hospitals. The market for mechanical human augmentation systems (e.g. exoskeletons, ocular sensory-substitution devices) was worth $29 million in 2010, and will experience compounded annual growth rates of nearly 41% and be worth up to $877 million by 2020.

**The use of cognition-enhancing drugs has become the norm in some societies.** About 7% of U.S. university students take enhancers for non-medical reasons. The numbers are even higher in the more competitive private universities in the U.S (25%). In the scientific community, 20% of those surveyed used these enhancers. Markets for cognitive enhancers have been and will continue to be very lucrative in the near future. Provigil, a neuro-enhancer initially marketed in 1998 for "excessive daytime sleepiness" due to narcolepsy, grew in popularity and by 2004 had its labels expanded to include more general "shift-work sleep disorders". Net sales of Provigil grew rapidly, from $196 million in 2002 to $988 million in 2008.

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**Gene therapy can cure diseases from birth, or alter basic qualities in individuals.** Germ-line genetic engineering involves a new gene being inserted into an individual when that individual is just a single fertilised cell. When this new gene integrates into the DNA of that single cell, every subsequent cell in that individual's body (from infancy to adulthood) will contain that new gene. Progeny of that individual will also have this new gene. Although there is no human test case reported, this theoretically allows one to choose his offsprings' appearance and even character traits when the child is only a single fertilised cell. Gene therapy is estimated to become mainstream by 2025 according to the technology forecast thinktank TechCast.

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**3D printing of body parts allows "democratisation" of human enhancement.** Pilot trials on 3D-printed body parts were confined mostly to laboratories but activities show that 3D printing may allow for individuals to manufacture replacements or customise their body parts. An 83-year-old received a 3D-printed lower jawbone — the procedure took 1/5 the time it would have taken for traditional reconstructive surgery, and the patient was able to speak a day after the procedure. In 2010, scientists unveiled the world's first 3D-printed human vein. Such developments suggest that the technology to print human organs will not be too distant.

## Developments in Singapore

Pre-implantation Genetic Diagnosis (PGD) involves screening the genomic sequence of gametes or embryos prior to implantation and selecting those with desired characteristics, like gender. In Singapore, successful PGD diagnoses were performed in 2009. PGD is currently a Health Service Development Programme (HSDP) in Singapore, and trials are being conducted in public hospitals.

Research in assistive leg devices is being conducted by the Nanyang Technological University's Robotics Research Centre in an attempt to help partially paralysed patients and the elderly walk steadily. Such technologies resemble the powered exoskeletons developed in other research institutes, and could be used for augmenting rather than remedial purposes in the future.

## Controversy

The debate on the safety and ethical aspects of using human enhancement technologies continues. Issues include:

- **Treatment versus Enhancement:** Traditionally, there has been a differentiation between treatment for medical therapy to alleviate a condition of human suffering, and treatment to enhance the human condition. Opponents of human enhancement argue that technology should not be used to alter human nature, but should be used only to treat human suffering. Proponents of human enhancement quote many examples in history that show that what has been used as a medical treatment (such as immunisation against measles and rubella) is actually a form of enhancement of the human condition against lethal diseases. Proponents also cite that some types of human enhancement may be able to save lives and costs for governments in the long run.

- **Fundamental alteration of humanity:** Opponents of the use of human enhancement technologies say that the very core of human nature will be altered or lost with emerging human technologies. Augmenting the human body with additional physical parts, or ingesting chemicals or drugs to improve the human body, alters the notion of a "normally functioning" human. Proponents say that it is at the very core of human nature to want to improve the human condition, and that the net effects of human enhancement will make human life better in many ways. Furthermore, they argue that technological changes will happen so gradually that people will be able to accept and adapt to their new forms of living, just like during the Industrial Revolution.

- **Impact of lifespan increase:** Opponents argue that too long a lifespan will make life meaningless, and worsen the challenges of ageing found today. Proponents say that it is the individual's choice to lengthen his or her lifespan, and define the meaning in that lengthened life. They argue that knowing that one is going to live for much longer enables a person to live "several lives" of varied and richer experiences.

- **Alteration of future generations:** There are ethical concerns that gene therapy alters human choice and interferes in naturally-occurring processes, for instance, germ-line gene therapy, which alters an individual's gene make-up when the individual is a fertilised cell. This means that when the individual becomes a foetus, is born and becomes an adult, his genetic make-up would have been altered without his consent, and will even be passed on to his progeny.

- **Safety:** Due to the experimental nature of many human enhancement technologies, the safety aspect of some techniques is not guaranteed. For instance, gene therapy is still experimental, and trial patients have died due to cell rejection of certain genes inserted. Proponents argue that completely banning human enhancement methods due to safety reasons simply moves these efforts underground, where a black market will likely develop. This might give rise to unregulated, unsafe and unethical techniques of enhancement, causing health risks and inflated costing for such methods.

- **Transhumanism:** A group of proponents of human enhancement has created an influential movement called Transhumanism to spread ideas of how technology will fundamentally alter human existence, creating the emergence of a "super-human super-intelligence" through the merger of human and machine. The unofficial head of the movement is Ray Kurzweil, author of *The Singularity is Near* (Viking, 2005). Transhumanism has received criticism by opponents of human enhancement for challenging notions of human identity and human nature.

## The Promise

*[... Small tingling feeling, even with anaesthesia.]*

*The training starts at the clinic the next day. (You've taken leave from work for a week to get this right. If not, it will be a waste of good money.) On the first day, the implant accustoms itself to the parts of your brain controlling vision. After viewing a series of images on the screen, you are asked to close your eyes and visualise what you see. Within the hour, the implant is able to record the images, and play it back in your mind long after you've viewed the images.*

*On the second day, you are asked to control the motion of a ball on the screen, using only your mind and without using the keyboard or joystick. It is frustrating at first, as the ball wobbles, but after a while you become familiar with the control. You can actually visualise the trajectory of the ball, and after more tries, you are able to control the motion of the ball quite well.*

*During this process, you realise that you have managed to control the implant itself, by visualising a mental screen in your mind (much like an iPhone interface used two decades ago) and assigning buttons and functions. You get on the Hypernet in your mind, and wirelessly download an application from the manufacturer that enables communication with other implant users without having to speak to them. With this application, you are able to "detect" others, and can "befriend" them to communicate with them.*

**What economic potential does the human enhancement market offer Singapore?**

Human enhancement technologies arise from the convergence of nanotechnology, biotechnology, information technology and cognitive science, all of which are areas of research that Singapore is heavily investing in. Many developed countries, such as the U.S., have outlawed certain types of genetic treatment due to ethical concerns. Already, Singapore's strong support of stem cell research has attracted top minds from the U.S. to pursue research here. The question is whether other types of research considered controversial could be conducted in Singapore, with ample regulation and safeguards.

**How could workforce productivity be enhanced with the use of psychopharmacological and robotic technologies? Who would fund such technologies?**

Affordable exoskeletons or alertness-enhancing drugs could provide productivity increases in our workforce. Older workers might be able to use cognition-enhancing drugs to multi-task better, while exoskeletons might give a new breath of life to persons with disability, allowing them to do the same types of jobs as non-disabled persons. However, who might fund such technologies? The private sector might be willing to enhance their existing workers to meet productivity goals, but might need Government financial support through grants if they are expected to employ disabled persons and older workers. It would also be worth considering if enhancement costs could be covered likewise by the current healthcare framework for treatments, or if other mechanisms are needed, especially if the enhancements are seen as investments in human capital leading to productivity increases or career boosts.

**How might talent availability issues be mitigated with enhancement technologies?**

By extending life expectancy, mitigating the debilitative physical and mental effects of ageing, and restoring human functions lost via accident, disease or genetic predisposition, human enhancement can boost workforce productivity, as people can work at a higher level of ability for a larger proportion of their extended lifespan. Numerous demographic groups such as the disabled and elderly can be as economically productive as the average healthy adult working population, reducing dependency ratios and the strain on public health and welfare systems. In addition, artificial organs, prosthetic limbs, gene therapy to enhance vision, resistance to disease and neural implants for direct interface between brain and machine are only some possibilities that could make up "Human 2.0", who may have significant advantages in fields like education, economics and the military compared to "normal" homo sapiens.

The value of having professionals, managers and businessmen with decades of accumulated expertise as well as the vibrancy and stamina of youth cannot be underestimated. Ageing populations may become assets instead of liabilities, leveraging on many more years of knowledge, networks and familiarity to gain advantages over younger peers. However, this will largely depend on the access and affordability to longevity and augmentation healthcare. If this technology were only available to the wealthy, the middle and lower class will not have access to these enhancement technologies that would have allowed them to carry on in the more physically demanding jobs that they are in (see below under "The Challenge").

## The Challenge

*As soon as you return to work, your implanted friends are able to wirelessly detect that you have just been implanted too. After "befriending" them through the social networking software, you are able to "speak" with them without actually speaking. It feels wonderful, and you finally feel like you're in the group. At first it feels odd, but you realise that it's just like speaking on the mobile phone, because you can "hear" your friends' voices in your mind. (One of them tells you that there is an add-on application if you wish to communicate with someone overseas, but that it will be charged by the minute.)*

*As you turn on the music application and listen to the classic hits of Lady Gaga that are fed directly into the hearing part of your brain, you notice that the cleaning lady has come near your desk and is speaking to you. You try to respond in your mind, but all you get is a blank stare. You realise that she does not have an implant. You grumble in your mind about having to actually use your voice, and start speaking to her.*

*Later that evening, at the team meeting, your director asks that three of the five members of your team — the ones with implants — lead a presentation at the senior management meeting. Apparently, the company President prefers people with implants to make presentations at meetings, as such presentations are more "efficient and immersive". You chuckle to yourself at the great timing of your implant decision, as you know that an audience with the President is a sure-path to promotion next year. As you leave the room, the other two team members who did not get selected look visibly upset. You feel bad for them, but now is not the time to empathise — there's a presentation to prepare. In your mind.*

**How might human enhancement technologies be regulated?**

Human enhancement technologies are not exempt from the regulatory hurdles arising from safety and risk concerns, which may slow the development of such technologies. Nanomedicine, for instance, could target treatment of diseases but the technology has raised ethical concerns, on top of concern over unintended dispersion of "nanoparticles". The bio-printing of organs and tissues could revolutionise health services by ameliorating scarcity in organ supply, but like stem cell research, this raises considerable ethical concerns. A country might choose to be more lenient and progressive about regulating such "risky" research, in order to gain first-mover advantage on any new technologies and methods that result, but this could lead to difficult ethical questions and unintended consequences with regard to human safety and well-being.

**If introduced in Singapore, how might enhancement technologies exacerbate existing social and income inequality?**

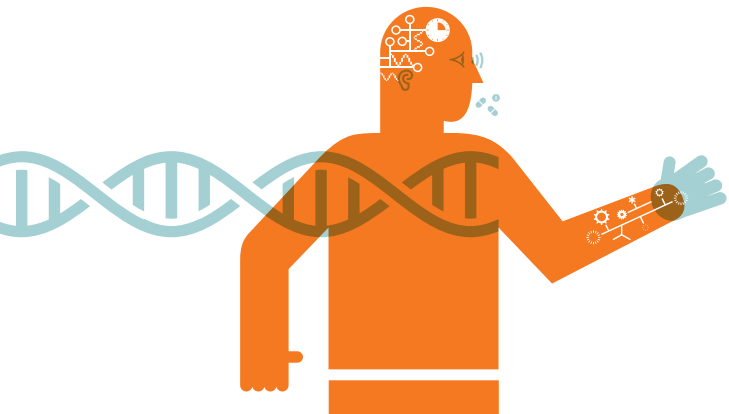
Human enhancement technologies, if they become exclusive and available only to a few before becoming affordable and all-pervasive, have the potential to exacerbate existing social divides. Biotechnology can open new doors for people to adapt and modify their bodies to suit their individual preferences, assuming they are willing to pay for it. The cosmetic drugs industry is extremely lucrative, worth US$40 billion in the U.S., and is likely to grow significantly as developing world citizens become more prosperous and demand such products as their lifestyles improve. There is a growing concern that healthcare priorities will shift, particularly under pressure from aggressive biomedical companies that identify lifestyle treatments as a "growth market", diverting the system's limited resources away from the development of new life-saving treatments, which patients would then find harder to pay for.

Workers may come under pressure to undergo enhancement when their colleagues are doing so. Companies may explicitly or implicitly require workers to undergo a certain level of enhancement in order to boost productivity, such as remaining alert or being able to engage with overseas colleagues who are also enhanced. Workers with financial difficulties and are unable to undergo enhancement procedures may be disadvantaged in terms of advancement prospects.

Students may come under pressure to undergo enhancement to perform well in school. Psychopharmacological drugs such as Ritalin (developed to treat Attention Deficit Disorder, also used to enhance attention, memory, test scores) and Modafinil (used to treat narcolepsy, also being used to remain awake for lengthened periods of time) could be used to gain an edge over peers. Demand for enhancement drugs may be similar to that of tuition in Singapore. Students from families with financial difficulties may be disadvantaged, resulting in decreased social mobility.

**How might human enhancement lead to increased social fissures?**

The debate between proponents and opponents of human enhancement may evolve into larger-scale polarisation or even discriminating behaviour if there is a growing number of enhanced individuals who openly declare their enhancement and are vocal about promoting a "Human 2.0" lifestyle. Interest groups for and against human enhancement may seek to influence the national agenda and if not managed well, this division may intersect with other fissures that exist along ethnic, religious and income lines.



**How might enhancement technologies pose new security challenges?**

Militaries around the world will inevitably use human enhancement technologies to create experimental platoons or squads of "super-soldiers". The U.S. agency in charge of experimenting with new technologies for defence purposes, DARPA, is sponsoring research into continuous assisted performance, which involves developing pharmacological products that enables soldiers to operate continuously without sleep for several days, and drugs that can control pain. Although direct solider-to-soldier combat is not the norm in contemporary warfare (with the advent of drones and missile launches on enemy territory, or cyber-attacks), it is worth considering how human enhancement technologies could be a potential game-changer in the military setting. However, there are ethical issues to consider. Could an enhanced soldier be subjected to enhanced methods of interrogation or torture? How might troop morale be affected with both enhanced and unenhanced soldiers in the same unit? Can soldiers truly remove their enhancements when they retire, and how will this impact their lives in the society?

Abuse of enhancement technologies may occur. Memory manipulation methods that erase memories and recover fading memories have been found. Researchers have discovered and synthesised a chemical that erased rats' memories, and used an engineered virus to significantly boost retention of memory. Such memory-erasing drugs could be used by criminals to remove witnesses to crimes, or for purposes of identity theft. If brain-to-brain communication becomes prevalent, hacking individual neural systems and illegal "downloading" of personal information and memories could be possible. The appropriate ethical and legal frameworks need to be considered for these possible scenarios.

Unintended vulnerabilities introduced by human enhancement technologies may lead to black swan catastrophes. For example, genetic selection or genetic engineering may result in an unintended shrinking of the genetic pool, leading to increased vulnerabilities to epidemics. Psychopharmacological drugs may have long-term health effects not readily observable. Given that the demand for such drugs may rise rapidly over a short period of time once they become mainstream, large segments of the population may have already taken the drugs by the time health effects are finally observed.

## Conclusion

Human enhancement technologies present a whole range of opportunities and challenges for Singapore. The nature of each type of technology also presents unique ethical and practical considerations. There is also the question of cultural and religious acceptance to such technology, and whether they are beneficial in general or only serve to intensify existing fault lines and fissures in society. It is fairly certain that we need to constantly monitor progress in this field globally, and prepare for rich discussions with stakeholders from society on these issues.

## A Summary of Human Enhancement Technologies — Quick Reference Sheet

| Types of Enhancement | Function | Example | Availability |
|---|---|---|---|
| Cosmetic surgery | Alters physical appearance | Facelifts, breast implants | Available |
| Pharmacology | Alters bodily form and/or function | Growth hormones, steroids | Available |
| Psychopharmacology | Alters brain state/mood | Prozac, Ritalin | Available |
| Pre-implantation Genetic Diagnosis | Embryos selected to avoid particular genetic disorders | Cystic Fibrosis, Multiple Sclerosis | Allowed and available in Denmark, Sweden, France, Norway. Available in Singapore only to test for life-threatening diseases. |
| Gene Therapy | Alters genetic make-up of selected cells in body | Treatment of cystic fibrosis by replacing unhealthy gene with healthy version | Research underway |
| Cybernetics | Altering mental or physical function using electronic systems embedded in the body | Implanting silicon chip in a person to improve nervous system function | Research underway |
| Nanotechnologies | Similar to cybernetics but using much smaller implants | Nano-level particles to deliver medication in the human body | Research underway, treatments not expected for at least 10 years |
| Radical Life Extension | Combination of several technologies to increase human lifespan (e.g. to 150 or beyond) | Repairing cell damage caused by ageing | Research underway, treatments not expected for at least 25-30 years |

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## Corporate ladder or roller-coaster ride?

