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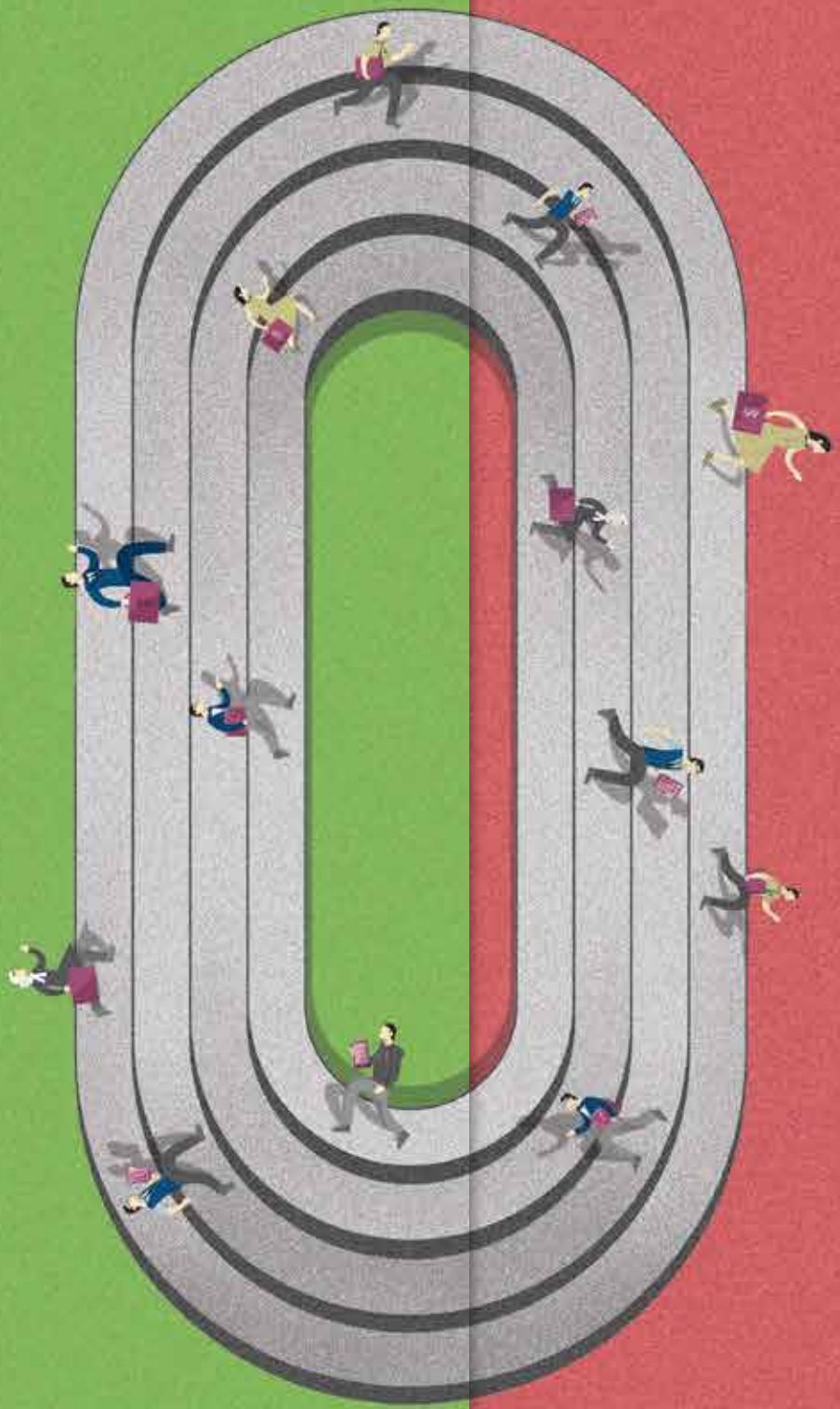

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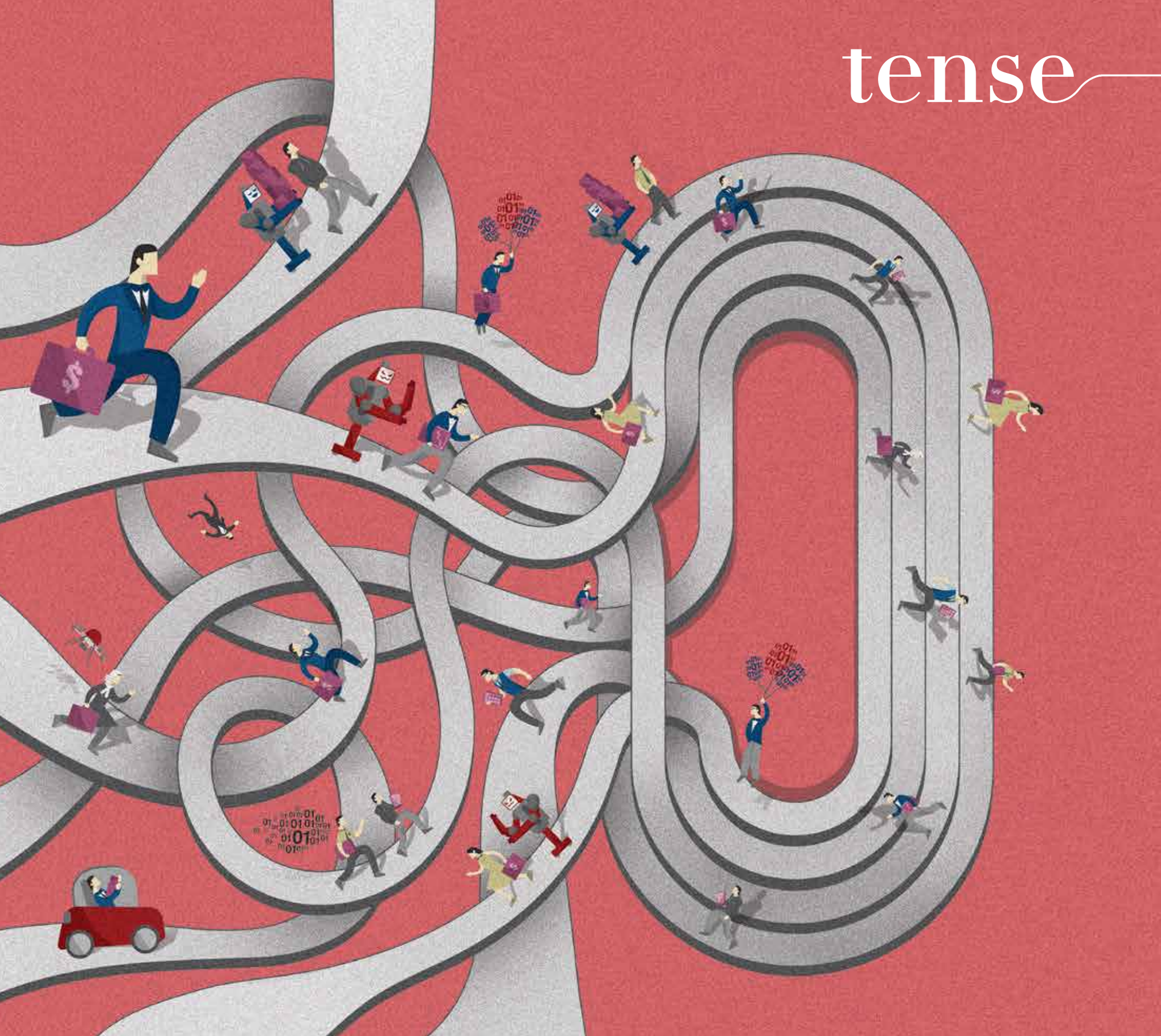

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Foreword

What are the good jobs of the future? What are future sources of growth?

Economic transformation is happening in major markets like China and Japan, while the quest to balance green growth and secure energy may drive developed economies like Germany to deeper industrial transformation. Cities are reinventing themselves as the race for talent and capital intensifies. New York City bounced back quickly from the depths of the financial crisis to emerge as a technology hub; neighbouring cities like Bangkok and Kuala Lumpur are climbing up competitive rankings quickly, despite political and social challenges. Technologies like robotics and autonomous vehicles are starting to redefine global value chains; algorithms are starting to disrupt professional services and digital giants like Alibaba are using Big Data to compete in surprising sectors like banking. The changes that lie ahead may be complex, but they present opportunities.

For Singapore to maintain its place as a global city, we need to not only be aware of these opportunities, but think ahead and prepare to take advantage of them so that future growth and good jobs continue to be created and sustained. Foresight provides policy makers with an intuitive understanding of what is around the corner, so that they can shape progress in this new and evolving environment. I hope this edition of Future Tense will give you a sense of where these opportunities for a better future can be found.

Mrs. Ow Foong Pheng
Permanent Secretary
Ministry of Trade and Industry, Singapore
May 2014

Emerging Asia: Prospects and Possibilities

Keynote Address by Singapore Prime Minister Lee Hsien Loong at The Singapore Summit 2013

World Economy And Asian Markets

Welcome back to the 2nd Singapore Summit!

We meet at an interesting time for the world, and especially for Emerging Markets and the Asian economies. A few years ago, when the Global Financial Crisis (GFC) struck, many doomsday predictions were made for the system as a whole, and for the developed world in particular—US would go bankrupt, Eurozone would split, the "Grexit", Greek Exit, would start it all. It did not happen, the situation has stabilised—although not all problems have been solved—and risks still remain. In contrast, at that period, there were similar, equally passionate views about Emerging Markets—that this was the future of the world economy, that this was going to be the primary engine of growth, that the last shall be first.

Indeed over the last five years, the Emerging Markets have done well; a primary engine of development. Last year alone, in Asia, the Emerging Markets grew twice the world average. But this was not necessarily because of its intrinsic capabilities and drive, but partly fuelled by QE (quantitative easing) and robust domestic demand. Recently, the lustre has been lost. The prospect of QE tapering off was enough to cause capital outflows, currency depreciations and asset/equity markets to soften. The mood changed, and many people now doubt the sustainability of the Emerging Markets story. Some even wonder whether in Asia, if this is a repeat of the Asian Financial Crisis which happened a decade and a half ago. I think it is useful to take a step back and avoid getting carried away by prevailing sentiment and try to get a feel for what are the longer, more enduring trends and factors, which are at work.

Indeed, individual Emerging Market countries have weaknesses. They have relied excessively on capital flows, their current account positions are not bad, but weakening, and there are shortcomings in infrastructure and governance. Indeed the leaders of many of these countries have acknowledged this candidly. Malaysian PM Najib Razak said this year, that there is a "need for (Malaysia) to strengthen the fiscal and macro position of the Government". In Indonesia, President Yudhoyono identified five "illnesses and factors that have caused development to fail at the national and regional levels", and he listed the—inefficient bureaucracy, regional governments, investors who did not fulfil pledged commitments, a flawed legal framework, and unhealthy political interests. In India, Finance Minister Mr. Chidambaram said, "India needs a more open economy to seed growth. And it needs more reforms and less economic restrictions". So the problems are recognised, but they were glossed over and could be put aside, as the capital flowed in—cheap money. As the euphoria subsided, and with the threat of the (QE) withdrawal, the issues now re-surface and loom larger.

But I do not believe that we are in the situation of the Asian Financial Crisis. The fundamentals are stronger than they were back then in 1997. The banks are better capitalised—non-performing loans are lower, capital adequacy ratios respectable; external balances generally stronger, although some countries have recently slipped into deficits; and a smaller proportion of debt has been denominated in foreign

The societies with young populations have opportunities, but the opportunities also come with challenges.

currency, so that the external debt is only about half of what it was, in terms of % of GDP during the Asian Financial Crisis. Countries have built up reserves significantly higher than last time. Also, they have learnt not to peg their exchange rates, so with more flexible exchange rates, they can ride the ups and downs, and the bumps. We have put in some firewalls, e.g. a regional initiative, called the Chiang Mai Initiative Multilateralisation for countries to come to one another's help capital flows. Central banks have had bilateral currency swaps, and the presence of the fire brigade and these precautions have deterred excessive speculation as well as panic.

Challenges And Opportunities For Asian Economies

Overall, we are betwixt and between. There are challenges, but overall in a stable position. If you look beyond where we are today, and try to see what are the deeper issues which face many of the Asian economies, I think you will find some common features. And how the countries deal with them will determine how well these countries do over the longer-term. Let me just list four of them—demographics, a generational change, transformations of the economy and society, and lastly, security factors. Let me start with demographics.

Ideally, societies are in demographic equilibrium—people grow old, people get born, but the society stays about the same shape. There is no Asian society which is like that. We are all either growing old, or with lots of young people. The ones which are growing old, are among the most rapidly ageing societies in the world. Japan has had a workforce which has been declining since 1995. China, a dynamic economy, but its workforce has also started declining last year. Hence, the worries that China will grow old before it gets rich. And this poses very difficult challenges which have to be met early. How to build an entire system of financial, social and medical support for the elderly population, how to maintain the vigour and competitiveness of the economy, how to make sure that you are looking forward, changing and transforming yourself when a large proportion of the population prefers the status quo, security and comfort. At the same time, it causes the countries to encourage parenthood and procreation. More children, try and balance the accounts. Almost all East Asian societies have been trying this, very hard, but unfortunately, mostly in vain. It is a very difficult problem to solve. That is on the ageing side.

The societies with young populations have opportunities, but the opportunities also come with challenges. You take countries like India, Indonesia, Vietnam. The median ages are below 30, reaping significant demographic dividends—more and more people working, not many retired to be carried, not so many who are very young, still to be supported before they have started working. In India, the estimate is that because of demographics, India can generate 2% extra growth per year. But you can only collect the dividend if the government can educate the people, find jobs for the people, invest in them, and bring them up to be productive citizens and contributing members of the economy, and not young people, frustrated, disgruntled, worried, looking for translations of Arab Springs. That is not easy to do. In Indonesia, for example, less than half of students are finishing secondary schools. In South Korea, where the young people are well educated, finding them jobs is the next hurdle. And among university graduates in South Korea, unemployment is higher than among graduates of →

vocational high schools. Well educated, unable to find jobs to match. But these are tasks which the governments have to do, which are soluble, because otherwise, the country will face social and political problems. So the first issue is demographic challenges.

The second issue, which is related to that, are the generational changes which the countries are undergoing. Changes in values, experiences, attitudes and aspirations, between one generation to the next, all happening faster than ever. The older generation which began this process of rapid development and take-off experienced the whole range, from war, poverty, disorder, and later rapid transformation and improvement. They created the improvement. They appreciated what they themselves have achieved. But now the world has changed, a new generation is coming along, and the older ones are under pressure from rapid changes and from the younger, better educated cohorts coming along and putting pressure on them. The younger ones are the beneficiaries of the take-off. They grew up in peace and affluence. They are "digital natives", meaning born with fingers on keyboards, comfortable with social media and new technology. This is the world which they have known and know how to operate it. This is the world from which they set their base aspirations and expectations. This is what I want to improve on and have my children enjoy even more of, than what I have.

Generational differences per se are not new. It has happened since human beings formed societies and old generations worried about young ones. But the changes are happening faster than ever, because the world is changing faster, and technology is widening the gaps between "digital natives" and "digital immigrants". Especially in Asia, which has among the most IT literate populations and most wired and wireless countries in world. Korea is probably top of the list and Singapore is somewhere near there. Even China has the biggest population of internet users and mobile users, anywhere in the world. So the differences are no longer just between one generation and the next, but even between cohorts several years apart. I went onto Facebook, which for me is quite a migration because I was advised, young people are there, you have to be there. One day, I met a relative, a teenage young lady, I said, are you on my Facebook? She made a face. Facebook is passé to that generation, they are on Instagram! So now, I am there too. But you have to be not just with that generation, but of that generation. And that generation has to produce people who will be there for them and with them.