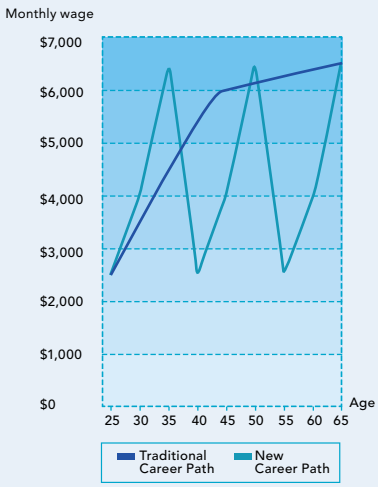
# Roller Coaster Career Path

As technological change and industry re-structuring proceed at a faster pace, the obsolescence of swathes of job categories could force more workers to undergo retraining and mid-career job changes.

This means that the traditional career-wage trajectory, where wages rise with greater years of work experience, might be dismantled.

In its place might come a "roller coaster"-shaped wage trajectory, which is less conducive to the pursuit of traditional priorities like home ownership and raising children.

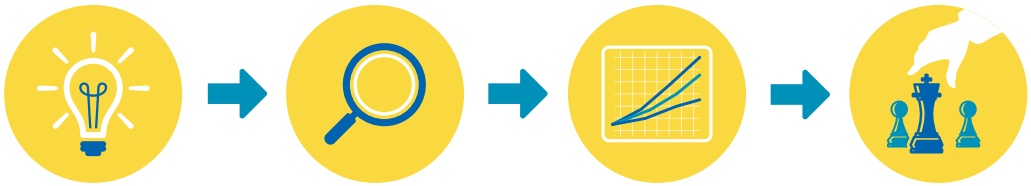
**The New Career Trajectory?**



# The Future of Work

Lee Seng Teck and Lewis Liu

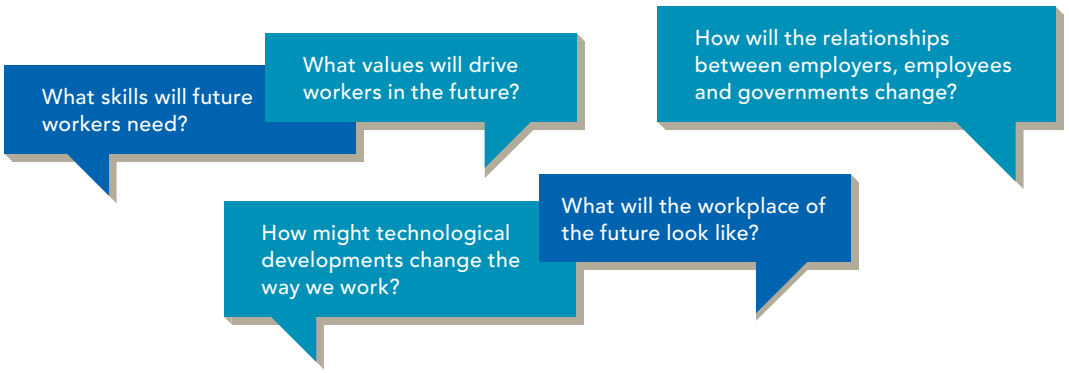
In March 2012, we initiated an inter-agency project to study the future of work in Singapore over a 20-year timeframe. This project was set up as a series of four workshops over six months, culminating in a set of scenarios intended to challenge current assumptions and stress-test existing strategies.




## Step One: Issue Definition

To start off the process, we did a round of sharing about the aspects of the Future of Work our agencies might be interested in, and defined the issues that we would like to explore as part of this project.

We defined work broadly — including both workforce and workplace issues, as well as upstream concerns like education and downstream ones like inequality and welfare. These are some questions that we set out to discuss:



## Step Two: Thematic Clusters

We brainstormed potential issues associated with the Future of Work, and worked through this list of ideas by considering how each idea might fit into the four quadrants of the Cynefin framework.

Developed by Dave Snowden of Cognitive Edge, the Cynefin framework is a problem-definition tool used in sense-making, to identify the boundaries of problem spaces, and understand the nature of the issue being studied.

It challenges the assumption of an ordered world where there are always discernible cause-effect relationships, and allows the user to better assess the situation and determine the appropriate response. The Cynefin framework differentiates between ordered systems that are simple or complicated, and unordered systems that are complex or chaotic. A more detailed explanation of the framework can be found at: **http://bit.ly/cynefin-framework**

Cynefin Framework

Overleaf, you will find a snapshot of issues arising from our discussion, to illustrate how one might apply the Cynefin framework. The intention of this exercise is not to definitively pin down which space each issue belongs to; the use of the Cynefin framework is more to help discussants appreciate the nature of the operating environment and allow the ideas to be fleshed out in greater clarity.

## Simple

### Sense ➡ Categorise ➡ Respond

Simple contexts are characterised by stability and clear cause-effect relationships that are easily discernible.

This is the realm of "known knowns", where problems are readily resolved through best practices and standard operating procedures.

- Establishing work-from-home practices
- Providing job matching services

## Complicated

### Sense ➡ Analyse ➡ Respond

Complicated contexts, unlike simple ones, may contain multiple right answers. Though clear cause-effect relationships exist, not everyone can see them.

This is the realm of "known unknowns", where the understanding of the situation is unevenly distributed, and where expert knowledge may be required.

- Harnessing algorithms to enhance the workplace
- Redesigning jobs
- Customising education for different learners

## Complex

### Probe ➡ Sense ➡ Respond

Because complex contexts are in constant flux, cause-effect relationships cannot be determined *ex ante*. This is the realm of "unknown unknowns", where we understand why things happen only in retrospect.

Problem-solving in a complex space thus requires a degree of experimentation, and a tolerance for failure.

- Tackling the widening wage gap
- Improving access to opportunities
- Recalibrating the practice of meritocracy

## Chaotic

### Act ➡ Sense ➡ Respond

In a chaotic context, searching for the "right answers" is pointless.

This is the realm of "unknowables", where cause-effect relationships have become so destabilised and have no discernible pattern. The only sensible response is to act first, move out of the chaotic space, and establish order.

- Containing a large-scale industrial accident
- Responding to a mass strike

We then grouped the ideas in the Complicated and Complex quadrants into six thematic clusters for further exploration. We have included the complete write-up for one of these clusters here, centred on the topic of "defining oneself through work".

## Defining Oneself Through Work

One defining characteristic of work today is the large extent to which work defines the individual — consider the way one might introduce oneself as “a doctor” or “a lawyer”, or view employment as a civic or moral duty.

However, the centrality of one’s occupation to one’s identity is likely to be undermined by the growing prevalence of inter-disciplinary work. Instead of remaining committed to a single vocation throughout their careers, workers are increasingly expected to perform in multiple vocations, and to achieve serial mastery of skills.

### Five trends in volunteerism that could impact businesses

1. Technology unlocks personalised volunteer opportunities

2. Companies introduce skills-based volunteering as a talent development tool

3. Volunteering becomes an increasingly important part of one’s resume and social cache

4. Increased competition for “talented volunteers”

5. Volunteering will be tax-deductible

Rachael Chong, “5 Visions of the Future of Service in America”, *Fast Company*

**http://bit.ly/future-of-service**

The eroding significance of deep domain expertise or of traditional professional communities might push workers to instead define themselves through achievements, experiences and personal causes. These could be in the form of particular projects they had worked on, or unpaid volunteer work, as opposed to “careers” in the traditional sense.

There may be a generational aspect to this — younger workers tend to be more mercurial and thus less likely to stay in a single job for long, whereas older workers are more likely to value

loyalty and stability. At the same time, younger workers appear to be more emotionally invested in their work than previous generations — we are likely to see an increased demand for jobs that are inspiring and fulfilling, appealing to life goals beyond material fulfilment.

More fundamentally, the idea that work defines the individual could also become challenged by more people becoming unemployed. This unemployment could be structural — for example, due to middle-class jobs being replaced by automated processes or algorithms. Global economic rebalancing could also be accompanied by long periods of mass unemployment, with severe societal consequences — as in the case of the current "lost generation" of European youths remaining unemployed into their thirties.

The other five thematic clusters are:

**Achieving work-life harmony**

As faster and more reliable communications technology facilitates new working arrangements like telecommuting, businesses may no longer need to be conducted out of fixed locations. The practice of working from home or out of dispersed "satellite offices" could eventually replace face-to face interactions.

Improvements in communications technology have also brought about the rise of an "always-on" work culture, where the boundaries between work and personal life are blurred. This puts pressure on employers to flatten workplace hierarchies, and harmonise workplace interactions with those in "regular life".

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**Achieving fair outcomes for society**

Technological advances may result in human workers replaced by intelligent machines or algorithms, even among the professions. This "hollowing out" of the middle class might place fresh pressures on governments to correct the inequalities of the free market through more aggressive redistribution.

At the same time, people's faith in meritocracy as a mechanism to allocate opportunities and rewards could be undermined as socio-economic disparities widen. This will create fresh challenges across the economy as both employers and the government adapt to shifts in what "feels fair". Globalisation is likely to result in a workforce that is increasingly diverse. both in terms of attitudes and demography. However, greater tolerance may not accompany this greater diversity — emerging societal shifts might deepen existing divides or create new ones.

**Managing demographic and attitudinal diversity**

One potential divide is inter-generational. Given improved education opportunities and access to information, the rising generation of workers is likely to be more discerning and outspoken than ever before.

With increased life expectancies and shifting attitudes towards retirement, seniors are likely to feature more prominently in the workplace. Will the increasingly multi-generational workplace be a harmonious one?

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**Sustaining economic relevance**

Investment into human capital development and education will remain pivotal in determining if workers can remain competitive in an increasingly globalised world. But there are concerns that higher education that is centred on paper qualifications and book smarts might be of decreasing relevance.

In an increasingly complex economic landscape, are we going to see the decline of professional "vertical" expertise relative to generalist "horizontals", such as the ability to network effectively or connect the dots between disciplines? Or might improved communications technology actually facilitate the rise of hyper-specialised workers, now able to market skills that were previously considered too niche?

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**Maintaining stable industrial relations**

It will become increasingly harder for unions to adequately represent the concerns of an evolving workforce, holding jobs that are increasingly multi-skilled and interdisciplinary.

Trends such as the rise of freelancing or project-based employment can make it meaningless to group workers by their employer or trade, eroding the effectiveness of unions' collective bargaining.

This might lead to less stable industrial relations between employers, employees and government.

## Step Three: Scenario Generation

At this session, we used the BIPED framework to flesh out "story elements" that would serve as the building blocks for our scenarios, and help make them more immersive and engaging.

Building on the lists of BIPEDs we generated, the group then clustered the different story elements into three plausible scenarios, paying particular attention to aspects of the scenarios that posed the most interesting policy questions.

On the next two pages, we have featured two vignettes from the scenarios, illustrating how the discussion on "defining oneself through work" was eventually incorporated into a narrative.

### BIPED in brief

The BIPED is a brainstorming technique aimed at generating ideas on different aspects related to a particular theme, which may then be incorporated into different scenario narratives. To help jumpstart the discussion, we asked the following questions:

**Behaviours**
How might people behave, and what motivates them? What would they say or do? What are social norms of behaviour?

**Issues**
What are the implications? Where are the potential sources of conflict?

**People**
Who are the key actors driving the issues? Are there new stakeholder groups to consider? Who are the supporters or detractors, winners or losers?

**Environments**
What is the systemic backdrop to the scenario? What is the legal or governance landscape like? What are the infrastructural and technological features?

**Derailers**
What could cause the issues that you highlighted to develop differently or in an unexpected fashion? What are some possible black swans?

## Life is About More Than Just Work

*The backdrop to this vignette is a strong Singapore economy, buoyed by the recovery of the US and Europe in late 2010s, and restored trust in global financial institutions.*

Consistently strong economic performance in the 2020s has underpinned gradual adjustments to people's attitudes towards work. Beyond a certain level of material attainment, people have started to turn to non-pecuniary forms of fulfilment, such as volunteer work. For a growing proportion of the population, save those in the bottom few deciles, the emerging consensus is that there is no need to "work so hard", as long as one's basic material needs are met.

Alongside this is broad agreement that having "a career" (at least in the traditional sense) is no longer a critical aspect of membership in society. Even among those who choose to stay employed in traditional roles, extended sabbaticals and other leaves of absence are increasingly commonplace — people are increasingly taking time out of their careers to find themselves and explore their passions. Factoring in life-enhancing advancements in medical technology, the average worker is now peaking ten to fifteen years later in their career as compared to the 2010s.

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**Discussion points**

- How might shifting attitudes towards work affect our productivity and the overall competitiveness of our economy?
- Establishing work-from-home practices
- How might we measure the well-being of a society that is increasingly finding fulfilment in non-economic pursuits?

## Holding Out for the Right Job

*The backdrop to this vignette is a "slow-go" growth story, underscored by Singapore's high exposure to the volatility of the international economy. This economic unpredictability has translated into stresses and strains on the domestic front.*

The Government introduces a raft of measures to broaden Singaporeans' access to jobs, among them increased investment into skills transfers to locals. Government is not alone in this — the big victory for civil society has been the introduction of a national unemployment insurance scheme, which has been hailed by activists as a step in the right direction towards a more inclusive Singapore. The insurance scheme is primarily coupled with programmes to facilitate mid-career transitions, whether in the form of job matching or skills retraining.

However, in spite of these efforts, many Singaporeans remain particular about the types of jobs they do. Buoyed by the hope of periodic economic upturns, many continue to shun jobs perceived as being menial or physically strenuous. For example, many retrenched professionals opt to ride out periods of unemployment through internships or apprenticeships, expecting that hiring will resume in the short run. This indeed happened during the long economic slump between 2022 and 2028 — having lost their jobs at the start of the recession, many Singaporeans remained jobless for close to five years. Today, even though the economy has broadly recovered, many are finding it difficult to return to the workplace, having lost many functional skills, such as the ability to navigate workplace hierarchies and processes.

The declining sense of urgency to seek re-employment has been attributed to a number of factors, including better social support for the unemployed. In addition, there is now greater visibility and acceptance of alternative pathways in life, not all of them predicated on constant employment or financial stability. While some are welcoming of this less transactional attitude to life, others worry that the growing incidence of voluntary unemployment has weakened Singapore's ability to recover quickly from cyclical downturns, as people get used to not working for a living. There is also growing concern about "unemployment hysteresis", where people who spend extended periods of time out of formal employment progressively lose the ability to integrate back into traditional work settings, and are unable to recover financially should the need arise.

### Discussion points

How might we better understand employees' perceptions towards different types of jobs, and their motivations?

How might the Government balance the need to take care of the needy with the need to discourage Singaporeans from being voluntarily unemployed?

## Step Four: Scenarios to Strategies

At the last session, we discussed possible follow-ups and policy responses to the scenarios, e.g. specific areas within the scenarios that fed into agencies' interest areas or ongoing work-streams.

This was a wide-ranging discussion from workforce and workplace planning to continuing education and training. Some questions we discussed were:

- How might we identify the skills required for the jobs of the future, to develop the necessary pipeline for manpower?

- How might investments in infrastructure to facilitate telecommuting or satellite offices catalyse innovative solutions to our land constraints or congestion problems?

- How might we think of the "investment returns" from education? Does pursuing an education in a field that does not become one's career constitute deadweight funding, or is it more important that such graduates are able to obtain employment and apply "horizontal skills" like critical thinking or good communications?

*Acknowledgements*

*We would like to thank the following agencies, who contributed ideas and research to this project.*

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## Does your organisation crowdsource effectively?

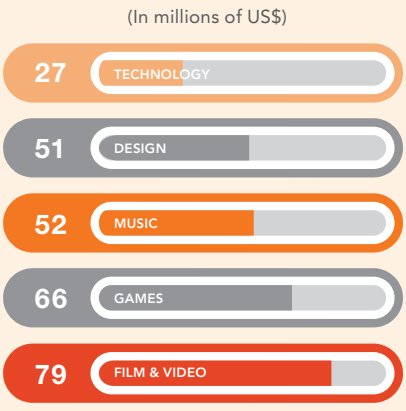
# Crowdsourcing 2.0

The potential applications for crowdsourcing continue to grow:

- **Venture Capital:** Crowdfunding may be the future for how entrepreneurs raise funds — retail investors provide start-up capital.
- **Public Policy:** Governments are using digital reporting from citizens for updates on the quality of service delivery, or to report corruption.
- **Academic Research:** Universities are using crowdfunding to fund research projects. Rather than relying on big donors, they are tapping "micro-philanthropy".