But now the world has changed, a new generation is coming along, and the older ones are under pressure from rapid changes and from the younger, better educated cohorts coming along and putting pressure on them.

But overall, these changes are a positive force. It is how societies progress and it is the way the world has always been. The young will always be better adapted to the world of today and the world of tomorrow. They will change societies to fit the temper of the times, to fit their own psyche, their own social mores and norms, whether in terms of social institutions, economic structures or political organisations. The "feel" of society will change, but it has to change because it has to fit the people who populate it, who animate it, who are its spirit. But as the world changes, we still have to strike a balance between the old and the new. To maintain values and group instincts that have enabled societies to succeed and endure, and which remain relevant today; while at the same

time, moving with the times, keeping vibrant and forward—looking, and developing creative responses to the new world.

Among the creative responses, is the third issue I want to discuss, which is the economic and social transformations which these societies have to undergo. Asian economies, I believe, have every potential to continue growing faster than advanced countries, and to catch up with them, or at least narrow the gap on them. To grow, it depends on free markets and private enterprise, but it also depends on active and effective governments who create preconditions for markets to be able to operate effectively, properly; for people to be able to have the trust, the contracts, the property rules, the whole environment on which production and prosperity depends. The Asian countries have done this so far, but the strategies which they have used to get here, in many cases, have run their course, and to continue high growth will depend on further structural changes. It will mean changes in economic restructuring —setting rules, defining and enforcing property rights, restructuring industries and state sectors, developing financial markets. It will mean changes in social policies—building social safety nets to protect vulnerable groups, strengthening institutions and social services, e.g. housing, healthcare, education, elderly support. It will mean political changes—to update and evolve systems and practices of government to keep abreast of economic and social conditions.

We see this transition, this inflection point, and these challenges in many Asian Emerging Markets. Take China—over the last 30 years, it has been one main story in the world. 500m people lifted out of poverty—almost the entire population of Southeast Asia. But now, it is at an inflection point. Having to shift to a more sustainable growth model—more balanced, more emphasis on social development and more environmentally-friendly. The Premier, Mr. Li Keqiang, speaks of humanity-centred urbanisation, having this in mind. If they get this right, it offers the opportunity and potential for many more years of high growth, but that means far-reaching reforms. The ideas for these reforms and economic policy changes are there. The World Bank has done a study, they did a "China 2030" report last year, which offers a comprehensive roadmap of the things that need to be changed and fixed. But the reforms will not stop with the economy. You also need social transformation, e.g. healthcare, education, social equity. And you need, in parallel, political adjustments, to curb excesses and malpractices, meet rising public expectations for accountability and participation and maintain social order and stability. That is the hardest of all. Unlike economic reforms, there is no World Bank to do it for you, there is no roadmap. Nobody has made this transformation, or walked this path before, starting from circumstances similar to what the Chinese are today. So they have to feel their own way forward, crossing the river one stone at a time, to borrow Deng Xiaoping's phrase.

China has a new leadership in charge, under President Xi Jinping and Premier Li Keqiang. There are high expectations of the new leadership and there is a clear feeling even among Chinese officials, who fully understand that changes are necessary, and indeed it would have been better if changes had happened earlier. We are not looking for drastic discontinuities —because with a big country that is risky and not possible—but considered, cogent steps that signal moves in the right direction, that will be carried out consistently and will build on one another, so that →

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Asian economies, I believe, have every potential to continue growing faster than advanced countries, and to catch up with them, or at least narrow the gap with them.

after two terms of leadership, you have left China better prepared for the next phase. I know they have been discussing these issues very seriously; they have fixed the date for their 3rd Plenum of their Central Committee, which is meeting in November, and that is when they usually make major policy initiatives. This will be closely watched for signs of the leadership's strategy and even more, of the leadership's resolve. It is not easy to do. When they tell you that they have a big challenge, they are not just being modest, or putting you on.

You look at developed countries having to make these changes; they do not find it easy either. Take Japan—not an Emerging Market, but a developed country trying to re-emerge. It has had a very difficult two decades since the bubble economy burst. But with Mr Abe who came back as the Prime Minister for the second time last December, he has changed the mood, and changed this course, with Abenomics. The Nikkei index has gone up 40%, the real economy is showing positive signs—output is rising, unemployment is down. And winning Olympics 2020 has been an extra bonus, because now he has "Three Arrows" and "Five Rings". These things do make a difference. But the Japanese economy cannot revive just by pump priming. So, when Mr. Abe says that the "Third Arrow" is structural reform—that is the key. The package of structural reforms was announced in June. It is the first step in the right direction, announced before an election and therefore, very cautious. But a lot more will have to be done, whether it is more flexible labour markets, healthcare and pensions, or agriculture reform. These are things which take years and not months to do, and even more years to show results, and to entrench themselves. Japan needs to do that. But Japan, to succeed, needs to go beyond domestic policies and ensure a favourable international environment for itself. This starts with good relations with its neighbours, especially China. It has to open itself further to the outside world. Therefore, I welcome Japan's participation in the Trans-Pacific Partnership (TPP) negotiations, an FTA covering both sides of the Asia Pacific, including the US, and Singapore is part of the negotiations too. Japan joining this is a signal to its own people that it wants to revitalise itself, to contribute to the prosperity of the broader Asia Pacific region. It is an example interesting in itself, but also an example of how difficult it is for countries to reinvent and transform deep characteristics of the country. And therefore, to come back to China, we wish China every success. We wish China every success because we believe that China has a role to play in the peace and security of the region, which is the fourth critical factor relevant to all the emerging economies.

Peace and security has been the basis for Asia's progress since the war. All our projections and assessments and people plotting charts and calculations, how fast you are going to grow and when you are going to reach middle income status and so on, all those assume one big unspoken presumption, that the region will remain peaceful and stable, that there is no war—otherwise all bets are off. There are potential hotspots in the region. There are territorial disputes—between China and Japan, between Korea and Japan, in the South China Sea between China and many ASEAN countries; there are tensions in the Korean peninsula; there is a problem we have with extremist terrorism, including the growing threat of people self-radicalising, making themselves believers of these extremist, radical views, just by going on the Internet.

These problems have (always) been there. If you ask me, over the last one year, they have not diminished. In some cases they have become more difficult, for example on the territorial disputes. So we cannot neglect tensions and risk of mishaps, which may well jeopardize the overall climate of peace and stability. But these are individual issues. In the longer-term, the biggest determinant of regional security is China's peaceful development and integration into the regional order. This is a major shift in the global balance and so far, it has been executed remarkably smoothly. China has integrated well into the international order. It participates in WTO, G20; it has an interest in a peaceful environment with which it can do business, and which can free it to focus on domestic issues. But the process is not complete. China will continue to grow economically, and it will also continue to strengthen and modernise its armed forces. It is a major continental power; every power needs to do this. China also aspires to be a maritime power, and Mr Xi Jinping has personally championed China's efforts to do this. So this will create new realities and push it towards a new balance. Both China and its neighbours will have to continue to adjust to this new situation. It is essential that this process, the journey, be peaceful and be based on equal, win-win relations. This will be welcomed by China's many friends and partners, especially in Asia.

These four issues will shape the prospects for Asian economies, particularly the emerging ones. We cannot guarantee that all countries will manage them successfully, but on balance, I am confident of the future of Asia. In big countries like China and India, even if one part of the country, or the country as a whole encounters difficulties, that will not necessarily prevent individual provinces/states or cities in the country from forging ahead and doing well. If you look at India, you will see a very varied landscape where there are many bright spots and many cities and states which are pushing on their own and overcoming the problems of the broader subcontinent. Furthermore, Asia is home to more than half the world's population—a population which is driven, talented, hungry to get ahead, and wants to change the world. They have seen others succeed, and they want to do the same for themselves and their families. I think it is presumptuous to think that none of them will join the ranks of developed countries in the next 20 to 30 years.

So we cannot neglect tensions and risk of mishaps, which may well jeopardize the overall climate of peace and stability.

Singapore At The Heart Of Global-Asia

Singapore faces these issues too. We are not at the developing country income level anymore, but we face many of the same challenges that they do. In terms of demographics—we are an ageing society, anticipating and preparing for a rapid ageing population, and doing our utmost to encourage Singaporeans to have more babies. Alas, with limited success. We are undergoing generational changes too, rapidly, and are educating and engaging our youth to build a better Singapore for themselves. We are pushing for economic transformation, upgrading, and inclusive growth, so that there are benefits for the whole society. We are strengthening safety nets, so that we can prepare for the uncertainties ahead. And we hope and we work for peace and stability, together with ASEAN and external partners to promote a stable, predictable, open, regional environment.

We are preparing ourselves for a bright future in this new world. We are exploiting our Global-Asia position—connected →

to the world, located in Asia. We are staying wide open to talent and investments. We are connecting ourselves to the world, e.g. I mentioned the TPP, we have also completed negotiating a FTA with the EU, and we also are part of another FTA on the West side of the Pacific Ocean - the Regional Comprehensive Economic Partnership. We are serving as a bridge for Asian companies expanding globally, e.g. Amorépacific (South Korean cosmetics company whose Asia Pac HQ is in Singapore), Mitsui Chemicals (Asia Pac HQ and first R&D centre outside Japan in Singapore). We are a base for Western companies venturing into Asia, e.g. Halliburton (Manufacturing & Technology Centre for Eastern Hemisphere), IBM (Services Control Tower for Asia-Pac region), functions here which utilise Singapore to coordinate and manage operations all over the region. At the same time, we are helping Singapore companies internationalise, e.g. Olam, Keppel, SingTel. Traditional markets, developed countries, new markets. We have a Singapore company which does a very big business selling used cars all over Africa. And out of Singapore, setting up an operation here, to manage and oversee the business in all these countries, doing very well. We will do the same with Latin America, even though that is further away. We are upgrading our capabilities—transforming our businesses, investing in our people, through education and lifelong learning. We are creating new possibilities and overcoming our physical constraints, e.g. expanding Changi Airport. We are going to move one of our airbases, a big airbase, from Paya Lebar to Changi, free up land, airspace, height constraints, enable a big chunk of Singapore to be redeveloped over the coming decades. We are moving our port from Tanjong Pagar, where it has been for more than a century, to Tuas, where we are building a new one, bigger and better. That will free up another big piece of land, where we will develop, practically, a new Southern Waterfront City. We are seeking to unleash the human spirit and imagination in Singapore.

Singapore Summit

The Singapore Summit is one example of how we can unlock new possibilities and ideas. It is a natural and even platform to bring together thought leaders and successful practitioners from East and West. You will discuss significant Global-Asia issues—the current slowdown and uncertainties, the developments in China and Southeast Asia, the business models for succeeding in Asia. All of you have extensive experience and valuable insights to share. So I hope you will contribute as well as benefit from the discussion and the insights.

I hope you enjoy the Summit, and also make time to enjoy Singapore, as well as the entertainment and revelries that happen this weekend.

Thank you very much.

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The Singapore Summit is organised by the Global-Asia Programme Office, an inter-agency initiative, co-led by the Singapore Economic Development Board (EDB) and the Monetary Authority of Singapore (MAS) and in collaboration with the Ministry of Trade & Industry, Ministry of Finance, The Government of Singapore Investment Corporation and Temasek Holdings. For more info, visit www.singaporesummit.sg.

Energy For Jobs

—Manoj Harjani and Lee Chor Pharn

What the whole world wants is a good job,[1] and creating good jobs is becoming a matter of survival for many governments. Despite this, several countries are failing to acquire the energy needed—whether as a resource to raise competitiveness or as political will for reforms—to create these jobs because of convenient myths. One myth is that emerging market demand, driven by the new middle classes, is sufficient to reel in investment and job creation. Another myth is that developed markets can overcome sluggish demand with cheaper energy to lower production costs and spur re-shoring and job creation.

The first myth assumes new middle classes are a one-direction, positive driving force for growth. This glosses over how the same new middle classes are increasingly asserting their self interests to derail much needed institutional reform. In Thailand, the latest round of uncertainty in Bangkok is partly driven by an assertive urban middle class with interests diverging from their rural countrymen. In response, Japanese investors are diverting new investments to neighboring Myanmar and Vietnam.[2] This is complicating Thailand's efforts to break out of the middle-income trap,[3] as Japanese FDI has been a significant driver of growth for Thailand. Similar dynamics are also at play elsewhere in Southeast Asia, and *"S.E.A. shifts ahead"* explores how the middle classes may ironically hinder economies from overcoming the middle income trap.

The second myth assumes cheaper energy is sufficient to re-shore jobs in developed markets like the USA. This may divert attention from more meaningful reforms. In fact, lower energy prices form a minor consideration for re-shoring—explored in *"USA manufacturing renaissance, is it for real?"*—as companies look more closely at other factors like domestic demand prospects. The fixation over cheaper energy is also seen in other developed markets. In Japan, Prime Minister Abe has yet to fire his third and most crucial arrow of structural reform.[4] Nevertheless, he has reversed the "zero nuclear policy"[5] even though there are no guarantees that lower energy costs and the first two arrows are sufficient to shift economic momentum. The discovery of deep sea methane hydrates[6] off the coast of Japan may further distract or delay reforms.

In some economies, conditions may be ripe for a game-changing alignment of political reform and resource energy. India's Modi-Rajan team, both men of action, is expected to deliver a one-two policy punch in favor of reform and growth. If they can also stabilize politics and regulations to iron out production problems in India's largest oil and gas fields,[7] an energy-rich India will be set on a good trajectory of growth with Chinese characteristics.[8]

Jobs are on everyone's mind, but not everyone is aware how jobs themselves will change. Data and deep human expertise, and not cheaper energy or new middle classes alone, will underpin future jobs as tomorrow's manufacturing ecosystems become embedded with "digital DNA", robotics, and autonomous vehicles. The human capabilities[9] required for running this "Industrial Internet" in tomorrow's factories, mines, ports and warehouses will be scarce and highly renumerated. We can already observe how robotics adoption is taking off in China's Jiangsu province and Pearl River Delta megacities, following the path of South Korea and Japan. Policy planners need to look past convenient myths and move quickly to ensure open access to data and investments in deep human expertise, or risk watching tomorrow's jobs emerge elsewhere.

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S.E.A. SHIFTS AHEAD

— *Tiana Desker & Lawrence Wong*

Over the next decade, a new wave of dynamic regional cities and home-grown MNCs with global ambitions are likely to emerge in South-East Asia (S.E.A.). Against this backdrop of increased prosperity and competition, a more assertive S.E.A. middle class may inadvertently hold back some S.E.A. economies from breaking out of the middle income trap. →

Figure 1: Southeast Asia's 50 "Challengers" (Source: BCG Analysis)

Dynamic Cities

While Bangkok, Jakarta, and Kuala Lumpur are expected to join Singapore in the club of "high income" S.E.A. cities by 2025[1], Bangkok is also likely to contend for regional capital status with Singapore. Currently, Bangkok is already the de facto capital of the Greater Mekong Sub-Region (an area of some 320 million people)[2] and the Greater Bangkok area is a global manufacturing base centred on the automotive industry.[3] Looking ahead, Bangkok's location as a key node in new mainland ASEAN transport networks—the Kunming-Bangkok high-speed rail to be completed by 2018[4] and a planned 3,200 km highway linking India through Myanmar to Thailand[5]—may concentrate even more economic activity into Bangkok as network effects kick in. Breakout mid-tier cities like Penang[6] and Bandung[7] could also surprise on the upside for growth and investment.

Global Ambitions

BCG identified 50 "challengers" from S.E.A.—companies that have at least US$500 million in annual sales, are fast growing and profitable *[see Figure 1]*.[8] While many of the "challengers" are unsurprisingly in resources and consumer goods, a few are in high-end service industries (e.g. Aviation - Air Asia,[9] Banking - CIMB[10]).

Middle Class, Middle Income Trap

However, the path ahead is not necessarily as rosy. Historically, economies that pursued sustained institutional reform[11] moved up the value-chain, and were able to break out of the middle-income trap. Much will depend on whether the growing middle classes become a driver or a derailer of institutional reform.

One possibility is that a more activist middle class demands greater accountability from governments and businesses e.g. Malaysia's middle class marched in support of the Bersih 2.0 demonstrations to demand electoral reform[12] and Indonesia's social media-equipped citizens have tweeted evidence of the luxurious lifestyles of bureaucrats and lawmakers.[13] But this is not the same as institutional reform. In much of S.E.A., the middle classes avoid relying on government services by "opting out" of public education and healthcare, and saving for private schools and hospitals. Instead of demanding access to clean water and a reliable power supply, the middle class family buys bottled water and purchases a generator.[14] In effect, rather than demanding better public services and more effective governance, the middle class retreats into their own enclaves. In some cases, the middle classes actively oppose reforms e.g. the Indonesian government spends 25% of its annual budget on fuel subsidies, because that segment of the population affluent enough to own motor vehicles has strongly resisted attempts to remove them.[15] In this case, the middle class acts as an interest group defending the privileges of the more wealthy, and recruiting the poor as paid demonstrators for the cause.

The rise of an assertive urban middle class can lead to greater conflict, as their interests diverge from rural voters. The contest of rural-urban, low-middle incomes being played out prominently in the streets and courtrooms of Thailand since 2005[16], also evident in voting patterns in other parts of S.E.A., reveals the divergence in political attitudes[17] and challenges to social cohesion. For S.E.A. states trying to leap the middle income trap and follow the trajectory that economies like Korea took to become mature, tech-based economies, the journey is likely to get harder before it gets easier.

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USA MANUFACTURING RENAISSANCE, IS IT FOR REAL?

— Chua Seow How & Lee Chor Pharn

There is much hype in popular media on the reshoring of manufacturing activities back to the USA as it turns into a "low-cost country[1]". This hope is premised mostly on cheap domestic energy[2] and rising Chinese labour costs eroding China's cost advantages, and assumes labour and energy costs are important reshoring drivers[3].

American manufacturers offshored activities over the past two decades in response to cheaper labour costs. However, the momentum has ebbed considerably with increasing automation and an increasingly competitive domestic workforce. The tailing off of offshoring however, does not indicate reshoring despite high profile announcements like electric car manufacturer Tesla's "Giga" car battery plant, Apple's MacPro production in Austin etc.

In a survey[4] on how companies plan their global manufacturing footprints over the medium term, labour and energy prices were minor[5] considerations for US manufacturers to consider reshoring, with the natural exception of energy—intensive sectors such as Chemicals. Companies prized two factors significantly above others:

Improved USA Growth Prospects:

Improved domestic demand outlook is a major factor for increasing USA capital expenditure. However, this is not likely to come at the expense of high growth markets. Over two-thirds of global manufacturing locate close[6] to demand. This is why manufacturing output and employment is expanding in markets like China even as wages or energy prices grow rapidly. The survey showed that companies are holding USA capital expenditure allocations on an even keel, while increasing capital expenditure in China/ emerging markets over the USA.

Lower Corporate Taxes:

The USA has the highest[7] corporate tax rate among all major manufacturing regions and this is widely viewed as a major barrier to increasing capital expenditure. However, tax reform is unlikely to happen in the near term, given mid-term elections in 2014.

Should both factors be met in the future, a true US manufacturing renaissance may occur, with selected sectors[8] more likely to significantly expand their U.S. manufacturing capacity. Hypothetically, who would benefit most if there is a manufacturing renaissance? With a well-educated, bilingual workforce, proximity to the USA market and cheap (USA) energy, Mexico is likely to benefit the most by default. Recent energy reform in Mexico opening oil and gas drilling to private (and perhaps mostly USA) investment will likely intensify already close integration of both economies[9].

Cheap energy will likely come to the fore of future national competitiveness discussions in developed nations e.g. Energiewende 2.0[10] in Germany and deep sea methane[11] hydrates in Japan. Just as in the case of shale gas in the USA, it would be useful to unpack the accompanying hype to tease out deeper dynamics that may lead to a true manufacturing renaissance.

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TECHNOLOGY: Once The Rebel, Now The Establishment

— Lee Chor Pharn

Foresight is less about making predictions, than about identifying the dynamics of change i.e. explaining "why X can happen" is more valuable than "X will happen". One danger is to get locked into a reliance on comforting, familiar explanations of the future using "stock" dynamics of change to discern what might lie ahead.

Technology foresight is a good example. The "stock" dynamics of Moore's Law and the Gartner hype cycle are familiar, linking through to an accepted list of future technological breakthroughs such as robotics, AI, 3D printing etc. However, technology foresight arguably does not take into account social-cultural-political dynamics and is much weaker for this.

Let us explain. Silicon Valley has always celebrated its counter-culture "damn the establishment" roots. The sector is unique in that it relies on not merely consumer trust but consumer faith that rebelling against the status quo will bring rewards. But there is growing recognition that the tech sector also has a conventional side—maximising profits—and this means working with and not against the government. Consumer trust has been shaken with Snowden's revelations that technology companies enabled excessive government surveillance. For business models built on monetizing data that consumers freely supply, losing both trust and faith can be the kiss of death.

For example in "*Digital Conglomerates*", we see how China's digital giant Alibaba monetises consumer data to know, perhaps more than anyone else, about the spending habits and creditworthiness of the Chinese middle class, and millions of Chinese merchants. Alibaba's real-time consumer database is superior to the central bank's credit information system which only stores borrowers' credit records for the previous five years Google's NEST acquisition allows it to have intimate knowledge of home-usage data—was there a home fire, a carbon monoxide leak, did your pipes freeze, how many times did the power go out—answers that we may not volunteer but a data driven industry like insurance would love to use to advantage. This knowledge makes Google a kingmaker in the insurance industry. In effect, digital giants are turning into central (data) banks for tomorrow's economy.

There is more. Data is about to explode when the unconnected, numbering four billion globally, go online in the decade or two ahead. Because of persistent poor national connectivity, they may go online via the technology establishment rather than Internet providers, or through special deals that prioritise and subsidise data delivery. Project Loon, Google X's aim to deliver wireless broadband worldwide with balloons, is a weak signal of this future. Another untapped source of data is the illiterate. In India, millions of illiterate will go online for the first time through video instead of text on a nation-wide 4G network, each identified with a unique biometric-based ID system. This is a great resource for Google translate and its AI

acquisition Deepmind, or whoever succeeds, to dominate the illiterate Internet.

The implications just described are not the crowning achievements of the digital age. They are the warm-up acts. In the articles *"Making Manufacturing Stick"*, *"Emerging Drone Economy"*, *"Automation of Knowledge Work"*, we learn how machines and algorithms may alter the nature of jobs tomorrow. The emergence of a small percentage of "cognitive elites" or human-machine/machine learning teams that are well remunerated with good job security; versus the majority "cogs" who face a much more uncertain future, will intensify social-cultural-political angst against the technology establishment.

As everyday life becomes more impacted by lines of code made by the technology establishment, rather than lines of regulation or law by nations, the angst could well turn into anger. We see weak signals of this incipient rage against the technology establishment, and by extension the technology elite, in the Occupy Silicon Valley movement in San Francisco today. It does not help that the technology elite talk of having their own "cloud country". Peter Thiel funds Seasteading Institute that plans to setup an autonomous, unregulated floating platform in the Pacific Ocean to serve as a quasi-independent economic hub for technology companies; Tim Draper proposes to make Silicon Valley its own state; and Balaji Srinivasan has a vision of Silicon Valley's "ultimate exit" to a place free from messy politics where engineers can build a world "run by technology".

Technology CEOs may, sooner or later, join bankers and oil chiefs to be demonised publicly, but the digital age is not likely to reverse or halt just because consumer trust and faith in technology ends. In an unexpected twist, governments are becoming the prime movers of the digital age. State involvement in the Internet and key technology companies that aggregate consumer data is increasing for national security, law and order reasons etc. This pattern is clearest in the USA and China, and is an emerging national interest for Brazil, Germany etc. Technology companies will likely work ever closer with state interests in return for market access. By then, their transformation from rebel to establishment would be complete.

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MAKING MANUFACTURING STICK

— Eddie Choo

Manufacturing contributes around 20% of Singapore's economy, and employs about 20% of the workforce. Manufacturing sectors generally experience higher productivity growth, carry out more innovation and generate spillovers to other economic sectors[1]. An MTI paper noted that, "for every dollar of direct VA generated in manufacturing, there is a spillover of 27 cents in the other sectors of the economy[2]." Anecdotally, manufacturing is "stickier" than services during economic downswings as large capital investments in manufacturing facilities are far less easy to relocate than services outfits that consist primarily of people.

Additive manufacturing (AM) and robotics have been in the limelight as potentially disruptive technological developments that can change the nature of manufacturing. This primer explores how these developments could impact manufacturing in Singapore, through:
(i) making sectors more "sticky" and
(ii) supplementing a declining manufacturing workforce.

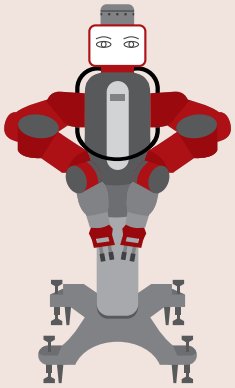
What Makes Additive Manufacturing And Robotics Developments Worth Watching?

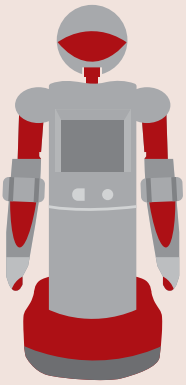
While AM and robotics have been around for decades, pundits have recently described them as heralding the "next industrial revolution". What has changed, according to a May 2013 McKinsey Disruptive Technologies[3] (DT) report is that, for robotics, a mixture of technological advances and declining costs has opened up new applications for robotics, making it now practical to substitute robotics for labour in more manufacturing and some services jobs. The same report is more restrained in assessing AM, noting that while the mixture of technological advances and declining costs could lead to AM proliferation, it could take years before impact is felt beyond a limited range of goods.

In DT, McKinsey described the possible impact of both AM and robotics. Of particular relevance to Singapore are the following: →

Sized applications of advanced robotics could have direct economic impact of US$1.7 Trillion to US$4.5 Trillion per year in 2025

Figure 1





Sized applications	Industrial Robots	Commercial Service Robots
Potential economic impact of sized applications in 2025 US$ trillion, annually	0.6 - 1.2	0.1 - 0.2
Estimated scope in 2025	355 million industrial workers	130 million service workers
Estimated potential reach in 2025	30-60 million full time equivalents of work potentially automatable	10-15 million full time equivalents of work potentially automatable
Potential productivity or value gains in 2025	75% potential improvement in productivity per unit of work automated	35-55% potential improvement in productivity per unit of work automated

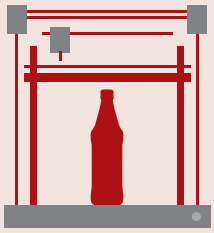
Figure 1 reflects the impact of industrial robots and commercial service robots. The report projects about US$1.4 trillion of global economic impact/year in 2025 with up to 75 million full-time equivalent (FTEs) of work replaced by industrial and commercial service robots, with 35 – 75% improvement in productivity. Compared to industrial robots that have been around for decades, commercial service robots are now increasingly applied in food preparation, healthcare, commercial cleaning, and logistics. Kiva, a robot that automates warehouse operations, is one example of a commercial service robot. The range of human activities that could be automated will likely increase with time.

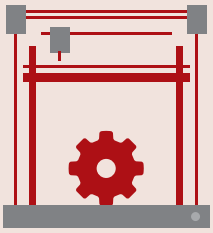
Figure 1:

Sized impact of advanced robotics (Source: Manyika et al. (2013). Disruptive technologies: Advances that will transform life, business, and the global economy. McKinsey Global Institute)

Sized applications of 3D printing could have direct economic impact of US$230 billion to US$550 billion per year in 2025

Figure 2





Sized applications	Direct Product Manufacturing	Tool and Mould Manufacturing
Potential economic impact of sized applications in 2025 US$ trillion, annually	100-200	30-50
Estimated scope in 2025	US$300 billion spending on complex, low-volume items such as implants and tools US$470 billion spending on complex, low-volume parts in transportation	US$360 million global marker for injection-moulded plastics
Estimated potential reach in 2025	30-50% of products in relevant categories replaceable with 3D printing	30-50% of injection-moulded plastics produced with 3D-printed moulds
Potential productivity or value gains in 2025	40-55% cost savings to buyers of 3D-printed products	30% production cost reduction using superior 3D-printed moulds

Figure 2 reflects the possible impact of AM to direct product manufacturing (complex, low volume, high value parts, mainly in medical and transport manufacturing industries) and, tool and mould manufacturing. The global impact of these two applications is estimated to be up to US$250 billion by 2025, with up to 50% of products replaceable by 3D printed products.

Figure 2:

Sized AM application and impact (Source: Manyika et al. (2013). Disruptive technologies: Advances that will transform life, business, and the global economy. McKinsey Global Institute)

Making Sectors "Sticky"

Our takeaway is that AM can speed up the innovation rate in industries, while robotics speeds up production for industries that depend on getting to the market for competitive advantage.

A scan for weak signals of the early adoption of AM and robotics by sectors and companies provides evidence for DT's suggestion that the combination of AM and robotics can cause sectors that produce high value goods to experience rapid innovation cycles and become more competitive. As a result, manufacturing activities which leverage AM and robotics can persist ("be more sticky") in the areas they are located. The aerospace, medical devices and retail/lifestyle goods industries could fall in this category. "Stickiness" of activities does not necessarily mean job "stickiness". Our scans also show that robots can now be used in many more sectors to automate tasks, which could render some human jobs redundant. These are in the food, logistics and general manufacturing industries.

Aerospace:
Robotics is already extensively used in aircraft production for heavy, repetitive tasks[4] such as drilling, painting, and inspection of cracks in the assembled structures. Given the rising demand for aircraft in response to the rise in air travel, use of robots is expected to increase in the manufacturing and maintenance of aircraft.[5] What is relatively new is that aerospace manufacturers like GE, Airbus and smaller companies are already experimenting with the use of AM techniques for engines and wings, and are starting to incorporate AM into existing production lines.[6, 7, 8] AM parts are already in use in the LEAP 1b engine, which is expected to power new versions of the Boeing 737.[9] In unmanned aerial vehicle (UAV) development, AM allows designers to learn quickly from their designs and iterate for another prototype. The high level of intrinsic knowledge has allowed early adopters to retain their competitive advantage by reducing development time by 60-75%, with cost reductions of 60-80%. [10, 11]

The continual improvements brought about by AM and robotics has enabled the major aerospace companies to retain dominance. With the aerospace industry growing, major companies are expanding in existing locations. Boeing is expanding facilities in South Carolina,[12] and is expected to employ 2000 additional jobs by 2020; General Electric Aviation is expanding facilities in Delaware to make components for the LEAP engines, adding another 70 jobs to the current 80.[13] The Delaware facility is meant to be a "Lean Lab"—a facility that bridges the development of new components and full-scale manufacturing.