**Venture Capital Funds Raised on KickStarter by Genre**

*(KickStarter, 2012)*



# Futures Conversations

April Chin and Lewis Liu

The Futures Conversations are chaired by Mr Peter Ho, Senior Advisor to the CSF, and bring together Directors and Deputy Directors from across the Public Service to discuss emerging strategic issues, latest trends and key developments that might have implications for Singapore.

The objective of the Futures Conversations is to sharpen officers' instincts for futures work, and to develop the ability to pick up and interpret weak signals. In doing so, we hope to develop and strengthen the anticipatory capabilities within Government.

Organised once every two months, the Conversations are deliberately kept unstructured with no pre-identified set of issues. They start with broad questions such as "What have you read in the newspapers that have surprised or concerned you?". The free flowing discussions give officers the opportunity to share their observations on any topic of interest. This unstructured approach has helped uncover insights on issues ranging from sweeping global shifts to decidedly local concerns.

To illustrate the thought process of thinking through the issues, we have selected the topic of "innovation" and presented the points raised in the form of an infographic. Starting from a single key observation, we take a deep dive into what might be the possible factors and implications for the future. Through these Conversations, we hope to continue to develop diverse ways of thinking about the future, and uncover surprising and impactful insights for Singapore.

Non-English languages such as Mandarin are not widely used in the global academic communities, and could potentially impede the cross-pollination of ideas across countries.

Some have also argued that intellectual property rights protection needs to be strengthened in order to incentivise companies to innovate.

**What are the factors necessary to create a conducive environment for sustainable and quality innovation?**

Even though Singaporean students do well on international assessments, some have observed that the students lacked the drive to do more than what they are asked to do, and avoided risk-taking.

Creative destruction is often seen as a necessary ingredient of innovation, while profit-driven motives can sometimes dilute the quality of innovation.

**How might we transform education to create the innovation spark amongst youths?**

Singapore wants creativity not cramming.

*Source: BBC News, Singapore*

The current education system in Singapore streams students according to their ability at a young age. This could potentially over-emphasise in-born giftedness and promote narrow pathways to success.

In 2009, 63 Israeli companies were listed on the NASDAQ — more than any other foreign countries.

*Source: Wall Street Journal*

With little natural resources and a volatile security situation, some have hypothesised that the success of Israel's high-tech sector could be attributed to a sense of fearlessness among its citizens, and a belief that innovation is necessary for survival.

South Korea ranked as the 2nd most innovative country in the world.

*Source: Bloomberg Businessweek*

**Can innovation be nurtured by the Government?**

**How do socio-cultural factors shape innovation?**

**How might the widening socio-economic inequality affect America's investment and emphasis on innovation?**

While the push towards greater innovation can unlock tremendous economic value, it is less certain if the benefits of an innovation-driven economy would trickle down to the masses.

While the number of patents applications has increased in China, patent quality has not improved proportionately.

*Source: European Union Chamber of Commerce*

Despite challenges to the US economy over the past few years, the uniquely American "sense of no limits" could have helped them to continue to push the innovation boundary and establish thought leadership in fields such as space travel.

The US is still seen as a leader in innovation.

*Source: GE Global Innovation Barometer 2013*

## The Secret to Innovation

**What is the fate of innovation in the hands of corporate giants?**

The Rule of the Few — just ten MNCs own majority of household brands.

*Source: Convergence Alimentaire*

Factors such as consumerism, market deregulation, free trade and globalisation have allowed MNCs to expand their reach.

As a major economic and employment contributor to nations, MNCs have further consolidated their position as corporate giants in non-financial domains, such as the political and public policy spheres.

Even though structure and hierarchy is typically seen as an obstacle to innovation, the Korean government has successfully accelerated innovation through promoting research collaborations between state think tanks and large conglomerates, streamlining business regulations and financing start-ups.

**Legend:**

- Observations of emerging issues, trends and developments
- Possible systemic factors or causes
- Thought-provoking questions about the future

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## Can a robot do your job?

# Automation of High-End Jobs

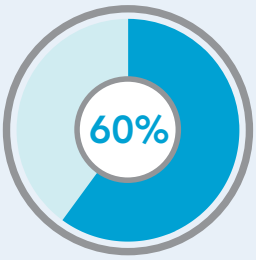
The pace of automation has increased. Machines now possess capabilities previously thought to be uniquely human, such as understanding speech and recognising complex patterns.

Whereas the previous wave of automation hit manufacturing jobs, the next wave will affect higher-end service jobs — such as those in accounting, finance, sales, marketing, and legal services.

This means that in future, the skills required in high-end jobs will be those abilities that machines lack — asking the right questions, solving unexpected problems, and programming machines.

**% of Existing Jobs Likely to be Displaced by Computers by 2030**

*(National Research Council, 2008)*




**"By one estimate, one lawyer is now as productive as 500 used to be. You might not lay off 500 lawyers, but the next time you might hire a few people and some software to read documents."**

*– Prof. Andrew McAfee, MIT*

# Global-Asia Confluence

*This article first appeared in* Future Tense, *a 2012 publication by the Ministry of Trade & Industry.*

The inaugural "Global-Asia: The Singapore Summit" was held in Singapore from 21–22 September 2012. The summit brought together the international advisors and senior guests of the Monetary Authority of Singapore (MAS), Singapore Economic Development Board (EDB), Government of Singapore Investment Corporation (GIC) and Temasek Holdings, providing a unique opportunity and setting for industry and thought leaders to interact.

Based on the theme "Global-Asia Confluence", the Summit discussions focused on how the global environment would affect Asia and, in turn, how a rising Asia would be able to shape and influence the rest of the world. Panel sessions at the Summit featured distinguished business and thought leaders, who discussed how macroeconomic and geopolitical developments (including demographic and technological trends, shifting consumption and investment patterns), regulatory reforms, as well as evolving economic flows, production networks and industry clusters will shape the Global-Asia landscape.

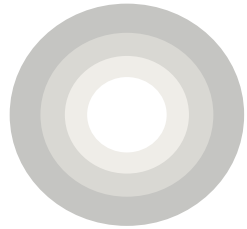
## What Is Global-Asia?

Asia is being globalised and, at the same time, the world is being "Asianised" at an unprecedented scale. Asia and the rest of the world are more interdependent than before. However, collaboration and convergence have become increasingly difficult, amidst a fragile global economy and domestic pressures. With the emergence of new players and institutions in a state of flux, there is a need to proactively define, understand and manage the confluence of Asia and the world. This necessitates a fundamental shift away from paradigms based on geographically defined dichotomies to a "Global-Asia" paradigm that focuses on the interconnections between Asia and the rest of the world. How well countries, cities and companies fare in the evolving global order will depend on their ability to build and deepen linkages by traversing and transcending differences.

## How to use this map

This map, and three associated perspectives, were developed as tools to help visualise coming changes discussed at the Singapore Summit. The map depicts five major drivers of influence, delivering three levels of impact where Global-Asia would change the economy, society, and lives over the next decade. The three perspectives — 1 Employing the Nine Billion, 2 Energy Abundance and the North American Renaissance and 3 A New Global Nervous System — are described in detail after the map.

**FIVE MAJOR DRIVERS OF INFLUENCE:**
This map is organised around five major drivers of influence. These are core stories that define the interactions of political, economic and social forces.



**AREAS OF IMPACT:**
Radiating out from the five major drivers of influence are the three rings, or areas of impact, that signify how the power of the hyphen will affect our economy, society and lives.

**THEMES WITHIN EACH DRIVER OF INFLUENCE:**
Under the umbrella of each major driver of influence are three themes that that relate to the bigger stories and expand on them.

**SIGNALS FOR EACH LEVEL OF IMPACT:**
These are signposts to the future, categorised by area of impact.

**Transaction**
Interesting data that we see today

**Transition**
Trends and possible tipping points

**Transformation**
Speculative questions that point out different pathways the world might take

# Global – Asia

## The Power of the Hyphen

TRANSFORMATION TRANSITION TRANSACTION

Average actual retirement age in the EU and North America (1970-2010) fell from around 68 to 63, even as life expectancy increased.

*(CECO, The Economist)*

Governments seeking to improve the value of the public dollar may increasingly turn to corporates to provide public services.

More content is generated on YouTube in one week than than by all the global news network in one year.

Cisco runs Songdo city.

Shared Leadership: Presidents, Mayors and CEOs

Powered by People

**LEADERSHIP & IDEAS**

Covergence and Competition

How will deeper governement-business partnerships evolve under greater public scrutiny?

Gaming unlocks the value of networked and unpaid crowds.

Language and firewalls separate the English-language Internet from 500m Chinese users - twice the number of internet users in the US.

Green Light for Redback

**MONEY & INSTITUTIONS**

New Global Governance Structure

Internationalism and Regionalism

What will society look like when Facebook and Google rival governments' ability to influence citizens' behaviour?

The Occupy Movement has spread to more than 130 cities around the world.

RMB-denominated trade settlements to account for 30% of China's total trade value by 2015.

*(Deutsche Bank)*

The RMB may acount for 15% of global currency reserve holdings within the next decade.

Will a highly polarised electorate result in global political gridlock?

The number of FTAs signed in the last ten years has increased, while participation in international organisations has fallen.

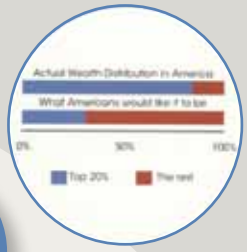
Will the world move towards a multi-reserve currency arrangement?

The ASEAN Capital Markets Forum seeks to grow the ASEAN regional capital market to 15% of the world's market capitalisation.

The ASEAN+3 Macroeconomic research office has been set up for surveillance across the regional countries.

International and regional groups fail to achieve common outcomes on transboundary problems.

More plural monocultures lead to new social fissures.



(HBS, Duke University)

The UN projects that in 2030, Africa will be the youngest continent in the world.

Will societies begin to include more redistributive approaches into their social contracts?

Will young societies build up their institutions fast enough to capitalise on their demographic dividend?

**SOCIETY & DEMOGRAPHICS**

Melting Pots, Boiling Over

Young vs Old or Young and Old

Economics of Envy: Skill Disparity

While 3 million graduates and post-graduates enter India's workforce annually, industries consider less than 25% of them employable.

(NASSCOM)

Deep sea mining exploits undersea mineral wealth, leading to new frictions.

What new international treaties and regulations should apply?

**NATURAL RESOURCES**

New Frontiers

New Energy Powerhouses

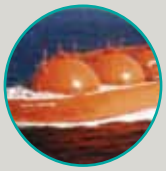
New Abundance, New Scarcities

US leads global shale gas exploitation and becomes a natural gas user.

Denmark, Norway, Russia, Canada, US have all stacked mineral claims to the Arctic.

Will developments in fossil fuel extractions impede investments in alternative energy sources?

Canada has the second largest proven petroleum reserves, mostly from non-conventional sources.



Energy independent North America becomes major global LNG exporter.

**REAL ECONOMY**

Augmented Economy

Global Corporations, Global Impact

The Great Trade Rebalancing

30% of global fish stocks are depleted, as seafood consumption rises.

Technological processes become reliant on increasingly exotic minerals, like rare earths and specific plant products.

What is the oil/LNG trade route switches from the Middle East to the Pacific?

Sales per employee Google: $1.2m Walmart: $100k

(McKinsey)

Foxconn is replacing 80% of one million workers with robots in three years.

How do we employ nine billion people when most work is done by algorithms or robotics?

Samasource's cyber platform delivers computer-based work to women, youth and refugees living below the property line, connecting them to the global economy.

(Samasource)

Corporates plug North Africa into Europe's energy market via a utility supergrid.

By 2014, China's trade surplus will turn into deficit.

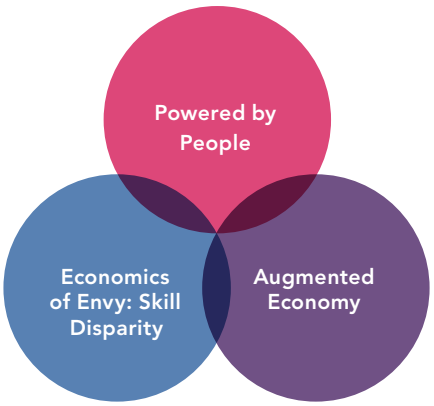
(Nomura)

How will the corporate bottom-line evolve?

PERSPECTIVE ONE

# Employing the Nine Billion

**Chris Ng**
Lead Foresight Strategist, Ministry of Finance




In this story, we explore how the interactions of unequal demographic growth with the emergence of a machine-to-machine economy may lead to wide disparities in skills, employment and income. This will create distinct challenges for societies and corporations across the globe. In this scenario, the ability of citizens to provide for their families and themselves, and contribute effectively to their societies and economies, becomes a point of uncertainty. In the absence of a sustainable strategy towards job creation and employment, societies and economies risk becoming unstable and may regress in their pursuit of progress.

The United Nations Population Division estimates that in a medium case scenario, the world's population will peak at nine billion people in 2050 before falling as fertility rates in the developing world start to erode. However this population decline is not uniformly distributed. As different regions of the world experience different rates of economic development, they will experience unequal demographic growth.

Europe and East Asia are experiencing rapid population ageing. Decades of low birth rates coupled with affluence and access to medical care and nutrition mean that the elderly live much longer even as fewer babies are born. With the sole exception of the US, falling fertility rates in the advanced economies are resulting in shrinking, ageing native populations. They face a fiscal challenge. The increased public expenditure on healthcare and pension systems are large fiscal burdens which the state will find difficulty financing given the conditions of a shrinking population of working adults, falling tax revenues and high dependency ratios.

Without prejudice to Singapore's efforts to raise fertility rates, these problems appear to be intractable. An OECD study of its members found that once countries fall below the TFR of 2.1, they almost never return to the level of population replacement (with the exception of Sweden for a brief period in the 1980s, and the US through the injection of Hispanic immigration from Mexico). Developed countries will likely turn to a mix of the following strategies in order to maintain their economic competitiveness, standards of living and unique social contracts[1]:

**Population augmentation** – Import of young labour and/or global talent to sustain labour intensive industries and create new economic opportunities for the host economy. This is the dominant strategy but has cultural limits. If and when countries where traditional labour sources develop and move up the economic value-chain, the labor supply available for import will dry up. Developed countries will need to import from non-traditional sources, but there are questions of cultural integration. Well-known examples are the North African and Turkish ghettoes in their northern European host countries.

**Capital augmentation** – Some societies prefer technology deployment to immigration to compensate for a stagnant or shrinking work force. Japan and Korea are the best examples, relying on an increasing level of automation and robotics.

**"Silver capital" augmentation** – As developed nations' economies become increasingly dependent on the augmented economy (below) as a source of growth, elderly experienced knowledge workers may become an asset and a competitive edge for developed countries instead of a fiscal drain. This may however require significant advances in technologies to support active ageing.

Demographic growth patterns pose a different set of challenges to developing and emerging economies. Less developed regions like Africa and the Indian subcontinent continue to see birth rates significantly above the 2.1 replacement ratio. Although their birth rates will fall as their societies develop and more women enter the workforce, greater access to health care and nutrition mean higher survival rates of infants reaching adulthood. This explosive growth of a young workforce is called a "population dividend". Rapid population growth could, however, result in overwhelmed public infrastructure (e.g. roads, housing) and institutions (e.g. education, access to government services). Many of these economies will face the challenge of gainfully employing their expanding young populations and pacing their infrastructure and institutions to cope.

If they succeed, they may be able to reap their demographic dividend and grow rapidly into middle-income economies. If they fail, high unemployment and unserved communities may become increasingly restless and agitate for political change and revolution. The International Labor Organization has attributed partial cause for the Arab Spring to youth unemployment in its "Global Trends for Youth Employment 2012" report.

There is more. The story of technological progress displacing human labour is an old one. At the start of the 20th century, approximately 40% of the US labour force was employed in the agricultural sector. By the 1980s, agricultural technology improvements drove that share down to 2%. Many of these displaced workers had to be reskilled for the burgeoning manufacturing sector, but this was a slow process that took decades.

In a 2012 McKinsey Quarterly publication, the economist Brian Arthur coined the phrase "The Second Economy" (we call this the Augmented Economy) to describe a second, machine-to-machine economy that is emerging. Human beings may design it, but few are involved directly in running it. While it may create economic growth with higher revenues and profits, it creates few new jobs while displacing many existing ones.

The productive power of the Augmented Economy is best expressed in the examples of Walmart and Amazon. Walmart, one of the largest and most successful companies of the old generation

physical economy, generates revenue of approximately $200,000 per employee. Amazon by contrast generates one million dollars per employee. But Amazon hires 60,000 people, while Walmart employs over 2.1 million. That said, while Amazon might be employing a more profitable and productive business model, Walmart's net income of $16 billion still dwarfs Amazon's $380 million. These disparities outline in sharp relief the different models at work in the global economy.

The stark contrasts in productivity can have a severe effect on the social compact between state and citizen, with many workers becoming displaced by robotics and new manufacturing techniques, and new sources of wealth generation created by a few enterprising and talented individuals. The wage share of each economy may become increasingly shared by fewer and fewer workers, creating large swathes of unemployment and exacerbating existing income inequalities.

> Human beings may design the "Second Economy", but few are involved directly in running it.

In the face of rapid technological changes, how can developed-ageing and developing-young societies rapidly re-train their workers for the Augmented Economy? With increasing income inequality, how will societies re-write their social compacts to mitigate the effects of wage concentration at the upper rungs of the wage ladder?

These disjunctures might present dilemmas for which there is no satisfactory resolution. Quoting Henry Kissinger, former Institute for the Future president Bob Johansen had this to say about world problems: "They are dilemmas, and dilemmas cannot be solved. They can only be survived." Countries will have to navigate through these dilemmas, and manage the impact and ensuing consequences of demographic decline or growth and technological change on productivity, jobs, wealth creation and distribution.

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[1] *Particularly for countries with implied social contracts where the elderly expect and receive a large amount of social support for pension and healthcare.*

PERSPECTIVE TWO

# Energy Abundance and The North American Renaissance

Cheryl Chung

Pundits have warned for many years of an energy-scarce future. However by 2030, with the increasing production of unconventional oil and gas, the US may become energy independent. With this seismic shift from energy scarcity to energy abundance, the US can solve many of its intractable problems. Energy abundance can fuel a manufacturing renaissance, correcting decades of trade imbalance with emerging Asia. National revenues could increase — something that could be welcomed in an era of austerity. The US could politically extract itself from the Middle East. A resurgent US will likely lead a wider North American renaissance.

There is a revolution in North American energy supply underway with the tapping of unconventional oil and gas sources. Innovative extraction techniques have enabled the recovery of natural gas trapped in shale formations that were previously too difficult and costly to recover. In 2000, US shale gas production was virtually zero. Yet, over the last 10 years, the US has emerged as a leading producer of shale gas. Today, shale gas contributes up to a quarter of US natural gas. According to the James A. Baker III Institute for Public Policy at Rice University, this proportion is expected to rise by half by 2030.

The price for gas, unlike oil, is set regionally. European and Asian markets pay roughly four to six times more for their gas[1] than the US. This is a major source of competitive advantage for the US that will last over the medium term. While China and Europe also have substantial shale gas reserves, they face challenges in recovery. According to its Ministry of Land and Resources, China has the world's largest reserves of non-conventional gas — double the US' estimated reserves. However, China's relative lack of equipment, experience and water may inhibit development. In Europe, uncertainty about geology, and the political and public acceptance of the environmental impact hamper shale gas extraction. Doubts about its financial viability, together with disparate national authorisation processes across EU member states, exacerbate those concerns.

For oil, according to the US Energy Information Administration, nearly half of the crude oil America consumes will be produced domestically by 2020. By 2035, according to OPEC, oil shipments from the Middle East to North America "could almost be nonexistent" partly because of more efficient car engines and a growing supply of renewable fuel. Strategic policy decisions such as paying a premium over world oil prices from North American sources to ensure security of supply could gradually move the US to energy independence[2].

US energy independence has wide ranging implications on energy security and geopolitics in the Middle East. The burden of ensuring security in the region is likely to shift to other rising powers, like China and Korea. The net savings in defence expenditure, if channelled to investments in research and development and social and physical infrastructure, could lay the foundations for future US economic growth.

But even if the net savings in defence expenditure are not re-channelled, unconventional oil and gas recovery are likely to contribute substantially to the US economy. In a 2012 study by consultancy firm IHS, shale gas production alone will create some 1.5 million jobs by 2015.

According to PricewaterhouseCoopers, there has been a shift in offshore chemicals manufacturing back to the US to take advantage of low-priced natural gas feedstocks. The same report estimates that the shale gas revolution could add one million US manufacturing jobs by 2025. Shale gas-rich states in the US are likely to benefit the most as manufacturing investments tend to gravitate to locations where transportation costs are relatively low.

The shale gas revolution could add one million US manufacturing jobs by 2025.

Beyond the energy, chemicals and transport sector, certain industries could find it attractive to relocate back to the US due to lower energy costs. These industries are likely to be those that have a lower share of labour costs and a higher share of logistics costs. They include fabricated metals, appliances and electrical equipment, machinery and furniture. The Boston Consulting Group estimates in the 2012 "US Manufacturing Nears the Tipping Point: Which Industries, Why, and How Much?" report that the US is poised for a manufacturing renaissance between 2015 and 2020, and is projected to gain two to three million jobs from higher exports and production work shifting from China.

Government revenues are expected to be impacted positively. By 2020, total government revenues from unconventional oil and gas activity will be about US$111 bil[3]. In an era of high social spending and public debt, this would be a welcome addition to public revenue.

As gas production continues to grow, the case for exports will become stronger. According to US-based gas producer Cheniere Energy, gas production in the US has grown at twice the rate of demand since 2005. Currently, the Federal Energy Regulatory Commission has approved the construction of only one LNG export terminal (Sabine Pass) but more approvals could come pending the outcome of the report by the Department of Energy to evaluate the effects of exporting LNG on

domestic gas prices. A new Pacific energy trade route from the US to feed emerging Asia's energy needs may emerge. Coupled with a US manufacturing renaissance, this would help reduce the US trade deficit and help reverse decades of trade imbalance.

Although the North American renewable energy sector has also been growing strongly in recent years, experts are concerned about the impact of shale gas on the emerging alternative energy sector. The shale gas boom comes at a time when green energy is still struggling to lower its costs to be competitive with fossil fuels. By bringing gas prices down, shale gas can crowd out and hobble alternative energy, especially as the US is phasing out many subsidies for this sector.

An energy abundant future for the US is by no means certain. Wildcard events such as natural disasters, political change and industrial accidents may trigger policy decisions that result in a trajectory very different from the future just described. Nevertheless, energy is arguably the most important lynchpin of economic competitiveness and with it, the US has the potential to solve many of their intractable problems, paving the way for a wider North American renaissance.

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[1] *Whereas the West has used free market mechanisms to secure oil and gas, some countries such as China are adopting a different strategy of "controlling the supply of resources". As a result of China's growing proportional size on the energy market, the nature of this energy market may be affected by becoming less liberal than it currently is.*

[2] *Experts argue if energy independence should be a goal for the US, suggesting instead that energy diversity is better for the economy.*

[3] *Cumulative tax revenue from unconventional oil and gas activity is estimated at US$2.5tril between 2012 and 2035.*

PERSPECTIVE THREE

# A New Global Nervous System

**Lee Chor Pharn**
Deputy Director,
Ministry of Trade & Industry

**Eddie Choo**
Strategist,
Ministry of Trade & Industry

In the past few decades of hyper-globalisation, developed market corporations have led the way in driving global integration, building a global nervous system to connect nations through trade, supply chains and in/out-sourcing. Corporations today own most of the global infrastructure connecting nations. For example, 30 corporations control 90% of world Internet traffic. Regional supergrids have plugged once 'off-grid' economies into world trade faster than state planning or diktat. One example would be 'Desert Tech', a privately run European utilities multi-country grid that links sun-drenched North Africa's solar energy output to Europe's electricity markets.

By contrast, countries and governments' roles on the globalisation stage had been diminishing, until the global financial crisis of 2008. The actions which governments were forced to take during the crisis, such as bailouts of mighty global banks and MNCs, appeared to have reversed the tide of growing dominance of corporations within and across nation states.

This power reversal may be brief. According to a PricewaterhouseCoopers report on 2030 trade flows, the shift towards emerging markets will re-chart global supply chains in the next decade and a half, leading to new major trade corridors being created between Asia and Africa, Asia and South America and within Asia. Transport operators from emerging markets will very likely be the corporations that build the new infrastructure for these radically changing trading networks.

What is perhaps more interesting is how corporations are likely to augment the role of the state within national borders. Corporations are starting to run core national assets like cities on behalf of governments in the emerging world.

This phenomenon will increasingly become more pervasive in the indebted West as it undergoes a decade or more of deleveraging. The compact between citizen and state is being redefined as governments struggle to deliver on their roles within newly reduced means. What is different from the era of Margaret Thatcher's privatisation of the UK is the extent to which corporations, charities, social enterprises and NGOs are being involved. However, the transformation may not be smooth. Take physical security — the provision of which is deemed the defining characteristic of the modern state. During the run-up to the 2012 London Olympics, the organising committee signed a contract with G4S, the largest private security firm in the world, for £236 million. Two weeks before the start of the Games, G4S alerted that they would not able to deliver. Two days after the admission, the

military was asked to step in. As this cautionary example illustrates, governments in the West may have to choose between the proverbial rock and a hard place in an era of diminishing budgets.

For corporations, charities, social enterprises and NGOs to deliver public goods is admittedly not a novel idea. They have often stepped in where governments are either inefficient or deficient in delivering those services. In the Global Nervous System however, we are witnessing a different set of commons being created by private companies, one which builds on increasing seamlessness of connectivity linking people together, within and across states, creating new interfaces — synapses, to use the biological metaphor. The importance of connectivity has led Finland to declare broadband access a legal right for citizens, and private telcos will be obliged to meet the requirement.

The same can be said for social networking platforms. Mark Zuckerberg declared Facebook a "social utility" in 2007, perhaps an unintended signal of things to come. Facebook is certainly not a country, even if 1 billion people "live" in its blue-and-white virtual space representing the world's largest structured web of people. The lines between private preferences and public good become blurred, however, when nearly a seventh of the world's population is using the service. Facebook has established a system of rules to make decisions about content and resolve "resident" disputes, paralleling some roles of a government. Although not a direct comparison, the difference in notional productivity is stark. Facebook has a billion "residents" with a few hundred Facebook employees (supported by algorithms) to make these decisions. Palo Alto city, where Facebook is based in the real world, serves 65,000 residents with 617 full-time government employees.

Facebook has created a system of governance optimised for totally different values (such as more time spent on Facebook) than traditional governments. Facebook "residents" do not get to vote on the system or the rules. Even when Facebook offered its users the opportunity to vote on a new privacy policy in April 2012, voter turnout was only 0.038%. Digital citizenship is much weaker than national citizenship. This apathy allows a few hundred developers to be de facto legislators, bureaucrats, police and judges of the one-billion "residents" of the quasi-state of Facebook.

Today, Facebook developers have more real-time information about real-world citizens at their fingertips than most governments. Soon, they will be able to complement, or rival, governments in influencing citizens' behaviour. If the role of public policy is to influence citizen behaviour, then the rules or regulations imposed by corporations such as Facebook are, in effect, more efficient policies than traditional governance. Users have no choice but to comply to access networks run by these new "digital technocracies". Since governance is by a knowledgeable elite who makes the decisions, these new digital technocracies are not democratic. When Facebook founder Mark Zuckerberg met UK PM David Cameron, was it a meeting between two heads of state? It was, and it wasn't.

There is no universal digital technocracy at present, nor is there likely to be. Facebook, Google, Amazon, Apple and their Chinese counterparts (behind the Great Firewall) Renren, Baidu, Alibaba and Tencent represent the ways in which the facets of digital citizenry are demonstrated and expressed. A new global nervous system is taking shape; one where the developing neurons of Facebook, Google, Renren, Baidu and the like are reaching out and connecting the world and within countries. Their connections and service delivery make traditional states appear slow by comparison. But this is a misleading comparison. The new digital technocracies are far narrower in their span of "governance" and indeed require the structures of the traditional state to scaffold their service offerings upon. The question is thus not when or whether the new digital technocracies will render nation states redundant; the question is how the role of these new digital technocracies and traditional states will interface, connect with each other and co-evolve.

# PROCESS AND PRACTICE OF FORESIGHT

CC BY peter.busse

## Is city-level cooperation the future of diplomacy?

# If Mayors Ruled the World

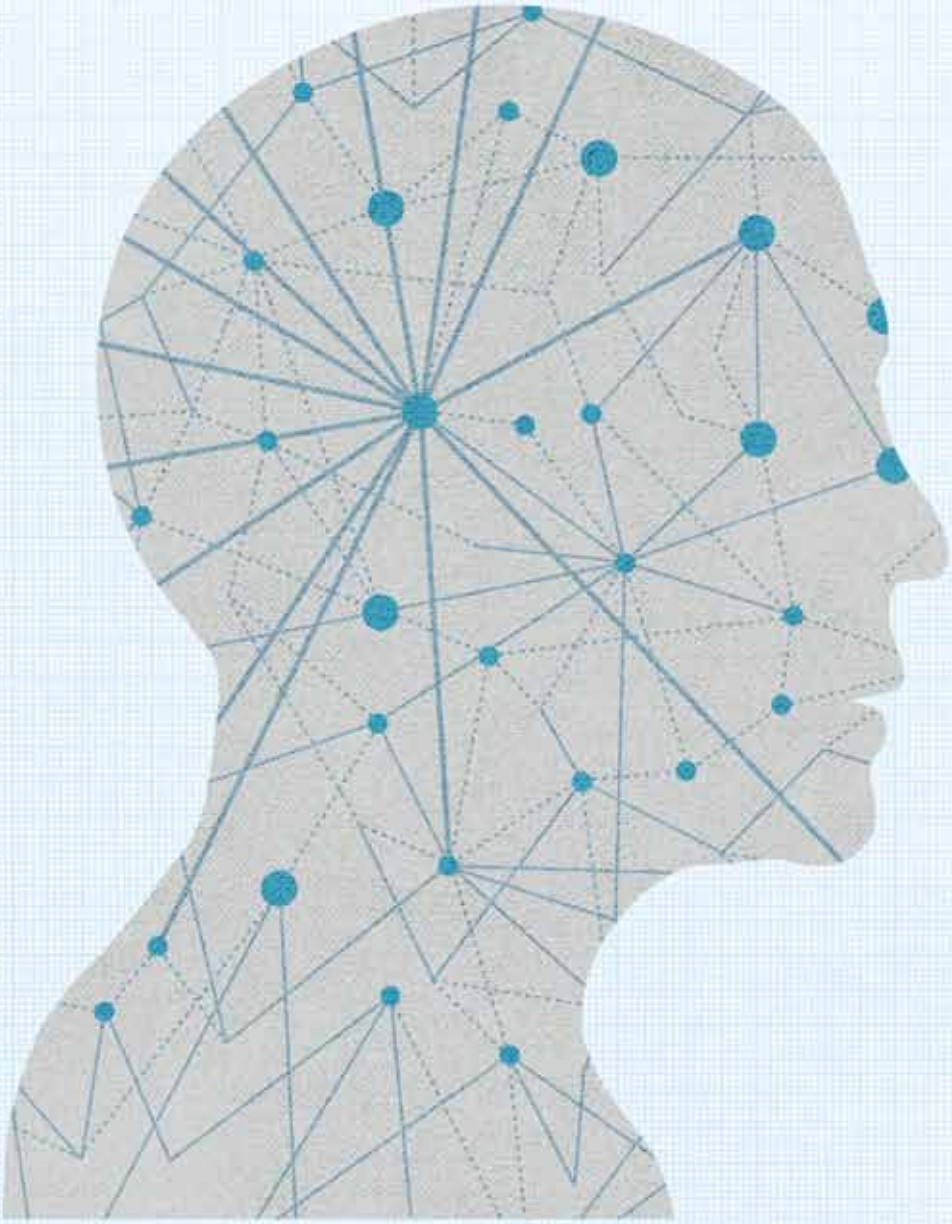
Stronger ties amongst cities could result in certain configurations of cities becoming more important than traditional state-based structures.

Cities may be the level at which "things get done". For example, inter-city cooperation has achieved progress in areas like climate change where country-level negotiations have failed. Decentralisation has also brought greater political power to cities in China and Indonesia.

In the future, cooperation amongst cities may become the new norm in diplomacy.