Medical Devices:
AM is already widely used to produce[14] customized in-ear, orthopedic and dental implants. AM processes allow medical devices companies to reduce costs and speed up the innovation cycle through rapid prototyping. Robotics is being explored for precise applications and where contamination is a concern.[15] In principle, the rapid development of products, and the adoption of robotics can raise product quality in the medical devices industry. The incumbents in the orthopedic devices industry are adopting AM methods e.g. Biomet, an industry leader is collaborating with an AM orthopedic implant manufacturer.[16] The orthopedic devices industry continues to be centred in the US, with Warsaw in Indiana the established hub for orthopaedic companies.

Retail And Lifestyle Goods:
AM is increasingly used by the fashion/apparels industry players such as Adidas and Nike[17] for internal rapid prototyping purposes. Nike announced in April 2013 plans to expand their corporate HQ in Beaverton, Oregon;[18] Adidas has a new corporate HQ in Bavaria, Germany.[19] Nokia incorporates AM processes as part of its branding strategy for phones which are customizeable by consumers. Philips uses robotics for the delicate assembly processes for consumer products that humans cannot match.[20] A Philips spokesperson claims that with the robots, "we can make any consumer device in the world." In the fast-moving retail and lifestyle sector, the deployment of AM and robotics to speed up the innovation and production parts of the value chain could help companies achieve competitive advantage through faster product cycles and high-value low volume production.

Figure 3:

Kiva, the robot currently used to make warehouse operations more efficient. (Source: http://wonderfulengineering.com/amazon-uses-an-army-of-robot-workers-in-its-warehouse-to-fulfill-orders/

Figure 4:

A robotic arm flexible enough to pack fresh vegetables without damage. (Source: Packaging Europe. http://www.packagingeurope.com/images/news/adeptclampack.jpg)

W(h)ither Employment?

While AM and robotics may raise sectoral productivity, they might not create more jobs, as on a net basis more lower skilled jobs are likely to be replaced (by robotics) than higher skilled and better paying jobs created (e.g. for AM design or to integrate robotics in a production line). DT estimates that in developed economies, 15 to 25 percent of industrial jobs in manufacturing, packing, construction, maintenance and agriculture could be automated, assuming continual improvements in robotics. In developing economies, the proportion is likely to be about 5 to 15 percent owing to lower labour costs.

One industry that has seen a decline in employment from the deployment of robotics is the logistics industry. In warehousing, a robotic system installed by Kiva at Zappos (both companies have since been bought over by Amazon) saved energy and used less time to handle orders[21]. While AM is unlikely to be deployed directly by the logistics industry, it is expected to have a transformative effect on the industry, by shifting demand to the movement of materials instead of intermediate goods, and towards production for final demand.[22,23] A scenario examined by Deutsche Post DHL found that, if 3D printers were to become widespread, supply chains could become less geographically dispersed, and the long-distance movement of final and semi-final goods could drop sharply. The movement of raw materials becomes more important, as will last-mile logistics direct to urban areas where demand is concentrated. As an indication of a possible business model, UPS has started offering 3D printing services to small companies that are not able to afford their own printing facilities.

Industries such as food packaging and general manufacturing also have relatively routine processes currently undertaken by humans. Robotics is increasingly applied in packaging, in materials handling, handling delicate farm produce and processed foods, and large heavy objects. As an example, a robotic system installed at a vegetable packing facility at Earthbound Farms in California replaced 2-5 people for every system installed.[25]

Supplement A Declining Workforce

The use of robotics is relevant for countries experiencing demographic declines in the workforce. Countries such as Japan, Korea and Germany look set to expand the use of robotics beyond car-making, as smaller, easy-to-use robots such as Baxter (to be elaborated in a later section) are developed. The Industrial Federation of Robotics survey (February 2013) on the impact of industrial robots on employment found overall increased use of robots per 10,000 employees in all six countries monitored (China, Korea, Japan, USA, Brazil, Germany) from 2000 – 2011.[26] China's 12th Five-Year Plan includes robotics and automation →

as part of a push to develop "emerging strategic industries". While China has an abundance of labour, labour costs are rising and manufacturing activities may shift to neighbouring countries with even lower labour wages. It is early days still for robotics as an emerging strategic industry; manufacturer Shanghai-Fanuc, for example, sold 4000 robots in 2012, compared to the 3400 sold in 2011[27].

Germany's plans are more for process automation, not robotics. To further reinforce the leading positions of German SMEs, Germany's Ministry of Education and Research has embarked on an "Industry 4.0" plan. The aim is to create "smart factories", allowing every single product to be tracked through digital means, respond dynamically to demand changes, and increase resource productivity and efficiency[28].

South Korea and Japan already have high densities of robots, mainly for car manufacturing. The industrial robotics used has taken on humanoid appearances, such as the Nextage model of robots, employed for Glory—a manufacturer of cash registers[29]. The appearances reflect cultural norms more than technical reasons.

Made for SMEs

Developments in robotics are making the technology much more accessible to SMEs. Baxter is the first model in robotics that is low-cost (at US$22,000), able to co-work with humans without the need for a cage, and can be easily trained by workers without the need for difficult re-programming. Future versions will have better context-awareness: take in more information from the surroundings and respond to changes autonomously, further reducing the need for human intervention. Baxter represents an opportunity for SMEs to reduce their dependence on low-cost labour, increase throughput and improve product quality. A toy company in the US using Baxter was able to reshore a part of the manufacturing back to the US, to better meet the demands of US consumers[30]. The company hopes that more advanced versions of Baxter will allow them to move more operations back to the US. While this helps SMEs against lower-cost new competitors, it potentially results in fewer jobs on a net basis.

Implications For Singapore

Both AM and robotics can contribute to "stickiness" of existing aerospace, medical devices and retail/lifestyle manufacturing activities in Singapore. There may be fewer jobs created as routine jobs are automated away, but the shift will be towards the creation of higher skilled PMET jobs. From our scans, the access to AM and robotics related skills is instrumental in increasing "stickiness" of these manufacturing activities. While a more detailed skill mapping is needed, these skill sets appear adjacent to current skills in design and engineering. For example, engineers today already learn 3D modelling and related simulation software. Along with conventional

Figure 5:

Use of humanoid robots (made by Kawada Industries) on the assembly line of Glory, based in Japan - a maker of cash registers. (Source: Financial Times url: http://ftalphaville.ft.com/2013/04/10/1456222/robots-china-and-demographics/)

Figure 6:

Baxter assembling parts in a factory. (Source: http://www.farmpd.com/product-development-projectst/rethink-robotics-2/)

skills in working with materials, the current skills of engineers are translatable to AM processes.

With the impending retirement of a large number of lower-skilled workers in manufacturing, and the need to create higher skilled PMET jobs to match the changing educational profile of the workforce, widespread uptake of robotics for SMEs through a national wide initiative (much like the former National Computer Board promoted computerisation) may enable Singapore to compete in manufacturing despite a declining workforce.

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THE EMERGING DRONE ECONOMY

— Cheong Kai Jian and Ong Hao Yi

About To Take Off

Land, air and sea autonomous vehicles (AV) are moving firmly from their military roots to enter commercial use. For land, autonomous cars are furthest along regulatory acceptance and may disrupt the traditional auto industry by shifting the value of cars from hardware to software. For air, while major corporations like Amazon are eager to use aerial drones to improve delivery service,[1] the absence of a regulatory framework is holding back take-off. For sea, plans for drone cargo ships are meeting resistance from international marine organisations.[2] This scan scopes the emerging drone economy, though given the different stages of industry acceptance it focuses slightly more on land AVs. Future scans will explore the types of jobs displaced by drones, and new good human jobs created by the drone economy.

The commercial aerial AV landscape today does not have large, established industry players and is fragmented into start-ups and hobbyists. Nonetheless, aerial drones have the most (and sometimes undesirable) media coverage due to military aerial drones. The economic impact of aerial AVs for USA airspace is estimated at USD$13.6 billion in the first three years of integration[3] with precision agriculture and first response service sectors benefiting the most. While regulations now hold back widespread commercial use of aerial AVs[4] there are surprisingly strong efforts, from major IT industry players such as Amazon, Google and Facebook to push for commercial drone use *(see Box 1 for Google's acquisition of drone start-up Titan Aerospace)*. Once the Federal Aviation Authority rolls out aerial AV rules by 2018,[5] these digital giants are expected to spread the reach of their own network for omnipresence worldwide, even in remote areas. However, unless prevailing consumer unease[6] over privacy concerns are addressed, the aerial AV sector is not likely to reach full potential.

The commercial sea AV landscape by comparison has less media coverage with the notable exception of Rolls-Royce's plans for trans-continental drone ships *(see Box 2)*. Drone ships can cause significant disruptions in the shipping industry via a drastic reduction in crew numbers and supporting services for ships as they call into port. However, the International Chamber of Shipping is sceptical that crewless ships can operate away from land for a long period of time. If regulations do not change, drone ships will not meet minimum crew requirements and will be considered illegal and hence not covered by insurance[7]. Until then, the disruptive potential of drone ships remains untapped. Aside from drone ships, other sea AVs are mainly underwater drones used for sea-bed survey in the oil and gas sector, ocean monitoring for research and wreckage recovery for air crash investigations.

Compared to air and sea AVs, commercial land AVs have began to actively address liability concerns. Several US states already allow the use of autonomous cars on public roads for research purposes. California in particular is expected to pass laws and provide a framework for public use of autonomous cars by end 2014 that may set a national standard. In anticipation, automakers Audi, Mercedes and Nissan are embarking on next generation autonomous car systems with interim market launches of partially autonomous cars. Closer to home, MIT researchers are test-bedding a small fleet of AVs in Singapore within confined environments such as industrial parks and university campuses. The researchers have also concluded in a study[8] that a fleet of autonomous cars at one-third the size of Singapore's current fleet of vehicles will be sufficient to meet the country's current transport demands.

While it may be reasonable to assume land AVs may remain as a developed market phenomenon because of the communications infrastructure

Box 1: Titan Aerospace

Titan Aerospace is a start up founded in 2012 that makes high altitude drones capable of cruise near the edge of earth's atmosphere. This enables the globe to be covered with cheap, omnipresent, Internet connectivity and helps bring remote areas online. Google's acquisition of Titan is expected to spread Google's potential reach and network. This is similar to Google's other well-known project±Project Loon—a balloon-based remote Internet delivery project. Titan's drones can also take high-quality images in real-time that will help with Google Maps initiatives.

Source:

Etherington, Darrel. "Google Acquires Titan Aerospace, The Drone Company Pursued By Facebook." TechCrunch, April 14, 2014

Box 2: Rolls-Royce's Drone Cargo Ships

Rolls-Royce's Blue Ocean development team has set up a virtual-reality prototype at its office in Alesund, Norway. It simulates 360-degree views from a ship's bridge. The goal is to eventually allow ship captains to use such control centres on land and command multiple crewless ships plying the sea lanes. According to Oskar Levander, the company's VP of innovation in marine engineering and technology, the absence of a physical bridge on a ship means more cargo space and lower costs to boost revenue. The ships would be 5% lighter before loading and burn 12-15% less fuel.

Rolls Royce remains optimistic that the transition will happen gradually as computers increase their role in navigation and operations, and conservative ship owners will need to embrace the change eventually.

Source:

Amsdorf, Isaac. "Rolls-Royce Drone Ships Challenge $375 Billion Industry: Freight." Bloomberg, February 26, 2014

required e.g. vehicle-to-vehicle communication, some emerging markets like China are starting to lead in adopting AVs.[9] The National University of Defense Technology created an AV that completed a 154-mile journey from Changsha to Wuhan in over three hours, navigating its way on the expressway with other human-driven cars. Compared to developed markets, emerging markets have fewer legal and government constraints to hold back AV rollout. More importantly, as almost all the growth in global car sales in the next decade is expected to be in emerging markets, the roads and telecoms networks that are being rolled out in the coming years will be better than those in developed markets and support the adoption of AVs.

The Auto Industry Shifts Gears

What is the timeline for autonomous car adoption? One optimistic projection is for autonomous driving in limited conditions to be available by 2018, and fully autonomous driving by 2023. Such a timeline seems highly feasible as the technology for limited autonomous cars will be available for the upcoming 2014 Mercedes Benz S-class, and prototypes for fully autonomous cars already exist today.[10] With increasing adoption, the auto industry may see two paradigm shifts: →

01

Value Shifts From Hardware To Software

Today, hardware forms 90% share of a car's value but this share is expected to drop to 40% for autonomous cars. Software's share rises from 10% to 40% *(Figure D)*. This is because, unlike today's cars, autonomous cars will operate off an operating system to be able to fully function without human direction. This opens up opportunities for either existing auto makers like GM, or external vendors like Apple and Google that have more experience with operating systems, to enter the industry. The analogy with the personal computer industry, where hardware comes installed with different operating systems, comes close to describing future arrangements where different automakers' cars may come with pre-installed operating systems from different vendors.

02

Content's Share Of Value Will Rise

Autonomous car occupants, freed from the need to direct driving, are the focus of a new revenue model to sell them content. The analogy is close to that for the current smart phone industry where the revenue source has shifted from selling the hardware to the stream of content offerings the consumer buys and downloads e.g. Apple's iTunes platform for apps, videos, books, music etc. Automakers are generally aware of both the new revenue opportunity from selling content (sized to be about 20% of the value of an autonomous car), and the competitive advantages of controlling an integrated, high quality driving experience replicating Apple's control of hardware-operating system-software-content. This allows them to charge premiums over what is a very price-sensitive industry.

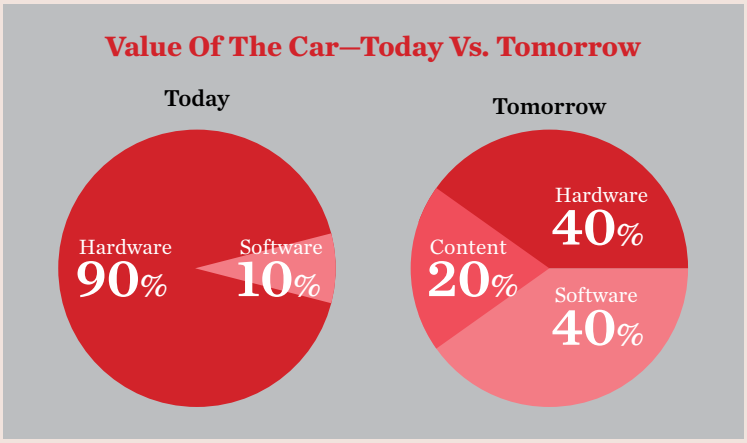

Figure D:

Morgan Stanley Blue Paper: Autonomous Vehicles, Self-Driving the New Auto Industry Paradigm, Nov 2013

Is there an "Apple" equivalent contender for autonomous cars? Silicon Valley-based Tesla Motors is emerging as a strong front runner building on their hardware and software successes in rolling out electric vehicles (EV). The system upgrades are done with over-the-air software updates (just like smart phones), and the vehicles are supported by an uninterrupted chain of charging stations across the USA. These successes have led to speculation that it will be relatively easy for Tesla to make the transition to AVs[11] with inherent advantages to controlling an integrated hardware-software-operating-system that few automakers today can challenge. *(see Box 3)*

It is useful to contrast Tesla with a similar spectacular technology startup in 2009 known as Better Place. Better Place was the toast of the startup world, and promised millions of EVs sold, all supported by an EV charging network.[12] Better Place had problems with runaway costs and getting consumers to embrace this new technology among other issues. The company filed for bankruptcy in 2013. Tesla appears to be on more sustainable ground, delivering its 25,000th car and managing a hundred charger stations across the USA and Europe.

Box 3: Tesla Motors Versus Traditional Auto OEMs

Several established auto makers have committed significant resources to autonomous cars:

- *Audi was one of the first OEMs to obtain a licence for an AV for its driverless A7 prototype;*
- *Mercedes-Benz will become the first OEM to commercialise a semi-autonomous car with its 2014 S-Class;*
- *Toyota was the first OEM to commercialise hands-free parking in 2007 with its Lexus-S, and has a small fleet of autonomous prototypes such as the RX450h;*
- *Nissan has the most concrete and aggressive AV rollout plan; with a 2020 target to deliver the first "commercially viable self-driving system" at a "realistic price".*

When compared to traditional auto makers, Tesla's advantage lies in having a closed ecosystem approach—meaning almost absolute control over every aspect of the product from design and engineering to direct sales. This is similar to Apple's closed ecosystem approach for its smartphone category, which helped it succeed in consumer adoption for early stages of a new product category—like autonomous cars—where many elements, like industry standards, are uncertain.

Source:

Morgan Stanley Blue Paper on Autonomous Vehicles.

What's next?

The weak signals for autonomous cars suggest that new jobs in autonomous car software-operating system-content are likely to be created in the next few years. As regulations for AVs become clearer to encourage commercialisation, we will provide an update on the types of jobs that will be created by the emerging drone economy. To end off, we would like to share with you a fun look into the emerging drone economy prepared by our intern Haoyi in the accompanying illustration.

⊣

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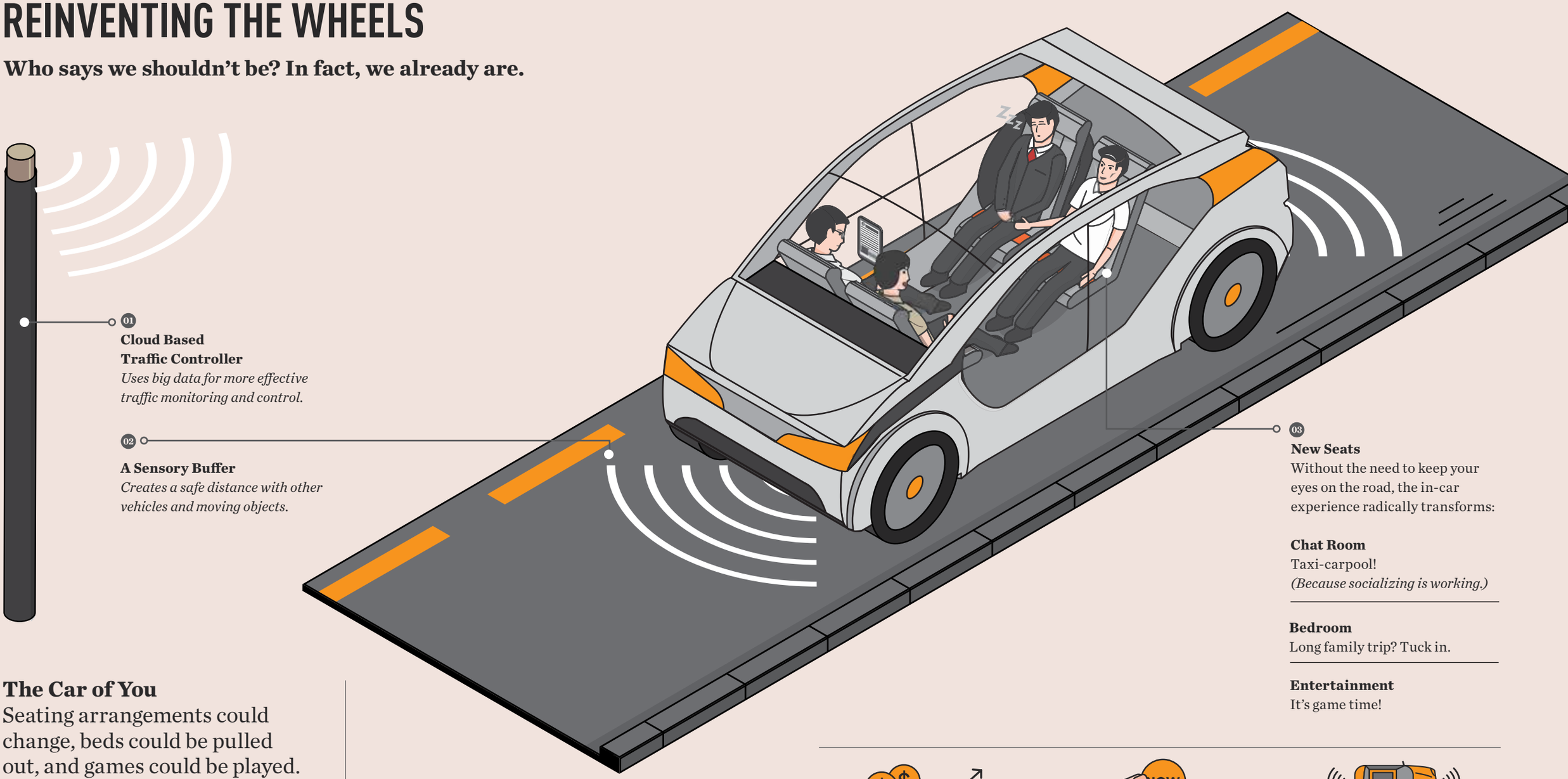
REINVENTING THE WHEELS

Who says we shouldn't be? In fact, we already are.



01
Cloud Based Traffic Controller
Uses big data for more effective traffic monitoring and control.

02
A Sensory Buffer
Creates a safe distance with other vehicles and moving objects.

03
New Seats
Without the need to keep your eyes on the road, the in-car experience radically transforms:

Chat Room
Taxi-carpool!
(Because socializing is working.)

Bedroom
Long family trip? Tuck in.

Entertainment
It's game time!

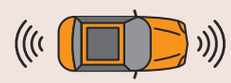
The Car of You

Seating arrangements could change, beds could be pulled out, and games could be played. But with hyper-efficient public transport and self-driving taxi fleets replacing the need of owning cars, how can mobility remain personal and emotional? [01]

– 01
Inspired by Chris Bangle's session on Personal Emotional Mobility at the Icsid World Design Congress held in Singapore in 2009.

An Expensive Venture
Driving is heavily taxed to reduce human-caused traffic inefficiencies. Only the rich can afford cars.

Carpool On-Demand
Clever algorithms dynamically route vehicles to pick passengers up and drop them off based on optimized routes.

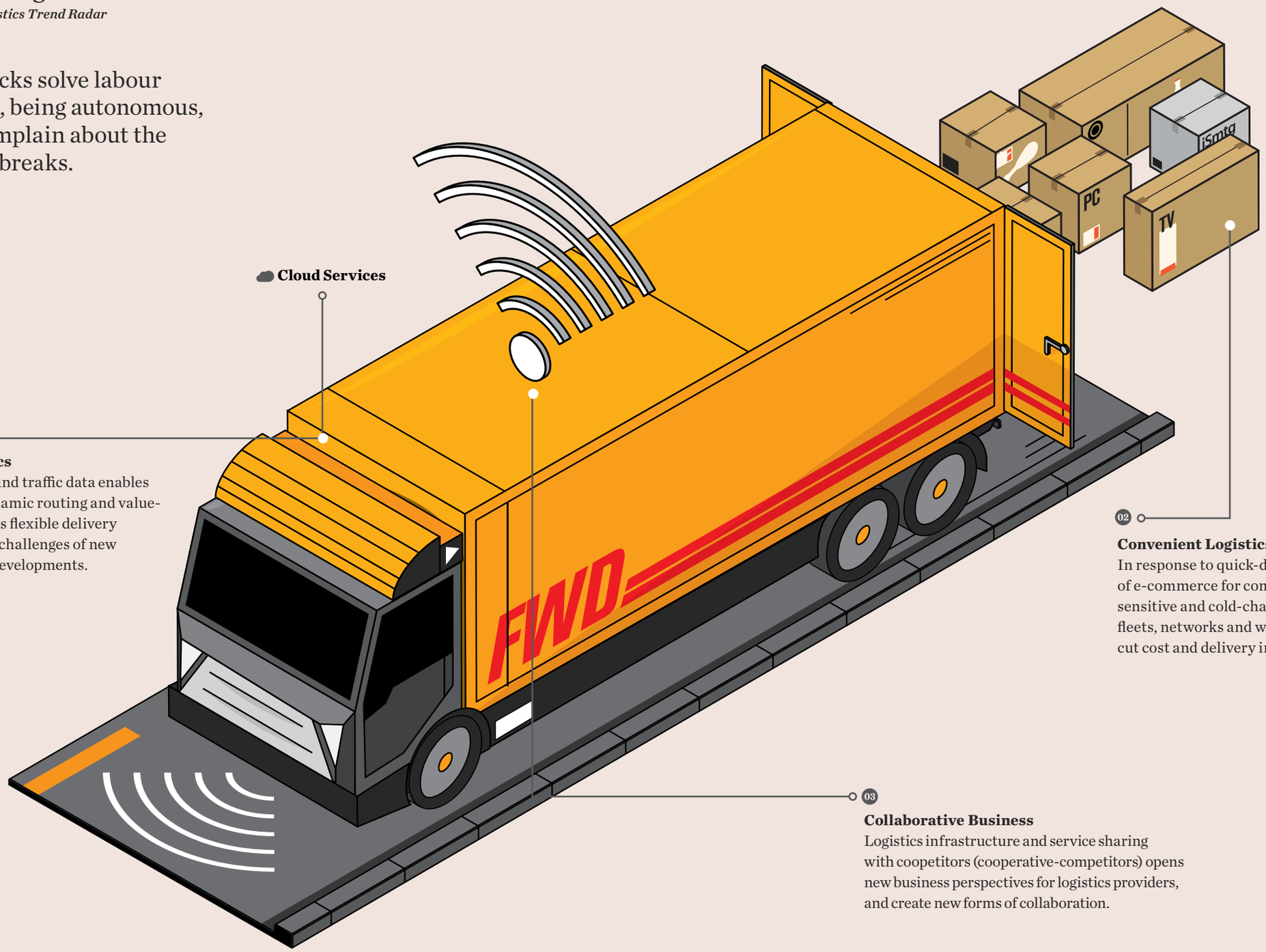


No More Road Rage
Communicating autonomous cars could increase road efficiencies by 273%, according to Columbia University.

Autonomous Logistics

Inspired by DHL's Logistics Trend Radar

Driverless trucks solve labour shortages and, being autonomous, they never complain about the lack of smoke breaks.



01

Next-Gen Telematics
Real-time shipment and traffic data enables new solutions for dynamic routing and value-added services such as flexible delivery offerings to meet the challenges of new business and urban developments.

02

Convenient Logistics
In response to quick-delivery requirements of e-commerce for commodity goods like sensitive and cold-chain products, automated fleets, networks and warehouses could cut cost and delivery inefficiencies.

03

Collaborative Business
Logistics infrastructure and service sharing with coopetitors (cooperative-competitors) opens new business perspectives for logistics providers, and create new forms of collaboration.

THE DRONES ARE COMING TO YOUR HOME

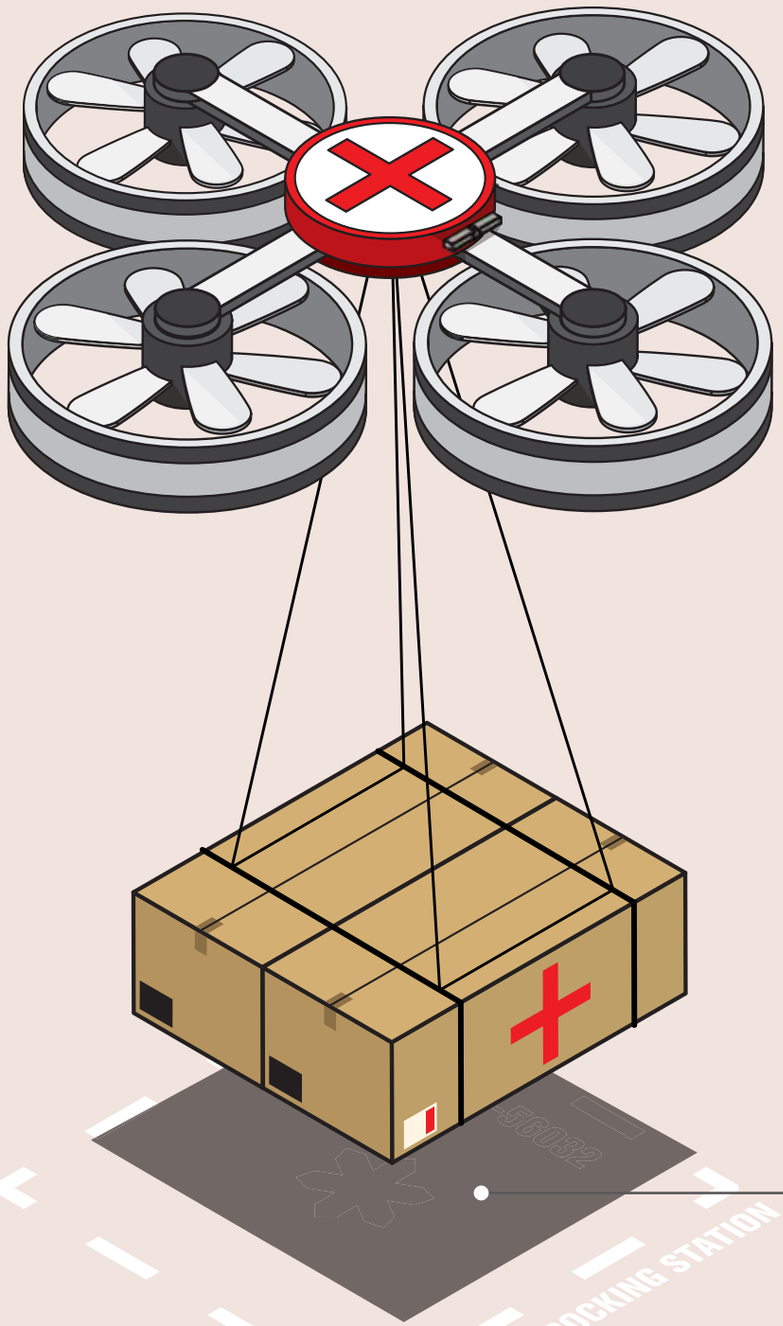
And you'll be glad they did

Matternet
Imagine a world where quad-copters fly the skies, delivering packages like hardworking bees collecting honey back to their hives. Leapfrogging traditional infrastructure, Matternet is a physical emulation of the Internet—an effort to create a world connected not by wires but tiny drones.

MATTERNET FIELD TESTS WERE SUCCESSFUL IN HAITI AND THE DOMINICAN REPUBLIC

In developed countries, such drones could replace the aging postal system and solve last- mile delivery needs for e-commerce companies; in developing countries, they could connect rural communities to markets, alleviating poverty and delivering badly needed supplies and medicines.