**In the Future, a Global Parliament of Mayors?**

**"Radical interdependence requires that we respond to problems through the actors that are not jurisdictionally limited by sovereignty."**
*– Benjamin Barber, Political Theorist*



# Governing for the Future: What Governments Can Do

**Peter Ho**
**Senior Advisor to the Centre for Strategic Futures**

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*Mr Peter Ho is Senior Advisor to the Centre for Strategic Futures and Senior Fellow in the Civil Service College, and also serves as an Adjunct Professor with the S. Rajaratnam School of International Studies. He is a Senior Fellow of the Lee Kuan Yew School of Public Policy, and was formerly the Head of the Civil Service in Singapore.*

*This is an adaptation of his speech that was delivered at the Australia and New Zealand School of Government (ANZSOG) Annual Conference 2012 in Wellington, New Zealand on 26 July 2012. The speech was subsequently published as a Working Paper for the S. Rajaratnam School of International Studies on 3 September 2012.*

*The paper looks at how governments can be better prepared to deal with increasing complexity. Complexity produces strategic shocks and generates wicked problems. A more complex operating environment increasingly challenges governance paradigms. A whole-of-government approach is a vital response to managing an increasingly complex world. There are also various tools that can be deployed to help governments better deal with complexity, and reduce the frequency and amplitude of strategic shocks.*

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## Introduction

On 25 February 2003, the SARS virus entered Singapore through three women who had returned from Hong Kong with symptoms of atypical pneumonia. The virus then spread with frightening speed through the hospital system. It confounded our medical authorities in the beginning. They did not know how the virus spread and why it spread so aggressively. The fatality rate was shocking. By the time the SARS crisis was declared over in Singapore, 33 people out of the 238 who were infected had died.

## Black Swans

SARS was a black swan for Singapore. Nicholas Nassim Taleb described a black swan as a hard-to-predict event with a large impact. Indeed, it was a frightening time for Singapore. Overnight, visitor arrivals plunged, and the entire tourism industry came to a grinding halt. SARS severely disrupted the Singapore economy, leading to a contraction and a quarter-long recession that year.

There are many lessons to be learnt from the SARS crisis of 2003. But I would like to highlight one, in order to set the context for this paper. The lesson is that other black swans will surprise us, time and again, as much as, if not more than we were by SARS.

In recent years, the world seems to have been beset by a succession of strategic shocks including 9/11, the financial and economic turbulence of 2008/2009, the 2011 Japanese tsunami and nuclear meltdowns, the Christchurch earthquake of February 2011 in New Zealand and the Eurozone crisis.

Furthermore, the frequency of such shocks seems to be increasing, and the amplitude of their impact appears to be growing.

The question is why?

The frequency of such shocks seems to be increasing, and the amplitude of their impact appears to be growing. The question is why?

## The Great Acceleration

From the middle of the 20th century — a period that is sometimes called the "Great Acceleration"— change has accelerated at a pace and on a global scale that is unprecedented in history. Population growth has surged. Combined with rapid urbanisation, it has generated enormous consumer demand. The effort to meet this demand through industrialisation and mass production has had a huge but unpredictable impact on the earth's eco-system. Globalisation resulting from and combined with technological innovation has, in turn, accelerated change on all fronts — political, economic and social.

## Complexity

Much of this change has followed unpredictable trajectories. The reason for this is “complexity”.

Complex is not the same as complicated. It is something very different. The natural world is complex. An engineering system is merely complicated. It could be a machine or an aeroplane or a telecommunications satellite. Its inner workings may be hard for a layman to understand. But it is designed to perform certain pre-determined functions that are repeatable. It embodies the Newtonian characteristics of predictable cause and effect.

In contrast, a complex system will not necessarily behave in a repeatable and pre-determined manner. Cities are complex systems, as are human societies. The earth’s ecology is also a complex system. Political systems are complex. Countries are complex. The world as a whole is complex and unordered. In all likelihood, a complicated world has not existed for a very long time — if it ever has.

The “Great Acceleration” has seen huge leaps forward in technology — in telecommunications, the internet, and transportation — leading to vastly increased trade and movement of people around the world. But the connections and feedback loops resulting from the “Great Acceleration” have greatly increased complexity at the global level.

The ancient Chinese philosopher, Lao Tzu, instinctively grasped the complex nature of the world that we live in when he wrote in the “Tao Te Ching” (or “the Way") that “everything is connected, and everything relates to each other”. But connections and interactions within a complex system are extremely difficult to detect, inexplicable, and emergent. Efforts to model complex systems, such as the Club of Rome’s famous model of economic and population growth, have not proven very useful. Unlike in a complicated system, the components of a complex system interact in ways that defy deterministic, linear analysis.

As a result we are constantly surprised and shocked by black swans and other unknown unknowns.

### Complexity is different.

The “Great Acceleration” has seen huge leaps forward in technology — in telecommunications, the internet, and transportation — leading to vastly increased trade and movement of people around the world. But the connections and feedback loops resulting from the “Great Acceleration” have greatly increased complexity at the global level.

Connections and interactions within a complex system are extremely difficult to detect, inexplicable and emergent. The components of a complex system interact in ways that defy deterministic, linear analysis.

| What these terms mean | |
|---|---|
| **Black Swans** | Events that have a large impact but that are hard to predict. |
| **Wicked Problems** | Large and intractable issues that have no immediate or obvious solutions, with causes and influencing factors that are not easily determined *ex ante*. |
| **Retrospective Coherence** | In a complex system, even if we were to start again and make the same decisions, there is no certainty that we would end up in the same situation. |

## Wicked Problems

Unfortunately, complexity not only generates black swans, but also gives rise to what the political scientist Horst Rittel called "wicked problems". Wicked problems have no immediate or obvious solutions. They are large and intractable issues. They have causes and influencing factors that are not easily determined *ex ante*. They are highly complex problems because they contain many agents interacting with each other in often mystifying ways. They have many stakeholders who not only have different perspectives on the wicked problem, but who also do not necessarily share the same goals.

Tackling one part of a wicked problem is more likely than not going to lead to new issues in other parts. Satisfying one stakeholder could well make the rest unhappy. A key challenge for governments is to move the many stakeholders towards a broad alignment of perspectives and goals. But this requires patience and a lot of skill at stakeholder engagement and consensus building.

Climate change is an example of a wicked problem at a global level. Pandemics are another. So are ageing populations in the developed world. Sustainable economic development, which is not unconnected to the triangular problem of food, water and energy security, is an enormous wicked problem.

In our increasingly inter-connected and globalised world, such wicked problems do not manifest in a singular fashion. Their impact can and will be felt around the world, in many forms, and in many fields like politics, economics, and in social and many other dimensions.

## Retrospective Coherence

In complexity theory, there is a concept known as "retrospective coherence". The current state of affairs always makes sense when we look backwards. The current pattern is logical. But this is little more than saying that there is wisdom in hindsight. It is only one of many patterns that could have formed, any one of which would have been equally logical. Simply because we can provide an explanation for why the current state of affairs has arisen does not mean that we are operating in a complicated and knowable world.

While what we are today is the result of many decisions taken along the way, retrospective coherence says that in a complex system, even if we were to start again and make the same decisions, there is no certainty that we would end up in the same situation. This is another way of saying that applying the lessons of history is not enough to guide us down the right path into the future.

Governments that do not understand retrospective coherence will often assume that the operating environment is merely complicated — and not complex — and that cause and effect are linked such that the output can be determined from the input, in which one step leads predictably to the next. This is of course a dangerous assumption if the operating environment is complex.

## Governments and Complexity

When governments ignore the complexity of their operating environment, they are at risk of assuming that policies that succeeded in the past will continue to work well in the future. They will deal with wicked problems as if they are amenable to simple and deterministic policy prescriptions.

The temptation to take this approach is understandable. It is easier, requires fewer resources, and may actually lead to positive outcomes — but only in the short term.

However, government policies that do not take complexity into account can, and often do, lead to unintended consequences, with a real danger of national failure in the long run.

Unfortunately, the evidence suggests that many governments will opt to take this path, either out of political expediency, or because of cognitive failures, or simply because they lack an understanding of complexity and the tools to deal with it.

Those governments that learn to manage complexity, and how to govern in a complex operating environment, will gain a competitive advantage over those that do not.

But to manage complexity requires fundamental changes to the mind-set, capabilities and organisation of government.

When governments ignore the complexity of their operating environment, they are at risk of assuming that policies that succeeded in the past will continue to work well in the future.

Professor Yaneer Bar Yam, a complex systems scientist, writes that "the most basic issue for organisational success is correctly matching the system's complexity to its environment".

This is another way of saying that the complexity of the government developing the policy should match the complexity of the system that will be affected by the policy.

## Fighting a Network with a Network

Let me illustrate this with an example. On 7 December 2001, the authorities announced the detention of several Singaporeans who were members of a previously unknown network of extremists, the pan-Southeast Asian Jemaah Islamiyah (or JI). The JI had been plotting acts of

mass terror against several targets in Singapore. Singaporeans were preparing to kill fellow Singaporeans in pursuit of demented ideological goals.

This was a black swan for Singapore that literally overnight produced a wicked problem for the Government — how to deal with the threat posed by extremists who were part of a larger Southeast Asian network, and who lived and worked within the community, like ordinary Singaporeans.

Someone told me in those uncertain days that you needed a network to fight a network. It was a profound observation that implicitly acknowledged that the JI, as a sprawling, multi-layered network, was a complex organisation.

Our response, both in terms of organisation as well as policy, had to match the JI's complexity. It was not possible to destroy the JI network by just hunting down the leadership and decapitating it. To do so would be to deny the JI's essentially complex nature.

Singapore took a whole-of-government — perhaps even a whole-of-nation — approach to the threat posed by the JI. The traditional approach, of delineating the boundaries between agencies so that each would be responsible for a particular area, clearly would not work. No government agency had the full range of competencies or capabilities to deal completely with this complex threat.

Rather than go the American way by creating our own Department of Homeland Security, we decided that a better way would be to strengthen coordination and integration among the government agencies. We leveraged on the diverse strengths of existing agencies. This meant coordinating the counter-terrorism efforts of the line agencies and ministries at the operational level, while integrating strategy and policy at the whole-of-government level. This approach meant that we would only have a small but active centre — the National Security Coordination Secretariat — with the capacity to drive the strategic national agenda in counter-terrorism, but which would not interfere with the accountabilities of each agency.

So, many agencies were roped in, and at different levels, from the security, economic and social sectors. Community groups and leaders were activated to manage potential frictions and manage communal sensitivities.

In the beginning, it was a real challenge. The non-security agencies felt that this was a matter to be dealt with by the security agencies. The security agencies in turn felt that their turf was being trampled on.

## Whole-of-Government

But now looking back, this whole-of-government approach had a compelling logic. A complex and multi-layered network of government agencies and non-governmental organisations had been created. The policies that were implemented were complex — both defensive and offensive, employing both hard and soft power. We established a complex system to deal with a complex situation. It is an approach that the Singapore Government has since applied to other wicked problems like population and climate change.

Governments will need to consider how they should be organised to deal with black swans, unknown unknowns, and the wicked problems that complexity generates. Creating new departments to deal with new wicked problems can be wasteful and ultimately ineffective if these creations do not contain enough organisational complexity.

Developing policies and plans to deal with such wicked problems requires the integration of diverse insights, experience and expertise. People from different organisations, both from within and outside government, have to come together and pool their knowledge in order to discover potential solutions. Cooperative mechanisms need to be set up to enable the sharing of information and to strengthen collective action.

The whole-of-government approach injects diversity and complexity into the policy process. It recognises that in complex situations, and when dealing with wicked problems, insight and good ideas are not the monopoly of single agencies or of government acting alone. It strikes a balance between strength and stability of the formal vertical government structure, and the diversity from different perspectives and solutions derived from a larger and more varied horizontal network of government and national resources.

While the whole-of-government approach may be an imperative, it is not easily achieved. Governments, like any large hierarchical organisation, tend to optimise at the departmental level rather than at the whole-of-government level.

In a hierarchy, the leader at the top receives all the information and makes the decisions. But, under stress, hierarchies can be unresponsive — even dangerously dysfunctional — because there are in reality decision-making bottlenecks at the top.

Complexity stresses hierarchies. The world that governments operate in today is too complex and too fast-changing for the people at the top to have the full expertise and all the answers to call all the shots.

Therefore, vertical silos need to be broken down, so that information can flow horizontally to reach other departments. It is not "need to know", but knowing enough so that each component of the larger organisation can respond to issues and challenges as they arise. An environment that encourages the spontaneous horizontal flow of information will enlarge and enrich the worldview of all departments. This in turn improves the chances that connections hidden by complexity, as well as emergent challenges and opportunities, are discovered early.

Governments will need to consider how they should be organised to deal with black swans, unknown unknowns, and the wicked problems that complexity generates. Creating new departments to deal with new wicked problems can be wasteful and ultimately ineffective if these creations do not contain enough organisational complexity.

## *Auftragstaktik*

The German military adopted with great success (at least at the operational level) a concept of military command called *auftragstaktik*. It was a philosophy of command that acknowledged the complexity and the chaos of war.

In *auftragstaktik*, even the most junior officers were empowered to make decisions on the spot, because they had a better and more direct feel for the situation on the ground. It meant that down the line, every officer had to understand not just the orders, but also the intent of the mission. In turn he was empowered to make decisions to adjust to the situation as he judged it, in order to better fulfil the intent of the mission.

Whole-of-government implicitly contains the central idea of *auftragstaktik*, which is that in complexity, it is not possible for everything to be centrally directed. Not unlike *auftragstaktik*, whole-of-government depends critically on people at all levels understanding how their roles fit in with the larger national aims and objectives. Agencies must have a strong sense and a shared understanding of the challenges that the nation faces, and the underlying principles to guide responses. Then, it depends on the good sense of each agency to ensure that its own plans and policies are aligned with the national imperatives, to the point that they instinctively react to threats and opportunities as they arise, knowing that what they do will advance the larger national interests, rather than departmental ones.

Whole-of-government is a holy grail. In countries like Singapore, it remains very much a work-in-progress. It requires emphasis, support and constant attention from the top.

## Dealing with Cognitive Biases

There is another challenge to governments in complex situations. It was evident in the April 2010 eruption of Eyjafjallajökull, the Icelandic volcano with the unpronounceable name. When a huge cloud of volcanic dust started to spread over Europe, air traffic authorities grounded thousands of aircraft as a safety precaution. Europe was almost paralysed. It caused travel chaos around the world and disrupted global supply chains for weeks.

We know that volcanoes erupt from time to time. We also know that it is risky to fly through volcanic ash clouds. Yet why, despite this knowledge, was the world so surprised and unprepared for the impact of this eruption?

First, although the risk of eruption is known, it is very difficult to assess its probability of occurrence. Behavioural economists point out that we underrate the probability of an event when it has not happened recently and overrate the probability of an event when it has. As a result of this cognitive bias, the risk of an eruption was underrated, as the Icelandic volcano had been quiescent for a long time.

Second, the effect of the eruption on aircraft flights was the result of complex interconnectivities and therefore highly unpredictable. When the Icelandic volcano erupted, aviation authorities depended on the predictions of analytical models and reacted with caution by shutting down all

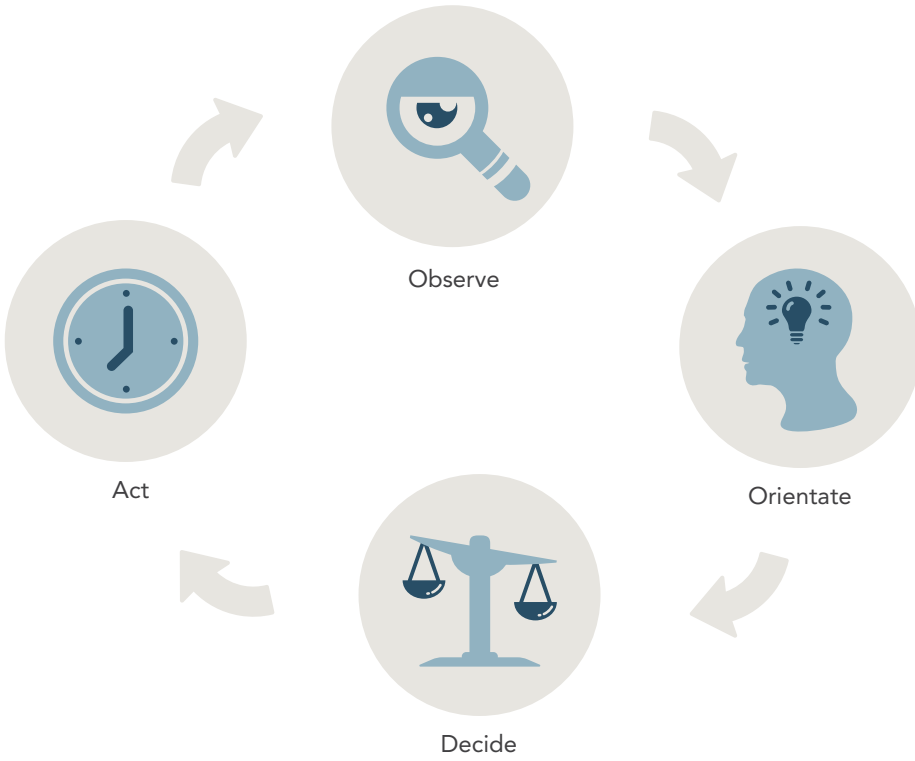
flights. But as the commercial impact grew, the industry began to question the reliability of these models and proposed doing experimental flights to probe whether it was safe to fly. In the event, the experimental flights proved to be a better indicator for action than reliance on the models. This is a clear demonstration of the value of exploration and experimentation when we are confronted with complex phenomena instead of depending only on the predictions of analytical models.