Open Skies
Despite the promise of Matternet, the idea has faced difficulties when it comes to aviation regulations. That said, even in the U.S., where commercial drone flights are strictly regulated, the Senate has mandated the opening of skies to systems like the Matternet by September 2015.

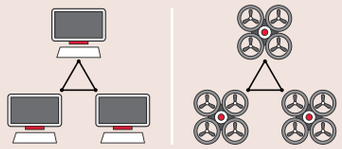


01

Matternet Docking Station
Wireless charging dock and package center all rolled into one

PEER TO PEER

Like how the internet sends bits from terminal to terminal in a peer-to peer (P2P) fashion, the Matternet sends packages from person to person.



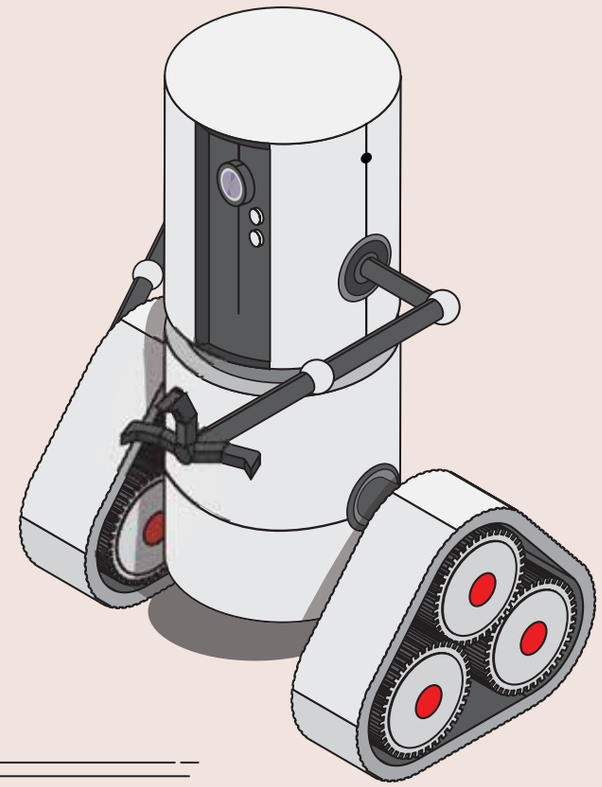
P2P physical distribution network revolutionizes small parcel delivery. Its potential, like the Internet's, is limitless.

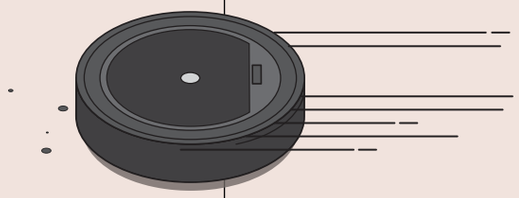
ROAD VS. DRONE

The traditional infrastructure by building single lane roads will cost US$1,000,000 for mere 2km. Using drones will cost US$900,000 for 150 drones and 50 recharging stations that can cover up to 140 km

2 KM	140 KM
$ 1,000,000	$ 900,000

Robotic Companionship
An intersection of medicine and engineering, domestic and therapeutic robots help society cope with elderly-care.



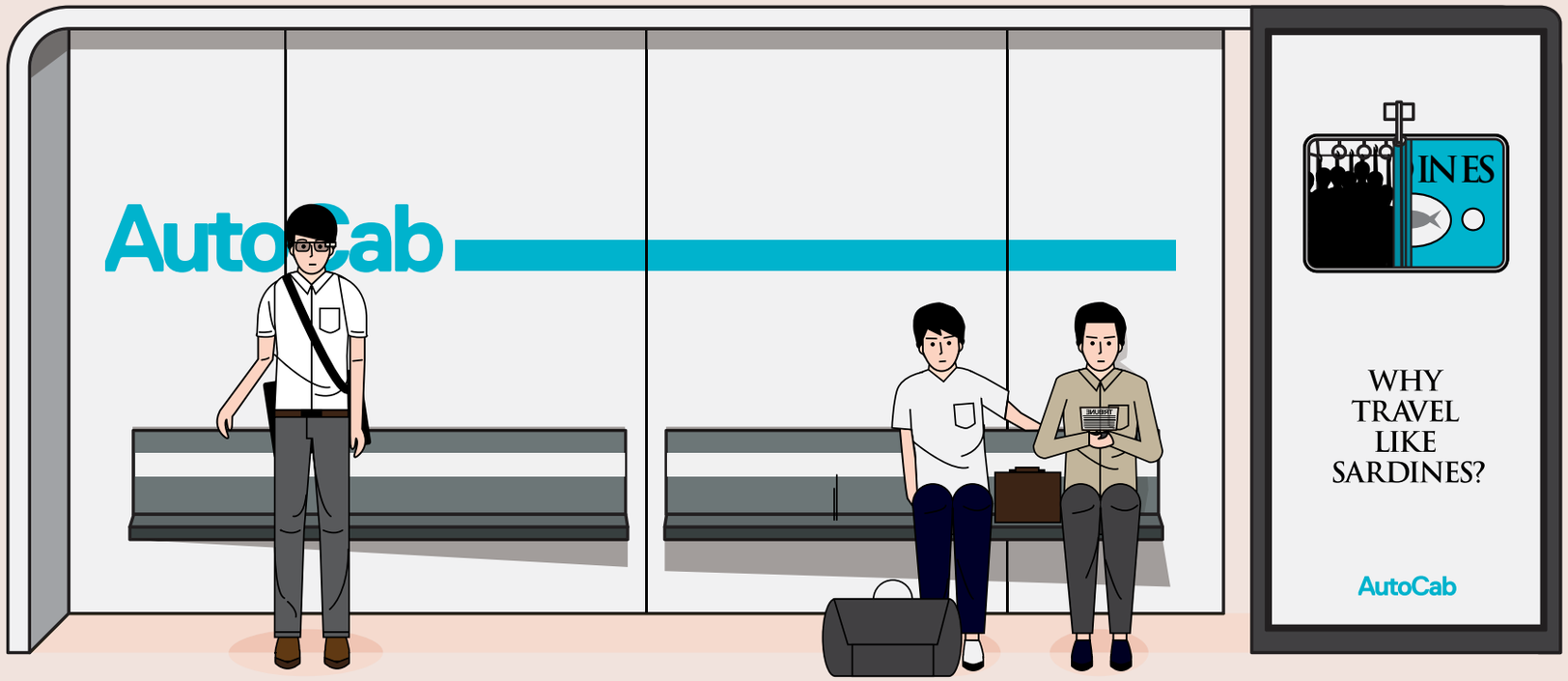


ROOM TO GROW

Autonomous System + Shareconomy = Urban (R)evolution

Death Of Buses
Current bus systems are designed to economize on one of their most expensive components: the human driver. Contemporary buses are enormous and run infrequently. At off-peak times, they are almost empty. Buses that drive themselves will be dramatically cheaper to operate, which means that we'll be able to afford many more of them. For example, engineers at Oxford aim to deliver an add-on self-driving system that costs US$150.

Indeed, it's not clear that the concept of a bus will even make sense in a self-driving world. More likely, when you order a self-driving taxi with your smartphone, you will be offered several options. You might be offered a private taxi for US$5, a taxi shared with one other person for US$3, or a carpool van with several other people for US$1. With these low-cost options available, bringing you to where exactly where you want without extra walking, it's not clear anyone would want to ride a bus.



SHARECONOMY

The Future Is Sharing
Why own when you can share? Enabled by online technology, infrastructure and service sharing between businesses and consumers save costs and time, preserve the environment, and allow access to products and services which are expensive to own or are used infrequently. In fact, sharing cars could cost up to 80% less than owning one.

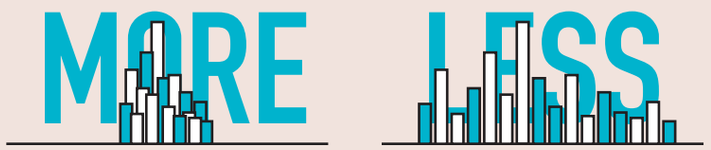
Sharing Culture: In Enlightened Self-Interest.
Self-guided vehicles need to be part of a larger shared infrastructure. Only if cars are networked can their routes be optimized by a dynamic routing algorithm and the roads efficiently utilized. Without pooling our cars together, we're merely replacing human drivers with machines—the traffic jams won't go away.

Urban Selves
With less cars and denser roads through car-sharing and shorter inter-driverless car distances, walk spaces can be widened. Well-designed spaces, such as steps for informal seating, support social and cultural life.

DE-CLUSTERING

Towards Less Density
Cheap self-driving taxis reduce the incentive of building urban clusters centered around transit hubs and stations (e.g. MRT).

Property prices become less dependent on the availability of last generation public transport, allowing the development of a less dense city.



Eye In The Sky
Skybox Imaging is deploying a fleet of mini-satellites to provide high frequency, high definition satellite images that enhances AV

Self-Driving Taxis
As a utility, it kills traditional taxi businesses and car ownership.

Licensed To Thrill
Test driving autonomous cars is possible in Nevada, Florida, California and Washington D.C. Another 15 U.S. States and cities have bills in process.

Lane Separation
Auto-cars can drive anywhere, but accident-prone human-drivers are relegated to the slow lanes. *Bum-per.*

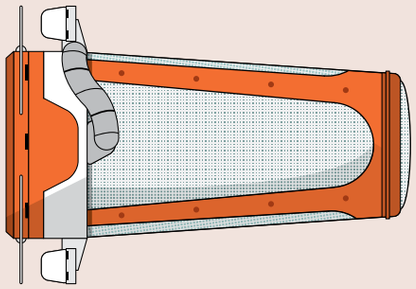
RelayRides
RelayRides is a car-sharing platform for owners to rent out their vehicles when they're not being used. Owners install a device that conveniently and safely allows any consumer that has booked the car to drive it.

MAKING A SPLASH

A People-Less Industrial Revolution?

Of Nodes and Swarms
It is often costly and complex to send large numbers of human-operated ships and submarines to forward operating areas. The energy and logistics needed to deploy manned systems over large distances limit the amount of work that can be done on and in the sea. Following the naval concept of deploying a mothership supported by swarms of self-guided drones, autonomous marine systems could solve some of these problems.

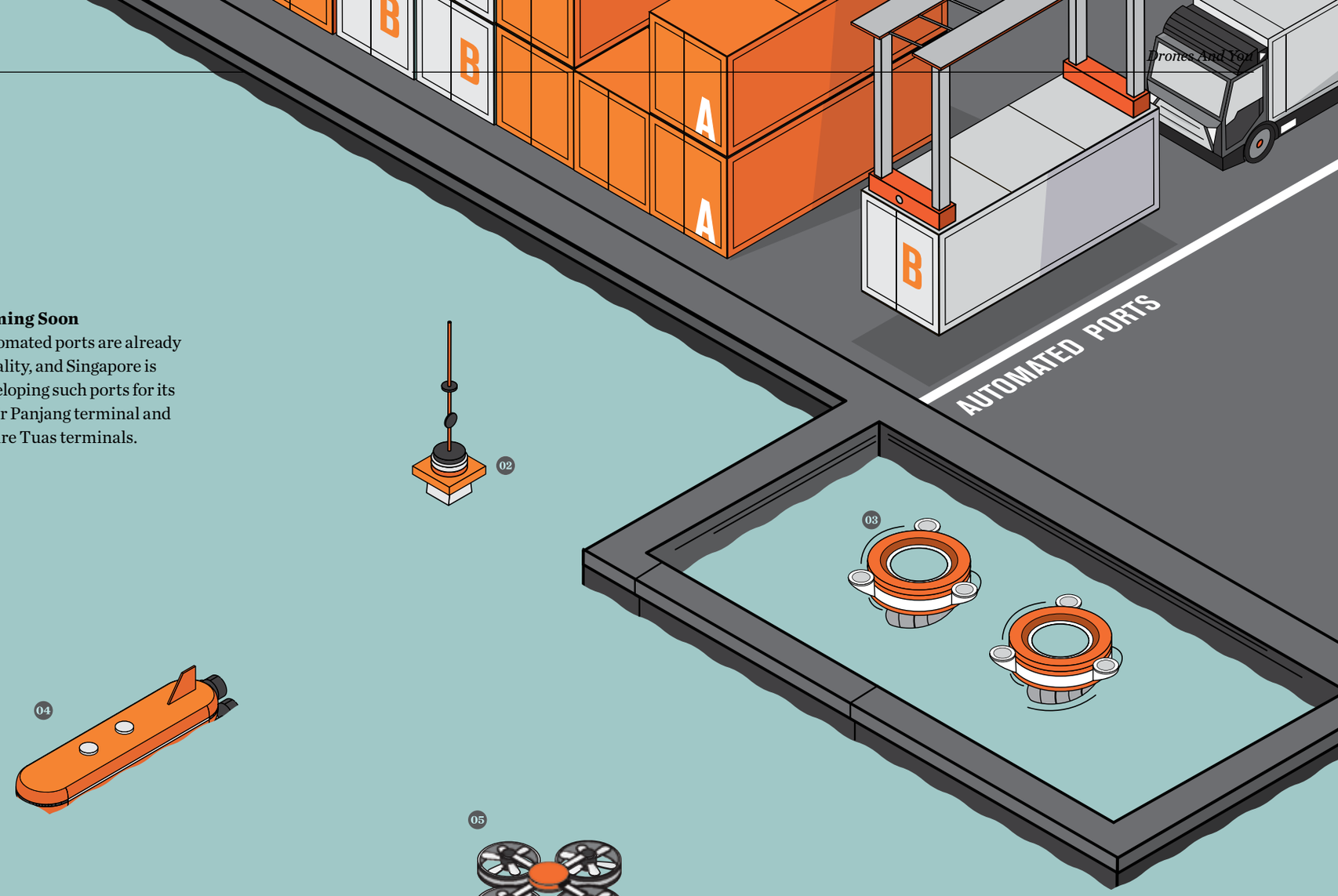
Take Elie Ahovi's swimming trash can concept. By deploying a number of rubbish collecting drones from a mothership, the human operator could simply manage everything from afar while his robots clean the water. And once that area is cleaned, he could simply move to another spot and repeat the process.



Swimming Trash Can
Elie Ahovi's marine drone uses sonar to detect and collect trash in the water

01

Coming Soon
Automated ports are already a reality, and Singapore is developing such ports for its Pasir Panjang terminal and future Tuas terminals.



02

Tweeting Drones
Underwater drone swarms equipped with various sensors monitor the waters and underwater pipelines

03

Submarine Coast Guard
Deep sea sleeper drones are pre-deployed in forward areas to respond to territorial incursions and security emergencies quickly

04

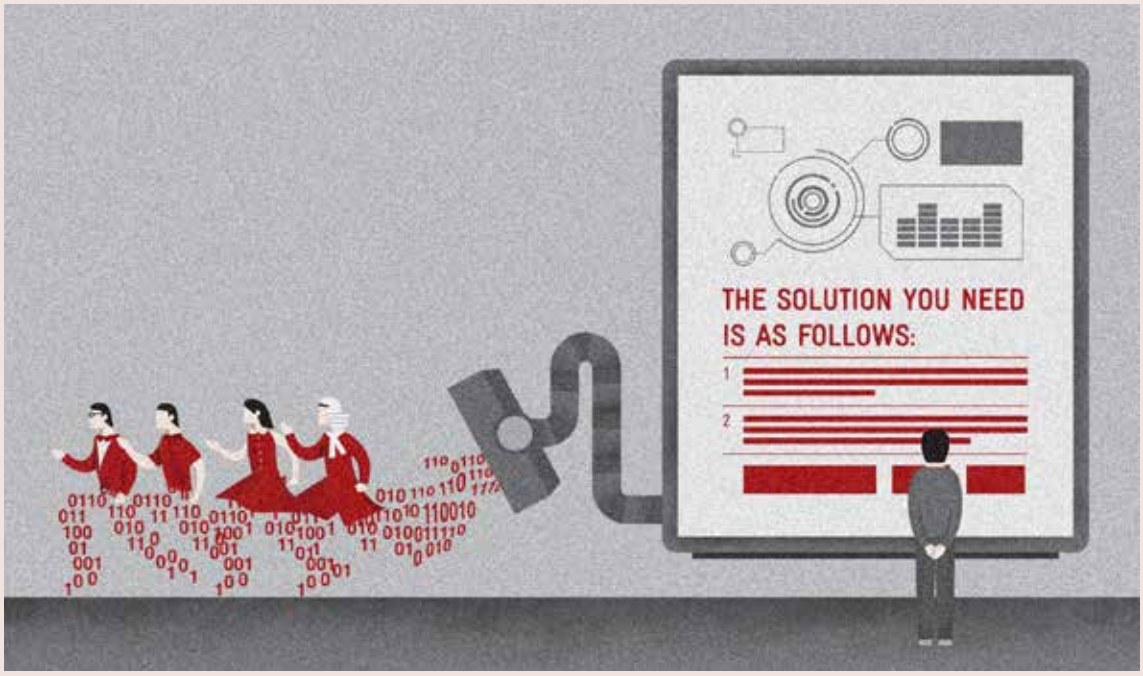
Drone Recovery
Elie Ahovi's drone recovers garbage for sorting and recycling.

05

Search and Rescue UAVs
Search and rescue motherships with GPS and heat-sensors equipped UAVs can be deployed far out in the sea to detect victims.

AUTOMATION OF KNOWLEDGE WORK

—Ong Hao Yi and Lee Chor Pharn



There is emerging recognition that a broad range of expertise-based industries are being disrupted by three key drivers[1]: remote supply and demand, process automation and machine learning. The disruption may result in broad-based automation[2] of expertise jobs in a decade or so, and traditional business models of delivering expertise will be challenged. What is a good, expertise-based human job in these alternative business models?

This report attempts to answer this question by teasing out the different dynamics of disruption in three expertise-based sectors (legal and consulting services, and education) to identify:
(a) where disruption comes from,
(b) a winning alternative business model and
(c) expertise segments, if any, that require high human touch or human judgment.

Where machine learning is less regulated, disruption[3] is more pronounced e.g. healthcare is omitted as there are stronger regulatory obstacles for machine learning to overcome as compared to other sectors. Our findings are:

Professional Services

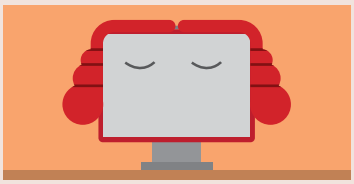
From the perspective of clients, professions are often[4] opaque, inefficient and at times ineffective, yet they are protected from competition in a variety of ways. Clients also find it difficult to judge performance in advance because they are hiring for expertise they lack. Law, accounting and consulting are being particularly disrupted as informational opacity is whittled away by a combination of remote supply and demand, and process automation. In particular, machine learning is starting to augment and in some cases replace, the judgment of human lawyers. For brevity, we have focused on law and consulting sectors.

Education

Digital platforms such as Massive Open Online Courses (MOOCs) where content is provided for free have unlocked remote demand and supply. The result is a concentration of enrolment in elite schools at the expense of mid and lower tier institutions.

The report ends by observing how, as the post-Snowden world moves from a general principle of free data flow to data-balkanisation because of privacy concerns, Singapore may benefit through a combination of domestic regulations encouraging machine learning and trade agreements protecting free flow of data across borders.

Professional Services—Legal



Policy changes in jurisdictions such as the UK that allow non-lawyers to own or invest in law firms[5] have led to the creation of new online legal products for simple solicitation and dispute resolution services. These alternative legal services providers tap into the unserved[6] demand of clients unable to afford lawyers[7] or from the traditional market looking for cost effective alternatives.

Alternative legal services providers are rapidly achieving scale to offer low-cost, transparent rates not matched by traditional law firms—e.g. US-based Rocket Lawyer has US$40 million annual revenue, 1.5 million legal matters/month, and just 190 employees since startup in 2008[8]—by unbundling[9] legal matters into manageable tasks and applying process automation for clients to self-help where efficient: →

- *LegalZoom uses online forms to automatically fill out wills, articles of incorporation, and other legal documents. Lawyers then advise clients or help them file documents. Reflecting the growing unmet demand for such services, in 2011, more than 20% of Californian limited liability companies were formed using LegalZoom. From 2009 to 2011, the firm has consistently achieved over 20% in annual revenue growth.*[10]
- *Online dispute resolution (ODR) software provided by companies such as Cybersettle and SmartSettle are used by eBay and Paypal to resolve 90% of all 60 million business-consumer disputes every year, entirely without human (lawyer) intervention.*[11]
- *Road Traffic Representation (RTR), a firm launched in late 2011, replicates the process a solicitor would go through with a client, providing free online diagnoses of motoring offence cases and the option of electronically booking a barrister for court representation—only much quicker and at no cost via automated Do-It-Yourself (DIY) forms.*

A freemium[12] model is emerging for clients who need the reassurance of lawyer consultation in addition to automated legal documents. Rocket Lawyer has over 500 lawyers in its branded network of lawyers offering legal services. These include advice and document help through calls, video conferencing, or IM-based 24-hours Q&A at 60% of conventional market rates.[13]

These alternative legal service providers are starting to tap into remote demand, despite regulation policy barriers[14] for non-lawyers offering legal products. E.g. US-based LegalZoom and Rocket Lawyer already operate in Canada and are expanding into the UK and the EU. They offer services similar to what they have for their US clients, contextualized to new market.

There are new developments to note. A wave of new legal-technology startups such as Lex Machina, LawGives, SIPX and Ravel Law are using machine learning and big-data analytics to augment human lawyers *(see Box 1)*.

Rocket Lawyer's freemium model shows human expertise can co-exist with process automation, while tapping on cross border demand. Lex Machina shows there is a role for intensive human judgment-machine learning collaboration. Humans with deep legal expertise may do fine, though traditional forms (and firms) will be challenged. There is an open window to anchor freemium models in Asia, though Singapore's legal sector may need encouragement to accommodate alternative service providers not in the sense of foreign participation (QFLP), but for non-lawyer participation. There is also space for an Asia-wide Lex Machina database based in Singapore, after cleaning up[15] legal data from electronic casefiling systems in Singapore and other Asian jurisdictions.

Box 1: Lex Machina Or "The Law Machine"

Lex Machina is in the vanguard of an emerging field known as legal analytics. Legal analytics practitioners statistically parse legal data that can be used to augment, or in some cases replace, the more qualitative judgment of human lawyers.

Lex Machina's database covers only the USA for now, using publicly available information on 130,000 U.S. international patent and antitrust cases dating back to the year 2000, including information on more than 1,400 judges, 340,000 litigants, 100,000 attorneys, and 30,000 law firms. Lex Machina intends to extend this reach to international patent cases. For an annual subscription fee of around US$50,000, customers get access to 13 years of US IP litigation.

IP litigation is big business, with patent wars intensifying in the technology industry (3,200 filings in 2010 to more than 5,000 in 2012). Estimates are that patent trolls cost companies some US$29 billion in 2011 and companies are looking for a way to cut those costs. Conventionally, a company being sued for patent infringement, or is thinking of suing because its own IP has been infringed, will hire top attorneys to pursue its case. Yet the process of deciding whether, how, and even where to file such a suit is often driven by gut instinct rather than facts. Even the best patent attorney may have seen tens of cases that are similar to a client's, but Lex Machina on the other hand has data on thousands of cases.

Lex Machina's database helps companies form broad strategies, such as analyzing whether peers settle similar lawsuits earl, thereby saving money; and select players using statistics to identify

(i) which attorneys do the best against a particular patent troll,

(ii) how much time and money it typically takes to fight a troll versus settling out of court, and

(iii) which judge to choose to hear the company's case.

This is good business sense.

For example, pharmaceutical company Impax Laboratories uses Lex Machina's database to guide its strategy for bringing generic drugs to market. This is a highly structured, litigious process with specific time limits for each step; knowing the history of a judge—e.g. the speed of which cases move through his or her court—is critical. Impax also uses the database to look up the litigation history of brand—name drug manufacturers to discover which attorneys are used and how successful they have been in defending their patent positions. Impax also uses the database to choose legal counsel by their performance record: how many cases these legal counsel are occupied with at any given time, which cases they have won or lost for Impax and their other clients too. Skilled legal analysts, using this database, can help spot meaningful but hidden trends in IP litigation to use to their advantage.

Lex Machina's team is small (18 employees), of which 6 have law degrees, 6 with computer science degrees, and 1 with both. The team took years to extract the data from millions of pages of legal documents that are available publicly free of charge, to construct an ontology of terms. This is refined every night when the system trawls the Internet for the latest data. A legal analyst reviews the algorithms' results and, if necessary, corrects them, and then an engineer tweaks the algorithms.

Source:

Harbert, "Supercharging Patent Lawyers with AI", IEEE Spectrum, Nov 2013

Professional Services—Consulting

Consulting is only beginning[16] to be disrupted, and the path of disruption is likely to be similar to legal services. Alternative consulting service providers are unbundling the "black box[17]" of consulting into manageable tasks and applying process automation where efficient, and use machine learning and data analytics to augment human consultants:

- *Eden McCallum and Business Talent Group keep costs down by assembling leaner project teams of freelance consultants (often midlevel or senior alumni of top consultancies) at a fraction of the cost of traditional competitors. This means doing away with the fixed costs of unstaffed time, expensive rent, recruiting and training. While these firms have started with smaller clients, they are starting to go upmarket*[18].
- *Narrative Science uses algorithms to run analytics and extract key insights of large data sets that are then delivered to clients; Beyond-Core evaluates large data sets, identifies insights, and presents these in an animated briefing; and Motista uses models and algorithms to deliver customer emotion and motivation insights faster and cheaper than a traditional consulting team. This removes jobs once performed by junior analysts.*

A winning alternative business model is less clear in these early days, though it appears that humans with deep consulting expertise may do fine. There is no "Lex Machina" equivalent yet, given the absence of a centralized consulting database. A possible future challenge could come from emerging market consulting firms such as Tata Consulting Services and Infosys to train a Lex Machina equivalent using their proprietary database built over years of outsourcing. Combined with price competition, this may help them succeed in moving into the ranks of top tier consulting firms.

Higher Education

Two emerging models of online education are significantly increasing the remote supply of global, cross-border online degrees:

- *Massive Open Online Course (MOOC): Free courses built for large global, online audiences. MOOC platforms make it free and easy for anyone to learn, and student reach is prioritized over profit making e.g. Coursera, Udacity.*
- *Branded for-profit: Completely online courses offered by top universities e.g. Stanford Center for Professional Development and eCornell.*

While online education is not new, the improved quality of course delivery and high caliber instructors[19] have led to the increasing success of these two models. The supply of quality online courses is reversing the scepticism of schools and regulators toward online certificates.[20] 77% of chief academic officers believe online courses are same as or better than face-to-face, and the American Council on Education has accredited an initial five Coursera MOOCs that students can use for a degree in 2013.[21]

On the remote demand side, online courses are becoming popular amongst students: In 2011, one-third of all US higher education students took online classes, and enrolment in online courses grew by 10%—in contrast to less than 1% in total enrolment growth.[22] In the US, masters programs targeted at working adults from 25-44 years old dominate the online market. In just 3 years from 2008, the number of US masters degrees completed online grew from 12% to more than 30%.[23]

Elite institutions that have gone online are already concentrating US domestic enrolment at the expense of domestic schools. For example, the University of Phoenix, once a market leader in offline and online higher education, has closed 115 campuses in 2012 (out of 228)[24] because of decreasing demand due to online competitors. On the other hand, top university online offerings such as eCornell

posted profits for the fifth consecutive year in 2010, enjoying a 25% revenue growth that year.[25] The number of top universities with online presence has doubled from 2010 to 2012;[26] and this trend of top institutions dominating online is likely to continue.

At present, the shift towards degree-granting online education is mainly within US borders, and the international market is largely untapped. Eduventures forecasts that the US online education market will plateau by 2015 and that US institutions will focus on international students to grow.[27] US institutions will need to overcome perception barriers of international students, and not all international markets have adequate Internet connectivity at scale.[28] If they succeed, international students may prefer to learn off-campus and obtain certificates from top US universities rather than geographically closer domestic institutions.

There are new developments to note. In 2014, a possible freemium model may unlock even more cross-border remote demand for degree-granting higher education *(see Box 2)*.

It would be difficult for non-elite institutions, in Singapore or elsewhere, to compete with a completely online model offered by elite institutions. If the freemium model takes off, MOOC platforms will need an Asian base to provide a seamless freemium service to account for the Asia-America time zone difference, →

Box 2: Georgia Tech's MOOC-Based Masters Course

In January 2014, the Georgia Institute of Technology plans to offer its Masters degree in computer science, ranked among the top 10 in the US, through MOOCs for US$6,600—one seventh the US$45,000 on-campus price. Zvi Galil, the dean of the university's College of Computing, expects the program to attract up to 10,000 students annually, targeted at international students for whom "online, there's no visa problem."

Following a freemium model, the courses will be online and free for those not seeking a degree; those in the degree program will take proctored exams and have access to tutoring, online office hours, and other support services. The plan is for Georgia Tech to provide the content and professors and to get 60% of the revenue, and for MOOC provider Udacity to offer the computer platform, provide course assistants, and receive the other 40%. The projected budget for 2014 is US$3.1 million—including US$2 million donated by AT&T, which will use the program to train employees and find potential hires—with US$240,000 in profits. By the third year, the projection is for US$14.3 million in costs and US$4.7 million in profits.

Many public universities have online degree programs that cost as much as the on-campus versions. But if the Georgia Tech program succeeds, that either-online-or-offline model may be vulnerable. Future programs would have "different price points for different levels of faculty involvement. If you want no touch, or very little touch, they will deliver that for US$6,000. If you want a higher-touch program, taught and graded by regular faculty, with a lot of faculty interaction, it's going to be more expensive."

The trend points to increasing three-way collaborations between MOOC platforms moving from individual noncredit courses to full degree programs, traditional universities expanding their online reach, and companies seeking novel, low-cost ways to train employees or identify potential hires. The education industry would do well to track Georgia Tech's progress.

Source:

The New York Times[29]

but it is unlikely these "high touch" activities (providing proctored exams, course assistants) require deep education expertise.

While the outlook may be bleaker for non-elite education institutions, and most higher education professionals, there is a bright future for a different type of expertise - superstar motivators. Only highly dedicated and conscientious students are able to take online classes in their entirety, the rest need[30] instructors to motivate them. These teachers are not necessarily the most knowledgeable in their field, but they can motivate and inspire. We already see weak signals in the outsized private tutoring sector in Hong Kong and South Korea where the best tutors earn millions annually.

What's Next?

We end the report with two observations: intensified polarization of good jobs between the "cogs" and "cognitive elite", and global data-balkanisation.