Cognitive bias and the extreme difficulty of estimating the cumulative effects of complex events make preparing for unforeseen situations an exercise fraught with difficulty. It also adds to the challenges of governments operating in complex situations.

## Managing Complexity

In such a complex operating environment, governments should be adaptive, and able to navigate situations characterised by emergence, multi-causality and ambiguity, as they were during the eruption of the Icelandic volcano.

Governments often have to make big decisions, and develop plans and policies, under conditions of incomplete information and uncertain outcomes. It is not possible to prepare exhaustively for every contingency. Instead, a "search and discover" approach should be adopted. The deployment of experimental flights to check out the real risk of flying into a cloud of volcanic ash exemplifies this approach. The military calls this approach the OODA (Observe, Orientate, Decide, Act) loop, which is a recurring cycle of decision-making that acknowledges and exploits the uncertainty and complexity of the battlefield.



Scenario planning is a linear method of carrying out the OODA loop, in the sense that it projects futures based on our understanding of the operating environment today. Used intelligently, it can be a very important tool for planning, and can help overcome cognitive biases by challenging our mental models. But it is insufficient in a complex unordered environment.

In this regard, non-linear methods should be part of the government complexity toolbox. They include back-casting, policy-gaming (which is akin to military war-gaming, but applied to the civilian policy context to condition policy-makers to complex and uncertain situations, and to help them confront their cognitive biases), and horizon scanning (which is the process of detecting emerging trends, threats and opportunities).

Governments must also be able to manage the risk that is a natural result of operating in complexity. There will always be threats to national outcomes, policies and plans, because no amount of analysis and forward planning will eliminate the volatility and uncertainty that exists in a complex world. These threats constitute strategic risk.

In Singapore, the government is developing a unique Whole-of-Government Integrated Risk Management (WOG-IRM) framework — a governance chain that begins with risk identification and assessment at the strategic level, to monitoring of risk indicators, and finally to resource mobilisation and behavioural changes to prepare for each anticipated risk.

But there is little by way of best practice to systematically address or ameliorate the threats to national goals that these risks pose. In Singapore, the government is developing a unique Whole-of-Government Integrated Risk Management (WOG-IRM) framework — a governance chain that begins with risk identification and assessment at the strategic level, to monitoring of risk indicators, and finally to resource mobilisation and behavioural changes to prepare for each anticipated risk. WOG-IRM also plays an imperfect but important role in discovering the inter-connections among risk factors. This in turn helps to reduce some of the complexity. The WOG-IRM framework is a work-in-progress, and we have started using it for strategic conversations on risks that occur at the whole-of-government level.

## Organising in Complexity

The WOG-IRM framework is also critical to building resilience, which is the ability to cope with strategic shock by adapting to, or even transforming with, rapid and turbulent change. Resilience ought to be a key characteristic of governments that operate effectively in a complex environment. Resilient governments must go beyond an emphasis on efficiency. Lean systems that focus

exclusively on efficiency are unlikely to have sufficient resources to deal with unexpected shocks and volatility, while also having the bandwidth to make plans for an uncertain future filled with wicked problems.

This is not an argument for establishing bloated and sluggish bureaucracies. Rather, having a small but dedicated group of people think about the future would help to make governments more resilient. The skill-sets needed are different from those required to deal with short-term volatility and crisis. Both are important. But those charged with thinking about the future systematically should be allocated the bandwidth to focus on the long-term without getting bogged down in day-to-day routine. They will become repositories of patterns that can be used to facilitate decision-making, to prepare for unknown unknowns, and perhaps to conduct policy experiments through policy-gaming or other simulations.

To this end, the Singapore Government set up the Centre for Strategic Futures (CSF) a couple of years ago. It is a think tank that promotes a whole-of-government approach to strategic planning and decision-making. It works on leading-edge concepts like WOG-IRM and resilience. It promotes fresh approaches for dealing with complexity like policy-gaming. It encourages experiments with new computer-based tools and sense-making methods to improve horizon scanning. Although a small outfit, the CSF is a catalyst for strategic change in the government and its agencies.

## Conclusion

The future promises ever more complexity, carrying in its train more black swans and unknown unknowns. Governments must learn how to operate and even thrive in this complexity, and to deal confidently with strategic shocks when they occur. The first step is to acknowledge the inherent complexity of the operating environment. Then they should consider the imperative of a whole-of-government approach, and the adoption of new non-linear tools for managing complexity, and strategic risk. These will not eliminate shocks. But by improving the ability to anticipate such shocks, governments might actually reduce their frequency and impact. In turn, this will help make governments and nations more resilient as their leaders govern for the future.

Resilient governments must go beyond an emphasis on efficiency. Lean systems that focus exclusively on efficiency are unlikely to have sufficient resources to deal with unexpected shocks and volatility, while also having the bandwidth to make plans for an uncertain future filled with wicked problems.

# Emerging Strategic Issues Project 2.0

Tiana Desker and Cheryl Chung

*The Emerging Strategic Issues (ESI) Project 2.0 is an update of a project that the CSF conducted with the Global Business Network (GBN) in 2009.*

## Objectives

The objective of the Emerging Strategic Issues Project was to identify and prioritise emerging risks and opportunities for the Singapore Government. After a period of crowd-sourcing, we prioritised the ESIs in line with these criteria:

**Institutional Surprise** - Were government agencies aware of the issue and its potential impact on Singapore? Had they begun to address the issue?

**Plausibility** - Was there a reasonable degree of evidence that the issue would occur?

**Significant Impact** - Would the issue have a significant impact on public policy in Singapore? Does public policy have a role to play in addressing the issue?

**What is "Institutional Surprise"?**

| | |
|---|---|
| **Surprise** | A personal response. Whether an issue is surprising depends on one's individual experiences and knowledge. |
| **Institutional Surprise** | This is surprise at the organisational level. An organisation is surprised because it had not focused upon an issue, though members of the organisation may have been aware of it. |

## Process

We followed a three-step process to scan for emerging issues that was inspired by the method used by the GBN, but adapted it for the local context.

### Divergent Phase

*Aim: To establish a pipeline for new ideas.*

In this phase, we canvassed for as wide and diverse a range of views as possible. The team at the CSF scanned publications covering emerging issues. We also met every month with futurists from 14 government agencies who were carrying out their own agency-specific scanning efforts.

**Our Inter-Agency team**

National Security Coordination Secretariat · Ministry of Home Affairs · EDB Singapore · Ministry of Manpower · MSF Ministry of Social and Family Development · MND Singapore · MTI Ministry of Trade and Industry Singapore · Ministry of the Environment and Water Resources · iDA Infocomm Development Authority of Singapore · MOF Ministry of Finance · Building and Construction Authority · PUB · Housing & Development Board

We also tapped on our network of contacts for our networking partners for ideas on emerging issues, and convened a workshop with Singapore-based academics, centred on "The Future of Singapore Society", which identified several emerging issues specific to the Singapore context.

## Consolidation Phase

*Aim: To develop a process for filtering through the list of emerging issues.*

By the end of the Divergent Phase, we had assembled a database of about 300 ideas on possible emerging issues. The next phase of the project involved further research and consultation, to arrive at a list of 48 emerging issues.

**Filtering Process**

Examples of Emerging Issues

We researched further each issue in the database, and asked ourselves to what extent there was institutional surprise, how strong the evidence was, and the potential impact on public policy in Singapore.

To communicate the issues, we chose a format inspired by the Arup "Drivers of Change" cards, to present the data. On the front of each card is an image and provocative question, and on the reverse is a description of the issue and a chart with supporting data. Unlike a report, cards are "generative". They stimulate conversation by providing a way to visually, tangibly link the issues together, or sort through and prioritise issues.

> The process of selecting issues is inherently subjective. The final list is inevitably a "curated list".

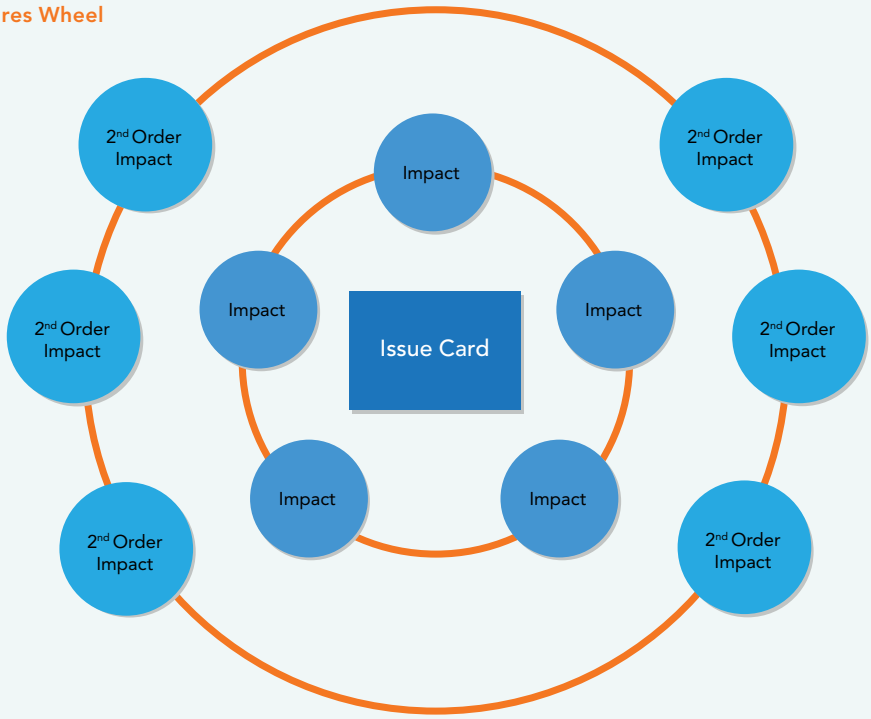
## Convergent Phase

*Aim: To inspire conversations and further research on the emerging issues.*

In the final phase of the project, we organised workshops to use the Future Deck cards to understand better the impact of the issues on Singapore, and explore possible future scenarios using the Future Deck cards as driving forces. We had workshops with senior government officials, policy-makers from government agencies, as well as academics from local institutions like the Institute of Policy Studies at the Lee Kuan Yew School of Public Policy.

We used the Futures Wheel to structure the discussions at these workshops. In this method, workshop participants were asked to select the cards that were the most striking or relevant for their organisations, and place each one in the middle of a Futures Wheel. They then came up with the first- and second-order impacts of that issue. These were represented visually by Post-Its laid out in two concentric circles around the original issue.

Futures Wheel




In thinking through the possible first- and second-order impacts of the issues, we invited participants to consider their other ramifications through the lens of the Integral Futures method, pioneered by Andy Hines of the University of Houston.

Integral Futures Framework

**Impact on Identity**

How does this influence our motivations?

How does this influence our values?

How will this influence our identity?

How is the individual likely to perceive this?

**Impact on Individual Behaviour**

How might this influence individual behaviour?

How does this affect how individuals interact with the external world?

**Impact on Culture**

How might this influence our institutions?

How does this affect group norms?

How does this influence our culture?

**Impact on the Physical World**

What is the impact on our systems and infrastructure?

How does this affect businesses?

How does this impact the environment?

We also used the Future Deck cards to create scenarios. In this process, we used the cards as a means of facilitating discussions about whether particular issues were "predetermined forces" (i.e. where there was broad consensus on their impact) or "critical uncertainties" (i.e. where there were conflicting views about their trajectory going forward). The cards provide a way to visually map the interconnections between the "predetermined forces" and "critical uncertainties", and thus generate quick scenarios via a short workshop process.

## Outcomes

Going forward, we intend to work with agencies on research into specific emerging issues, to flesh them out in greater detail and shape policy reviews. More broadly, we hope that the process of conducting workshops centred on the Future Deck cards has exposed policy-makers across the hierarchy to issues that they would otherwise not have the opportunity to think about, and spurred meaningful conversations on how these issues might be addressed.

We are especially heartened that the Future Deck cards are being used in unexpected ways that we had not anticipated when we conceptualised them. Agencies in the Singapore Government are adding new cards to the deck, and customising others for their particular contexts. The cards are also being used as a tool for policy gaming at the Civil Service College, and by our colleagues in risk management as a tool for identifying emerging risks.

The Future Deck cards have exposed policy-makers across the hierarchy to issues that they would otherwise not have the opportunity to think about.

*Acknowledgements*

*We would like to thank Peter Schwartz and the team at Global Business Network for first introducing us to new methods to scan for emerging issues. We would also like to thank Chris Luebkeman of Arup Foresight for sharing with us their "Drivers of Change" cards that we found so inspirational. And we would like to thank the members of our cross-agency team, as well as CSF members past and present, who generously contributed their ideas and time to this project.*

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## Who is watching you?

# Surveillance from Below

Today, surveillance comes from below, and the targets are often elites and the authorities, as well as ordinary people who violate social norms.

In China, "human flesh search engines" use crowdsourcing to identify officials clad in expensive clothing, and mark them as corrupt. In the U.S., secretly-filmed remarks threatened the electoral fate of presidential candidate Mitt Romney.

In future, smaller, cheaper, and more discreet monitoring devices will make it even easier for the public to record the actions of those around them. Firms and governments will face greater reputation risk.

**% of Internet Forum Users in Singapore Who Have Engaged in "Online Shaming"**
*(Nanyang Technological University, 2010)*

**"While the online news portal Stomp was not set up with the purpose of public shaming in mind, it has nevertheless provided a platform for many Singaporeans who are eager to play social police."**
*– Prof. Marko Skoric, Nanyang Technological University*

# Mapping and Navigating a Volatile, Complex Risk Environment through Networked National Risk Management

**William Liew**

*In an increasingly volatile environment, long-term policy planning is challenged by uncertainty and complexity. Tools and processes can help identity and assess the resulting strategic risks by better detecting weak signals, handling information and managing cognitive biases. In this regard, the Singapore Government is developing an integrated national risk management approach, that involves leveraging on networked capabilities and collaborative strategic conversations which cut across traditional policy domains.*

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A small island state with little strategic depth, few natural resources and no economic hinterland, Singapore is a price-taker on the international stage. As an open economy, it is vulnerable to global shocks and movements. In such an operating environment, its leaders strive to think ahead of the curve, and to constantly re-assess the country's long-term strategies, so the country can survive and prosper.

The operating environment has become increasingly volatile and complex, especially in the last decade and a half, since the Asian Financial Crisis. Singapore has had to deal with several strategic surprises: the 9/11 terrorist attacks, followed by the outbreak of Severe Acute Respiratory Syndrome (SARS) in 2003, and more recently the global financial crisis of 2008/2009. These surprises are examples of *black swan* events — unknown unknowns that suddenly surface and with high impact. In addition, Singapore has also witnessed the emergence of more *wicked problems* — highly complex issues for which there are no easy solutions because there are multiple stakeholders who perceive these problems in different and divergent ways. Examples include demographic trends of low fertility rates and an ageing population, and socio-economic issues such as a widening income gap. Such wicked problems may be slow-burning. They may not have immediate impact, but if left unaddressed, could lead to severe consequences in the future. Increasing complexity and uncertainty increase the frequency of the occurrence of *black swans* and the amplitude of the impact of *wicked problems*. These in turn pose *strategic risks* to our national goals. It is therefore vital that the government improve its capacity to manage complexity so as to reduce the frequency of black swans and the amplitude of wicked problems.

Increasing complexity and uncertainty increase the frequency of the occurrence of black swans and the amplitude of the impact of wicked problems. These in turn pose strategic risks to our national goals.

## Managing Complexity

Singapore's long-term strategic planning approach strives to better appreciate and manage complexity. The approach has its roots in the Scenario Planning process, a strategic tool adopted and then adapted from the Royal Dutch Shell Company. It is a structured method to develop different narratives for the long term, often 10–20 years, surface hidden assumptions and mental models, and inculcate an anticipatory mindset amongst officers. Scenario Planning has been taught to thousands of public officers, and forms the common language and basic framework upon which strategic conversations take place across government.

However, Scenario Planning is a linear process. It works well where cause and effect of driving forces are relatively clear, but less so in a complex operating environment where cause and effect are indeterminate. Scenario planning analyses current trends and developments to envision possible futures. While this is still a useful process, it is unable to cope with black swans, the strategic surprises that characterise a complex operating environment.

Realising this, especially after the strategic shocks of recent years, the Singapore government has sought to complement the Scenario Planning process by non-linear tools for use in a complex operating environment. One key milestone in this effort was establishing the Risk Assessment and Horizon Scanning (RAHS) programme in 2004. RAHS is a computer-based platform comprising a suite of methods and software to scan the horizon for weak signals of potential future shocks, and detect emergent threats and opportunities. By linking ministries and agencies across government on a single collaborative platform, it strives to harness the "wisdom of crowds". It also reduces information overload during horizon scanning, and helps the human analyst to address cognitive biases such as hyperbolic discounting, saliency bias and groupthink when he is analysing an array of inputs from disparate sources.

Building on the work of RAHS, the Centre for Strategic Futures (CSF) was established in 2010 to develop and promote futures thinking in the Singapore government. CSF is tasked to build up the government's capabilities in preparing for the future, and to help reduce the frequency and amplitude of strategic surprises. Among other things, the CSF fosters a network of strategic planners and futures thinkers across different government agencies. It also cultivates networks of local and international non-government partners and thought leaders in futures thinking. These networks are crucial in generating important strategic conversations as well as harnessing diverse viewpoints. They help alleviate the groupthink and cognitive biases of individual decision makers and agencies operating within silos. Conversations are coordinated and curated to ask "what if" and "so what" questions, thus helping to widen the perception of possibilities considered by policy-making agencies.

An example of how the CSF identifies such possibilities is its Emerging Strategic Issues (ESI) process, which identifies strategic issues not deemed critical in the near term, but which nonetheless could become significant over time. The process generates a diversity of ideas from research, interviews and online conversations with public, private, people and academic sector experts, both within and beyond Singapore. Ideas are then distilled and prioritised based on impact, likelihood and level of institutional surprise should they fully emerge. Top priority issues are actively studied, while others are still monitored, as they could be organisational blind spots and possible future strategic surprises.

## A National Risk Management Approach

Despite all the above efforts, it is neither possible to anticipate everything in the future, especially black swans — the "unknown unknowns" — nor to prevent them from happening. Governments hence have to deal with the intrinsic uncertainty, including managing the resultant risks to national goals and strategic plans. In Singapore, we seek to do so through a national and integrated risk management approach, in which different government agencies share information and collaborate to identify and monitor national-level risks. This approach aggregates a diverse collection of opinions on the risks to national goals and strategic plans.

Under this approach, national-level risks are first collated by the CSF in a whole-of-government process involving all ministries and key agencies. This process assesses and prioritises the risks and their significance and impact on national strategic goals. It also identifies where risk governance gaps exist, in which capabilities need to be built up in order to mitigate or adapt to these risks. The CSF will then identify owners of each of these risks, who are then responsible for

monitoring for their emergence. This reduces the fragmentation of risk perception and response in a government comprising dozens of agencies and thousands of officers, and ultimately aims to build a common, constructive culture of risk awareness across agencies. The CSF also facilitates an integrated national response to risks, through objective prioritisation and consideration of mitigation and adaptation strategies to be made under conditions of uncertainty.

Several other features of Singapore's approach are noteworthy. Firstly, the approach is meant to carefully distinguish between *risk issues* and *risk events*. *Events* are one-off incidents and often may be manifestations of underlying issues; *issues* are root causes that may build over time and emerge, and could operate as a lead indicator of impending threats. Dealing with risk events focuses on shorter-term impact management, while addressing risk issues requires a deeper understanding of their driving forces, and implementing solutions at that level.

Singapore's approach assesses risks as a product of *impact* and *interconnectedness*. The latter is in view that risks that do not conveniently fall into existing organisational or policy delineations could be overlooked or undermanaged.

Secondly, the approach intends to build on planning and strategic foresight inputs from other processes, such as Scenario Planning, the ESI process and scanning technology developed in RAHS. All of these help to develop a whole-of-government understanding and sensitivity to hidden risks, by overcoming cognitive biases, as earlier mentioned, and to emerging risks, by surfacing potentially significant trends. Such sensitivity is especially important for slow-moving or slow-emerging risks with far-off consequences, where decision makers have to be reminded to act now and not postpone action.

Finally, rather than measuring risk as a product of impact and probability, Singapore's approach assesses risks as a product of *impact* and *interconnectedness*. The latter is in view that risks that do not conveniently fall into existing organisational or policy delineations could be overlooked or undermanaged. Such a danger is exacerbated in a small country like Singapore, where policy making is especially inter-related across policy domains.

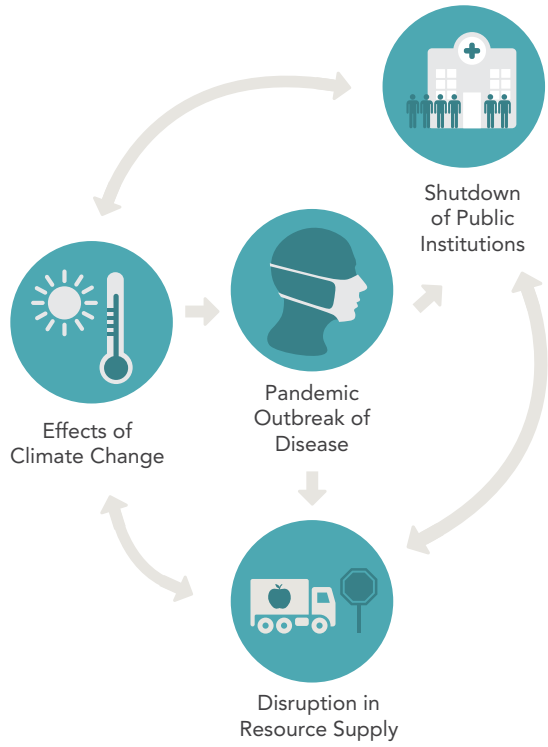
## Pandemic outbreak of disease

One example of a national-level risk faced by Singapore is the pandemic outbreak of infectious disease (refer to figure). This could be a repeat of the 2003 SARS crisis, or a spread of an influenza virus such as H1N1. The risk in itself already threatens public health — but also significantly impacts a whole host of other associated risks.

There are many challenges to consider in such a pandemic. These include: what if tightened border controls on people movement and vital goods (such as fresh foodstuffs) lead to prolonged disruption

of these critical supplies? How would public institutions and critical infrastructure (such as ports, electric grid, water utilities and hospitals) cope with increased manpower stresses, as quarantine orders are imposed and critical personnel are unable to work? From another angle, the connection between climate change and the spread of pandemics is manifested through increasingly severe weather crippling infrastructure and promoting the growth of disease vectors. Dealing with each of these challenges alone is already daunting; managing the consequences of all of them happening together plus the pandemic itself would increase the challenge by at least an order of magnitude. It is obvious that coping with this requires the blending of plans and capabilities between crisis response, healthcare and environment agencies, to name just a few stakeholders. The role that the national risk management approach serves is to articulate and communicate this interconnected system of risks associated with pandemic disease, thus guiding agencies and decision makers to better prepare and co-ordinate amongst themselves to prepare an adequate response.

Pandemic outbreak of diseases and associated risks




## Challenges and What Lies Ahead

Singapore's whole-of-government risk management approach is a work-in-progress, and there have been significant challenges in our effort to bring it from concept to reality. One challenge is to avoid making the process into an administrative "paper exercise" without tangible outcomes. Another challenge is the constant competition for the agencies' time and resources to implement the approach, given the agencies' need to also attend to other more pressing issues.

Notwithstanding these difficulties, the Singapore government will continue to refine and develop the national risk management approach. CSF will also continually engage stakeholders on risk management through various platforms, and work with them to deal with the uncertainty and complexity in the environment that the country faces, and to keep Singapore as ready as possible for strategic surprise.

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## The next powerful political force?

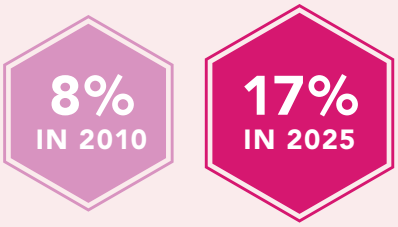
# The Elderly as Political Force

The elderly of the future might have higher expectations and be better organised and more politically active, as they will be more tech-savvy.

They may be "more demanding" than the current generation of elderly. They may expect better and costlier care, and assurances of a high standard of living, past retirement.

As with the AARP in the U.S. which is one of the most powerful lobbying blocks in the country, the elderly in Singapore could become a powerful political force, demanding greater benefits.

**Voters Too: % of Singapore Population Aged ≥ 64 Years**
*(Accenture, 2012)*




**"Parents and grandparents may be worried about their offspring's prospects, but not so worried as to sacrifice their own."**
*– Robert Samuelson*

# CSF's Overseas Visits in 2012

Here at the CSF, we take our networking very seriously. We know that even the most extensive network within Singapore would ultimately still be subject to some form of "national" cognitive lens and so we endeavour to maintain a wide range of international contacts and partners. We see networking as a way of helping to push the boundaries of our own thinking in both methodology and content, which in turn puts the CSF in a better position to guide policy-making in the Singapore Government.

For a start, we take the opportunity to meet international thinkers and foresight practitioners when they drop by Singapore.

But we also did a fair bit of travelling of our own this year. Our visits to the US and Europe (Austria, France, Germany and the UK) have allowed us to deepen our relationships with our existing contacts and establish new ones.

At the same time, we were keen to widen our portfolio of contacts beyond our traditional partners in the US and Europe. Our visits to Thailand, South Korea and New Zealand have allowed us to better understand the emerging strategic foresight landscape in these countries.

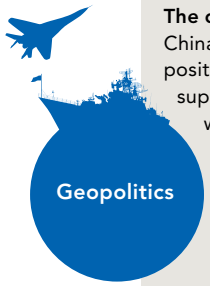
In all, 2012 was a busy year for the CSF, but the stimulating conversations we had with so many interesting people have made this an immensely enjoyable and rewarding journey.

## Where we've been

## What we've learnt

### Strategic Foresight

We interacted and exchanged views with a diverse group of people in the course of our travels. Our discussions with these contacts covered a wide range of topics, and this helped us to uncover our own cognitive biases and blind spots, and generate new insights about our operating environment. Some of the views expressed by our networks that challenged our conventional thinking include:




**The conventional wisdom**
China's rise will challenge the US's position as the pre-eminent global superpower. The new global order will be a bipolar one, and countries will need to balance their relations between these two.

**Our contacts' views**
The emerging world order will comprise "middle powers", rather than "big powers"; the new world order must be co-shaped with rising powers.

While the EU is losing its relevance in the global context and has little impact on global politics today, the European integration project is likely to persist because German support for the project is so strong that no political party can afford to place leaving the EU on its political agenda.

**The conventional wisdom**
In democratic countries such as those in Europe, election results provide political parties with a legitimate mandate to govern. Citizens thus vote for the party they believe most represents their interests.

The state is seen as the central organising unit of power particularly in countries in Southeast Asia (SEA), which have been characterised by decades of strong central leadership.

**Our contacts' views**
There is an increasing de-legitimisation of governments — citizens are voting not for the party they like, but against parties they *dislike more*, allowing fringe parties with a consistent message to gain prominence.

There has also been a re-evaluation of the role of government, especially as state/non-state lines have begun to blur, in the form of state-owned enterprises and state-sponsored activities by non-state actors.

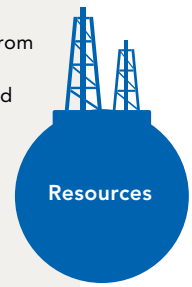
The political dynamics in SEA are also shifting, due to digital mobilisation and a new political consciousness in many SEA countries. Tight state control over traditional media has fuelled the increasing influence of the digital media in the SEA political sphere, which has helped to support more effective grassroots activism.

**The conventional wisdom**
Technology portends myriad benefits for governments and businesses. It enables organisations to innovate, simplify processes, cut costs and boost productivity.

**Our contacts' views**
Tech innovation is outpacing companies' ability to assess and harness them for growth. Governments are also struggling to regulate technology.

More companies are leveraging data analysis to make sense of the data they are aggregating, and are increasingly open to embracing co-innovation with tech companies, such as through crowdsourcing and open data initiatives. Many are also using emerging technologies and techniques to engage the community and solve challenging social problems together.

The most successful companies will be those that can understand human perspectives and behaviours, and leverage these behaviours and networks in the adoption of technology.




**The conventional wisdom**
Resource scarcity will inevitably lead to conflict between countries.

As long as the US relies on imported oil, it will continue to be engaged in the Middle East — this puts it on track for a head-on collision with resource-hungry China.

**Our contacts' views**
The changing energy landscape resulting from the shale oil and gas revolution might alter power configurations in the Middle East and Asia-Pacific regions.

Technological advancements could have an impact on the demand for rare earth minerals — the market for rare earth minerals is opaque and dominated by a few companies; tech decisions are thus based on limited information on the access to and availability of these minerals. Should access to key resources be curtailed, this may affect Singapore's manufacturing processes.

**The conventional wisdom**
Cities are the only way of housing the world's increasing population. As a larger proportion of the world's population lives in urban areas, cities in developing countries will continue to grow as centres and engines of economic growth. McKinsey estimates that 400 mid-sized cities in the emerging markets could generate 37% of global growth by 2025.

**Our contacts' views**
There is an increasing trend toward urban-rural migration in large cities — growth might thus take place beyond cities in the future.

In Southeast Asia, the penetration of infocomm technology into villages has supported knowledge diffusion and created economic opportunities for ruralites, narrowing the gap in living standards between rural and urban areas.

As a result of these trends, rural dwellers might well emerge as political and social change agents.

## Risk and Resilience

Participation in International Risk Governance Council (IRGC) events and the Australia and New Zealand School of Government (ANZSOG) Annual Conference gave us good insights into how other large organisations (including governments) manage emerging challenges and threats, and how we could refine our own risk management processes to improve our anticipation of, and early response to, emerging issues. In particular, the following were highlighted as key challenges facing governments today:

- **Co-ownership of risks with other stakeholders:** It is not possible for any government to deal with any complex risk without the cooperation of different stakeholders (i.e. private sector businesses and civil society). For a society to be resilient, the government should ideally be the risk bearer of last resort. It is thus important to resolve value conflicts through regular conversations and create an environment where data can be shared safely and adequately, so as to establish a hybrid risk governance system involving both public and private actors.

- **Separating factual assessment from risk evaluation:** While this is an important factor for risks to be dealt with effectively and efficiently, it is very difficult to do this in practice as risk owners are usually also the risk assessors. This might make the prioritisation of risks (and consequently, the allocation of resources) inaccurate, and more efforts should be made to avoid the under/over-reporting of risks by risk assessors/owners.

- **Subscribing 'new' meanings to risks:** Given the increasing complexity of today's world, it is important for governments to regularly gather new information to reflect their renewed understanding of certain risks in new contexts. Monitoring should not only include changes in existing knowledge (i.e. new data), but also include changes in the relevance and social saliency of knowledge (i.e. new perceived meaning to the society).

- **Avoid path-dependence and ensure alternatives are available as options for every intervention point.** Governments should remember not only to rely on tried-and-tested methods to deal with emerging risks, but also ensure that alternative options are available to build up the resilience of critical systems in their countries.

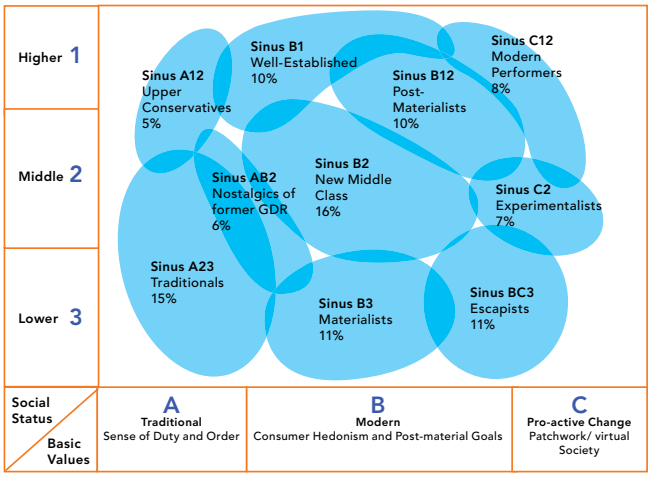
- **Instilling the right culture towards risk.** Governments tend to view risk solely as a compliance process; however, it is also important to encourage people to view good risk governance as an essential ingredient for success.

These insights will be very useful for us as we continue to refine the Singapore Government's Whole-of-Government Integrated Risk Management framework, and seek to strengthen the resilience of our society.

## Frameworks and Methods

Beyond insights on strategic foresight and risk, our overseas visits also exposed us to different frameworks and methods that our contacts use to develop a better understanding of the way the world works, and have been very useful in helping us expand our toolkit for thinking about the future.

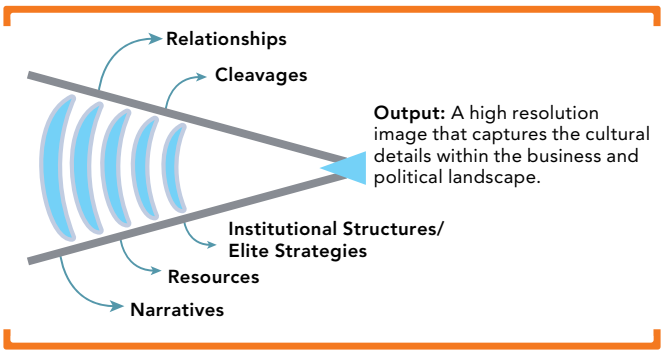
For example, France's Sociovision has developed a **Currents Monitor** which uses social drivers of change to measure societal values. Building on the information gathered from the Currents Monitor, the **Sinus Milieus Segmentation Model** maps out population archetypes based on socio-economic level and appetite for social change. The model can help to identify extreme or emerging groups in society, and illustrate the influence that a particular population group has on another group.




This could have important policy implications — it would allow policymakers to incorporate persona profiles and behaviours into their analyses of social trends and conditions, and avoid formulating one-size-fits-all policies that assume population homogeneity.

To integrate cultural dynamics into the analysis of politics, security and economic risk, the UK's Counterpoint has developed a five-category framework to illuminate cultural risks:

- **Institutional Structures:** (traditional and non-traditional, formal and informal) structures that create opportunities or obstacles for social change
- **Cleavages:** faultlines that could cause a breakdown within micro-social groups
- **Resources:** emotional and psychological resources that constitute resilience and well-being
- **Relationships:** links that bind individuals to one another, to institutions and to communities
- **Narratives:** myths or stories that shape people's perceptions of themselves and their worldviews




This framework could explain how social structures affect individual and societal perception and management of risk, and provides a more comprehensive lens to understand cultural underpinnings.

These frameworks have given us an idea of how we could overlay the traditional scenario planning methodology with *cultural* factors in order to perform deeper analysis for more robust scenarios.

We were also grateful for the opportunity to take part in the World Economic Forum's Moscow Meeting to discuss scenarios for the Russian economy. We have had regular conversations with the WEF's Strategic Foresight Team, and were invited to play a part in the October event. It was insightful to see how the WEF had facilitated the discussions on the scenarios around the Global Competitiveness Report, which provided a ready framework to think about the various scenarios.

> Serious networking requires a mindset across all levels of the organisation to commit to such efforts, and officers involved in it are making a life-long commitment, starting early, and maintaining and growing links over the years.
>
> Peter Ho, Senior Advisor to the CSF

In our various meetings, we also observed how different organisations tailored the scenario planning process for their needs. For example, the UK Foresight Programme Management team has integrated the red teaming methodology into scenario planning, Munich Re in Germany uses scenarios to test cross-dependencies of risks, while Z_Punkt develops its scenario narratives around quantitative indicators which could be used as signposts for the scenarios. Thailand's Noviscape, meanwhile, has involved the public in co-creating scenarios to develop more robust scenarios.

The various overseas visits that the CSF made in 2012 enabled us to maintain our links with existing contacts, and establish ties with new friends. The insights we gained from these meetings have been extremely useful in our projects, such as the Emerging Strategic Issues project and the Whole-of-Government Integrated Risk Management framework.

CC BY-NC-SA Mugunth Kumar

## What if cities are not the future?

# De-Urbanisation

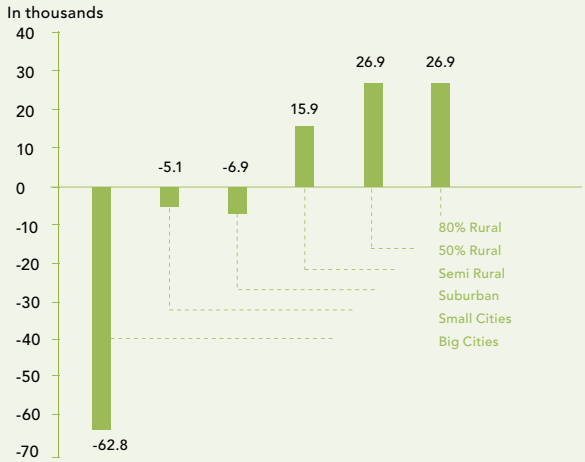
Rural areas are attracting people away from cities. 54,000 Britons moved from urban to rural areas in 2009-2010.

The desire for more space and greater access to nature is driving this shift. Technologies that allow people to work remotely can help unlock job opportunities in rural areas. Some U.S. companies are now turning to "rural sourcing" to lower costs.

In future, will people migrate out from cities into rural areas? What does this mean for the future of cities?

**Internal Migration in the U.K., 2009-2010**

*(U.K. Department for Environment, Food and Rural Affairs, 2012)*



# "What is Singapore's Dependency Ratio?" and Other Interesting Questions

## A REFLECTION ON AN ARUP FORESIGHT WORKSHOP

**Jonathan Ng**

*ARUP Foresight conducted a workshop for members of the Singapore Government foresight community in February 2012. This article outlines the process used and key learning points from the workshop. This provided many good ideas to the CSF's Emerging Strategic Issues project.*

## About the workshop

ARUP Group Director for Global Foresight and Innovation, Dr Chris Luebkeman, and Senior Foresight and Innovation Specialist Dr Stuart Candy visited Singapore in February 2012. During the visit, Chris conducted a workshop for members of the Singapore Government foresight community.

Chris began the workshop with a presentation centred on three key points. Firstly, change is constant. We can't stop progress and can only try to understand the context of change. It is not possible to get everything right. Secondly, the future is fiction. The future is a story that we all play a role in writing. Thirdly, participation shapes our world. Therefore, we need to encourage active citizenry.

Chris went on to explain that the workshop aimed to simulate discussion on the following questions:

## Workshop Process

The workshop was structured around ARUP's Drivers of Change cards **(www.driversofchange.com)**. The issues on the cards were divided into five categories according to their primary area of influence: Social, Technological, Economic, Environmental and Political.

Participants were divided into five groups, and each group was given all the cards in one category. Each group was then asked to prioritise the top 20 cards which it thought reflected the most critical issues. The rest of the cards were discarded. The top 20 cards were then passed on to the next group to choose the top 10 issues, before a third group selected the top five.

These top five cards from each category were put up on flip charts, and all the participants were invited to vote on the issues they thought were the most critical for Singapore. Each participant was given seven votes — one for each category and two additional wildcard votes, which they could use to vote for any other issue.

## Results of the voting (In descending order of prioritisation)

| Social | Technological | Economic | Environmental | Political |
|---|---|---|---|---|
| **Changing Households:** Who do you live with? | **Techno-reliance:** How vulnerable are you? | **Poverty:** Are there two cities within each city? | **Heat Islands:** How will you keep cool? | **Planning Policies:** Who are cities planned for? |
| **Ageing Population:** How many centenarians do you know? | **Energy:** How is your city powered? | **Dependency Ratios:** How many people will you support? | **Climate Change:** If cancer doesn't kill you, will climate change? | **Resource Conflicts:** What will you fight for? |
| **Community:** Do you know your neighbours? | **Virtue Engineering:** What would you change? | **Chronic Disease:** How much are you costing your country? | **Eco-cities:** How green is your city? | **Mayors:** Who do you want to govern you? |
| **Social Media:** How many communities are you in? | **Connectivity:** How do you keep in touch? | **Hub Ports:** What is your distribution network? | **Flooding:** Will your city drown? | **Primary needs:** Are food emergencies inevitable? |
| **Growth:** Is your city too big? | **Transport:** How will you move around? | **Inflation:** Are services energy-free? | **Polluted Waters:** Do you swim in the ocean? | **Minimisation:** Is zero-waste achievable? |

## Key Learning Points

**A simple facilitation process with good aids can be very effective.**

The workshop demonstrated that a simple facilitation process, with the good use of aids (in this case, cards) could be useful in drawing out participants' priorities and blind spots.

The cards can also be used to open up a dialogue with different groups and raise awareness of critical issues, as well as to establish a common vocabulary among agencies on the key driver of change.

Agencies have also created cards tailored to their own contexts, to facilitate discussions about the most critical issues facing them. For example, the Ministry of Education produced a set of thought cards on education issues and the CSF produced a set of cards on Emerging Strategic Issues.

**The workshop process is highly customisable.**

The process is flexible enough to meet the needs of different agencies and projects. For example, it might be useful to experiment with different methods of voting for the most critical issues. This could help to avoid overly aggregating participants' views and allow for a deeper examination of how different groups vote on the issues, and why these disparities exist.

In addition, instead of focusing only on the top five cards, an analysis of the discarded cards might help to uncover the participants' cognitive biases.

**Foresight practitioners need to read widely.**

Singapore's increasing dependency ratio[1] was highlighted as one of the key challenges for Singapore going forward. However, there was less clarity among the group about what the precise ratio was, and how it might change.

This taught us that foresight practitioners must constantly keep themselves updated on useful information in order to stimulate conversations and create good products.

Singapore's Old-Age Dependency Ratio in 2012 was 13.5 per 100 residents aged 15–64.

[1] *The Old-Age Dependency Ratio is the ratio of residents aged 65 years and over to residents aged 15–64.*

**Collaboration matters.**

This workshop also brought out the value of cross-agency collaboration and cooperation.

Our experience discussing Singapore's dependency ratio was one example — it highlighted how certain aspects of highly visible issues such as ageing might be overlooked, even by experienced foresight units that collectively agree on the importance of these issues.

Coming together as a multi-agency group gave us the opportunity to discuss aspects of the ageing issue that we had not individually considered, and generated the impetus for us to clarify our misconceptions and sharpen our understanding of the situation.

**Repeating the process with different groups of people would yield different results.**

The prioritisation of Driving Forces is often dependent on the audience, and can be subjective.

In this regard, while this workshop was held for foresight practitioners within the Singapore Government, there would also be value in conducting the process with people representing a cross-section of society. To facilitate these processes, cards could be tailored to fit Singapore's context.

This could help to uncover the issues which Singaporeans feel are most critical for Singapore. These issues can then be compared with those chosen by our leaders and decision-makers, and any differences in perception could be examined further.

## Conclusion

Participants were generally positive about the workshop. Many thought it was well-run and enjoyed its interactive nature. In some sense, the process is as important as the output. Workshops like this one play an important role in facilitating the frank exchange of ideas across the foresight community.

*Acknowledgements*
*CSF would like to thank the ARUP Foresight team for so kindly conducting this workshop.*

In some sense, the process is as important as the output. Workshops like this one play an important role in facilitating the frank exchange of ideas across the foresight community.

# Meet the Team

We welcome your opinions, thoughts and insights on this publication. Please feel free to contact anyone on the team for further information.


**Bai Huifen**
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Previously from the field of health sciences, Huifen gets excited about biomedical developments, novel technologies, engineering feats, science fiction and the like.


**April Chin**
Assistant Director
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April is fascinated by people and culture, and enjoys conversations in small, intimate doses. A social worker by training, she is passionate about drawing connections between everyday experiences and trends on the horizon. She believes that there will be chocolate in heaven, and occasionally indulges in a chocolate buffet for a whiff of what is to come.


**Cheryl Chung**
Lead Strategist
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Cheryl is an economist who draws. A seconded officer from the Ministry of Trade and Industry's Futures Group, her research interests focus on technology and innovation as drivers of economic growth. Since joining the CSF, Cheryl has been thinking about how technology can affect the role of the State. She is passionate about visual communication and hones her craft by doodling in meetings. This seems to have paid off as she now also teaches a course on Foresight Communication.


**Gunathilakan Darmalingam**
Senior Assistant Planning Executive
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Gunathilakan, or Guna as he's affectionately known, is the office's resident swami. After spending each workday bailing his colleagues out of trouble, Guna goes home to his three kids, two nephews, an amazing cook-of-a-wife and their veritable assortment of adorable pets. He loves airplane models and has a collection to rival the best of them.


**Tiana Desker**
Assistant Director
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Tiana comes from a policy and strategy background and is relatively new to futures work. She enjoys the challenge of translating futures research into actionable policy recommendations. Her current research interests are the geo-politics of Southeast Asia and creating a more resilient civil service. Tiana teaches scenario planning at the Civil Service College.


**Kay Chew Lin**
Strategist
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Chew Lin is interested in the way facilitation processes can bring out hidden connections, and is exploring how scenarios can help decision-makers to consider a wider range of possibilities. She also tries to collect interesting people of various stripes, and occasionally gets them to collaborate.

**Adrian Kuah**
Lead Strategist
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Loath as he is to admit it, Adrian has a PhD in economics. Despite (because of?) that, he is vastly more interested in philosophy, political theory and sociology. He will always make time to pronounce on, debate about, and quarrel over issues to do with social justice, global cities, and complexity. He also relishes the irony of being a technophobe even as he considers the effects of technological change on society.

**Kwa Chin Lum**
Head, CSF / Deputy Director
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Chin Lum spends much of his time talking to people about the future, and enjoys getting surprised by their thoughtful insights. He has previously worked in policy and planning roles on issues related to Singapore's fiscal reserves and the social services sector, and believes that getting people to agree is one of the biggest challenges of the future.

**Jasmin Lau**
Deputy Director
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Jasmin's favourite type of strategising revolves around sports. In her official capacity, she is involved in research involving governance, the resilience of public institutions, and public service capabilities. She secretly wishes she could be a professional athlete, and draws much inspiration from her hobbies that involve adrenaline rushes.

**Lee Seng Teck**
Senior Strategist
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As CSF's resident INFP, Seng Teck takes his colleagues more seriously than he should. His recent work includes projects on governance and HR trends, but privately he enjoys playing with coloured post-its more than research. Outside work, he volunteers as a tour guide at the local art museum. He also likes kick-boxing and colourful socks.

**Leong Ming Wei**
Principal Strategist
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Mingwei is chief specialist at the CSF, where he supervises capability building efforts for the Futures Community. After reading engineering in old Cambridge, and public admin at the new one, he's mindful not to allow school to crowd out his education. Hence, he's always keen to visit new places, meet people from all walks of life, and investigate every type of emerging issue.

**Leong Wei Jian**
Senior Strategist
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A chemist by training, Wei Jian used to teach Chemistry and English Language in a secondary school. He now applies his passion in teaching to facilitating workshops and foresight courses. Surrounded by creative colleagues in the office, Weijian has been inspired to hone his design instincts, and has recently fallen in love with infographics. That said, karaoke remains his number-one love in life.

**Lewis Liu**
Strategist
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Lewis is the guy with the suit — not because he wants to look awesome, but because he wants to keep warm in the office. He is working on various projects related to the Future of Governance and the Future of Growth. He loves using technology to improve his efficiency in life and will sell his kidney(s) for the iPhone 8.

**Jonathan Ng**
Assistant Director
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An economist by training, Jonathan started his career in the Foreign Service. His futures-related projects to date include one on the Future of the Public Service. When not thinking about the future for Singapore, he spends his time thinking about being a professional footballer, until reality kicks in.

**Janelle Moh**
Senior Strategist
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Janelle was a hard-nosed consultant advising companies on how to penetrate emerging markets. She later decided to apply the same instincts to serving the public, advising the Singapore government on how to better anticipate future changes. She is an avid runner and former gymnast.

**Tan Li San**
Senior Director (SPO)
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Li San oversees the Strategic Policy Office, as well as the Institute of Governance and Policy at the Civil Service College. At the SPO, she enjoys thinking about the future and advocating shifts needed to help make Singapore more future-ready. At the IGP, she is shepherding the process of integrating research, curriculum and programme development. Outside of work, she enjoys hanging out with her three kids, and sparring with her two older ones on the aikido mat.

The views expressed in this publication do not necessarily reflect the official policy or position of any agency of the Government of Singapore.

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