From the weak signals of each sector, we observe the winnings go to a relatively small number of "cognitive elite"[31]: humans with deep expertise or human-machine teams (ala Lex Machina). The cognitive elite are estimated[32] to form 15-20% of the (USA) workforce twenty years from now. The situation is much harder for the "cogs", people who are not educated to work within technical situations, and who have to scramble for jobs, freelance and face wage stagnation. It will also be harder for the young entering the job market as they face a broken job ladder. These are essential characteristics of our medium term labour market.

Developed economies may face restive popular movements driven by mass underemployment of "cogs" and the issue of jobs may move from the secular realm of economics and politics to become a quasi-religious issue. E.g. Pope Francis' critiques[33] of modern capitalism, global youth unemployment, the dignity of work and an exhortation to reduce inequality are weak signals of a global movement.

The second observation of data balkanisation applies to a post-Snowden world of intensive data surveillance. Technology pundits once thought a powerful technology sector would enhance personal freedom and constrain the excesses of government. The reverse has happened where a powerful technology sector enabled government excess. Without the large semi-monopolies of Facebook and Google to collect personal information, surveillance would have been far more difficult for the U.S. government. Protectionism, under the guise of a backlash, has started and may pick up global momentum with more revelations of data surveillance. Brazil's internet privacy bill, if passed, requires companies active in the Brazilian market to store Brazilian user data in data centers located in Brazil.[34] This momentum, if not stopped, has the potential to reverse global principles of free data flow.

⊣

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HUMAN AUGMENTATION

— Wang Ning

Augmented Worker[1]

We often hear people say they have tried their best. It is a valid statement given that our ability to perform is limited by physical constraints such as attention span. Where human workers have hit their performance peak, how can we turn to technology to raise the ceiling?

From a national perspective, the need for higher performance and productivity is at an all time high in Singapore. Singapore will be experiencing an unprecedented age shift from now till 2030 when more than a quarter of the current population will enter their silver years. The number of working-age Singaporeans is projected to decline from 2020 onwards. To sustain economic growth and a higher standard of living, technology might provide one source of help to augment workers' performance as Singapore transitions to a higher skilled economy.

While some of the cutting edge technologies discussed here are far from mature and some are even controversial, the future worker will likely have a variety of performance enhancers to choose from. With technology by their side, future workers are augmented workers.

Physical Performance Enhancers Tissue Engineering

The human body sustains wear and tear from even the most ordinary types of work. Ensuring workers' safety and health will help raise productivity. The future worker will likely have the option of tissue engineering to repair worn-out tissues and body parts. One of the most advanced applications is joint replacement with stem cells and bioactive scaffolds. Many tissue engineering approaches are currently expensive and complex. New techniques are now in development, and within the next 10 years we could see "off-the-shelf" engineered tissues that are entirely specific to the worker.

Hybrid Assistive Limb (HAL)

While tissue engineering is reparatory, robo-suits and exoskeletons are preventive. Wearing exoskeletons protect workers from harsh working environments. Being power-assisted, these robo-suits could also make weight-lifting effortless.

Even though such suits are not available today, there are indicative developments that these suits can be expected in the future. In February 2013, Japanese robot maker, Cyberdyne, obtained a global safety certificate for its Hybrid Assistive Limb (HAL). The power-assisted limbs

anticipate and support users' body movements. The suit is designed to improve mobility among the elderly and disabled and to help hospital or nursing care-givers lift patients.[2] The suit is currently under a rental/lease system in Japan.[3]

Cognitive Performance Enhancers

Other than enhancing physical attributes, the need for better performance is so great that many have started to use cognitive enhancing drugs which are used to treat specific medical conditions such as ADHD. The typical drug suppresses patients' receptivity to environmental distractions and stimulates focus and concentration over longer periods of time.

Statistics show that recreational use of cognitive enhancing drugs is increasing. Without proper and effective regulations, 16% of students in the US are already using cognitive enhancing drugs.

The increase in the number of people taking cognitive enhancing drugs is due to their pursuit of better concentration over longer periods of time. Initial clinical research shows that many of these cognitive enhancing drugs do not produce extreme changes in mood such as a "high" or "rush", and do not lead to obvious physical dependence. Instead, they lead to increased pleasure experienced in performing a task. Modafinil, for example, can increase motivation and the pleasure gained from performing routine cognitive tasks. It also improves planning, reduces impulsive behaviour and improves cognitive flexibility in sleep-deprived doctors. Methylphenidate, on the other hand, has the ability to improve short-term (or working) memory.

However, cognitive enhancing drugs are not magic pills. They may not produce the intended cognitive enhancement. Some drugs increase concentration but restrict creativity, making them counter-productive in high skilled and high value-add tasks.

Concerns over these cognitive enhancing drugs go beyond producing unintended enhancements. Medically, these drugs lack rigourous clinical testing. While extensive research has been conducted to treat patients with specific medical conditions, researchers have limited understanding of the side effects on healthy individuals.

On an ethical level, many people consider it wrong to meddle with innate human capabilities, especially through the taking of prescriptive drugs. In addition, these drugs are usually expensive and need to be taken regularly to maintain consistent enhancement. When only the rich can afford them for better performance, the social divide may widen. The incentive to perform better than their peers is so great that many people are willing to overlook any side effects and controversies.

If drugs are controversial enough, what about transcranial electrical stimulation? Studies show that low electrical stimulation of the brain has the potential to enhance learning and cognition, and the enhancement could last between 6 to 12 months. Drugs and electrical stimulation may only be the tip of the iceberg. The cognitive enhancers of tomorrow could be far more invasive.

Researchers will continue to study and develop more performance enhancing techniques. These techniques will likely push boundaries. Some, like the exoskeletons, will commercialize quickly while others, like the cognitive enhancing drugs and techniques, will challenge existing ethical frameworks. As individuals use these enhancers to give them a perceived edge over their competitors, society will continue to debate the medical and ethical controversies. The role of the government, perhaps, is to monitor these social and technological developments. In the future, it may need to intervene and regulate the market.

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SLIVERS OF TIME

—Chua Seow How

FG has explored the impact of digital platforms unlocking latent, cross-border supply of white-collar workers in a past Future Tense article "Future of Jobs"[1] and how it exerts downward pressure on selected white collar wages. In this report, we focus on lower-skilled, blue-collar jobs.

Over the next two decades, the Singaporean workforce is expected to shrink[2], even as it becomes more educated. Improving educational profile of Singaporeans, especially among the younger generation, inevitably results in fewer workers who will be willing to take on lower-skilled jobs that are nonetheless necessary to sustain a healthy economic mix. There will thus be a continued need for foreign workers (FWs) to support and complement the Singaporean workforce.

As we tighten the inflow of FWs, sectors with lower-skilled jobs are likely to be affected. The primary response is for companies in these sectors to improve business productivity in place of workers. Another solution (which will complement the raising of productivity) is to target the whole spectrum of Singaporean workforce and attempt to elicit additional labour supply via raising resident labour force participation rate (LFPR).

There are groups of Singaporeans who generally prefer or can only afford jobs with flexible hours ("flexi-workers") and there are companies that need workers on a periodic or ad-hoc basis. Resident LFPR can be raised if we can encourage these groups of Singaporeans to realise their job preferences through more flexible HR work practices. Current HR practices tend to assume some form of "normal working hours", for instance full day/half day shifts. To be able to unlock latent supply for the labour market, the needs of people who require extreme flexibility have to be catered to. Digital platforms are emerging, that allow companies to book pre-screened individuals at half hour blocks, bringing about a high level of flexibility that encourages more 'supply' to come on to the labour market (see Box for details). Among the sectors with lower-skilled jobs, raising the LFPR may be more possible for the hotels, retail and F&B sectors that are characterized by →

Slivers-Of-Time

Slivers-of-Time (SoT), a UK government funded privately run initiative, is an almost instant, online people-booking system for paid workers and volunteers.

The fundamental concept for SoT is that the labour market for lower-skilled work is not flexible enough to cater to the needs of people who need flexible working hours (e.g. parents with complicated childcare needs, partially employed personnel, freelancers, housewives, retirees etc) at some point within the year. The key feature of the system is that individuals can be booked at half hour blocks compared to the traditional full or half day shifts.

The system incorporates advanced, easy to use high frequency financial trading technology to help individuals who need to work, but can only do so for very short periods of time, to connect (on their own terms and at times of their choosing) with employers who need their labour and time. By allowing potential workers to specify their confirmed availability, SoT is overcoming the asymmetry of market power[3] that is currently present in the short-term job market. SoT is able to cater to the need for work that is starting in the next two hours (hence their name).

Ever since its debut in 2006, SoT has undergone feature-enhancing system upgrades with additional funding from charitable organisations[4] which aim to support deserving business ideas. Over 48,000[5] people have signed up with SoT and since 2010, a notable client of SoT has been Tesco[6]. The platform is currently used within the city of London and its boroughs by the UK public sector and recruitment agencies doing job matching for lower skilled jobs such as general administration, catering, cleaning and driving where there is short term and ad/hoc demand for manpower.

SoT also emphasises on screening[7] the supply of manpower such that it has a ready pool of vetted and approved[8] people who are right for the jobs/roles in demand for. Whenever the need arises, the platform shows the available manpower for the precise location, time and duration for which labour is needed. The potential employer is then able to engage (via text messaging) the manpower that it needs to get the job done; minimal time is wasted having to wait for the right person to apply for the job. A study showed that the increase in labour supply has contributed to increased British tax revenue[9] by £50-400 million per annum.

Source:

March 2013 FG interview with Slivers-of-Time; Rowan Wingham, "A new kind of job market", TED, 2012.

(1) part-time tasks with low barriers to entry and
(2) companies that frequently have to meet cyclical demand spikes for workers.

SoT is useful for facilitating part-time work. To make this flexi-work platform a success, some work still needs to be done. Firstly, we need to overcome the cultural bias of Singaporeans against lower-skilled jobs in retail and F&B sectors, given the low wage and the perceived stigma associated with such jobs. Secondly, the nature of existing lower-skilled jobs needs to be redesigned. For instance, an 8hr-sales assistant role could be split into four 2hr-blocks.

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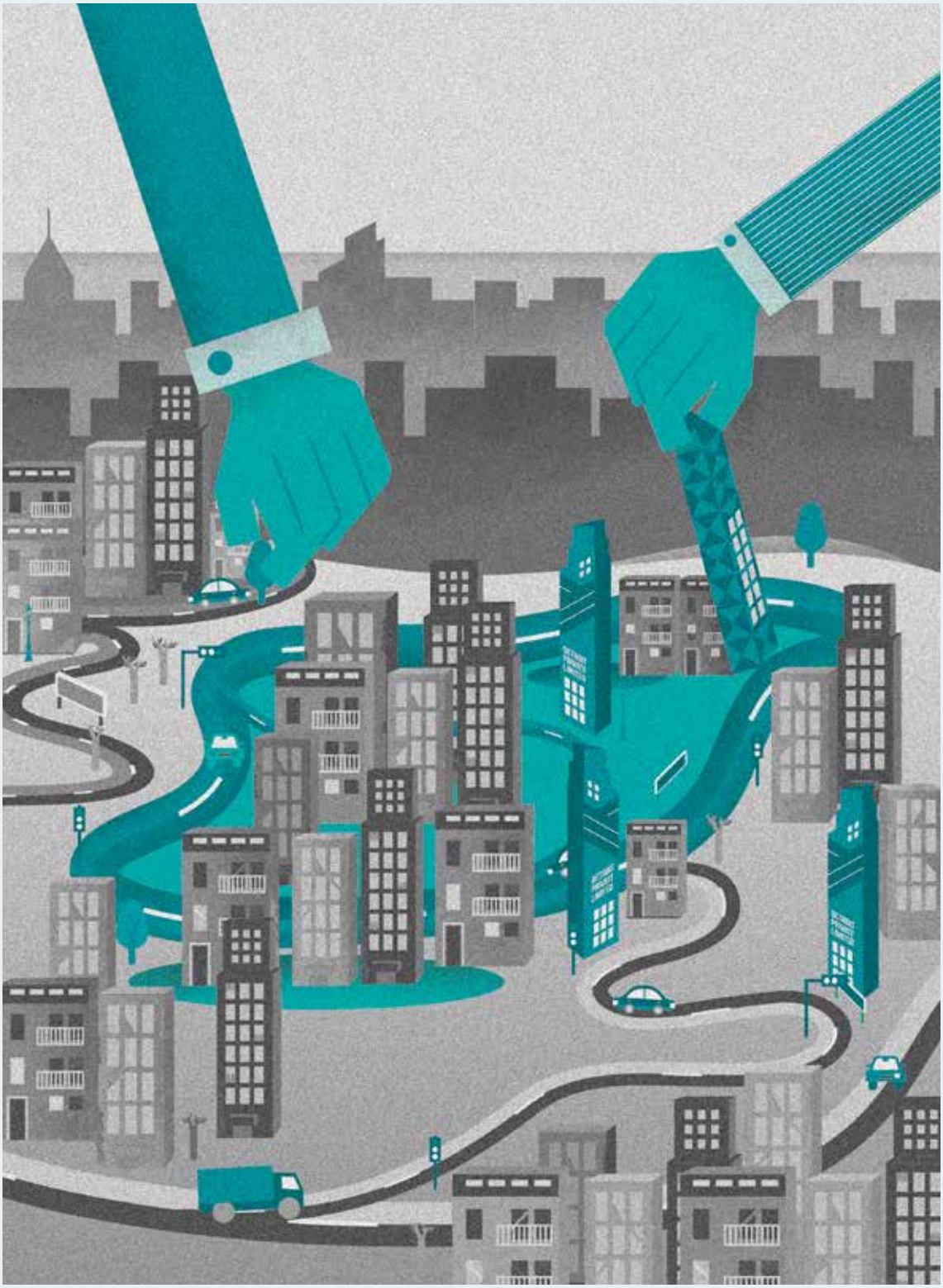

PUBLIC CITIES, PRIVATE HANDS

—Eddie Choo

This study reflects an ongoing Futures Group interest in cities as drivers of growth, innovation, investments and good jobs. We look for early signals of new forms of competition among cities.

In Future Tense 2012, we noticed the emergence of new forms of city-level public-private partnerships e.g. large corporations such as Cisco "run" cities like Songdo (South Korea), which are positioned as green, efficiently run cities built to attract foreign direct investment.

The jury is still out on the efficacy of these partnerships. In this study, we highlight early signals of a new type of private-public partnership between cities in financial distress and powerful individuals who have invested their personal fortunes in improving and, some might say, buying these cities.

Detroit And Las Vegas In The US

Detroit became the largest city in the history of the US to file for bankruptcy protection in July 2013, with a US$327 million budget deficit and over US$14 billion in long-term debt[1]. Las Vegas faces a declining gaming and tourism industry as visitors spend less per person, despite record visitor arrivals[2]. Unemployment in Las Vegas is still high at 9.8%, compared to the national rate of 7.3%[3] as of September 2013. While clearly not in a comparable situation as Detroit, Las Vegas remains in a precarious situation, drawing on reserves to fund budget deficits for essential public services in 2013[4].

Two billionaires—Dan Gilbert[5] and Tony Hsieh, are actively "buying up" distressed Detroit and Las Vegas respectively. →

Opportunity Detroit

Dan Gilbert is the founder and chairman of Quicken Loans, America's largest online mortgage lender and third largest overall retail lender and currently has 4000 staff in Detroit.

Gilbert is on a real-estate spending spree in downtown Detroit, which he brands as "Opportunity Detroit". It is both a "rescue mission and a business venture"[6], an attempt to revive Detroit to its previous heights.

Gilbert owns 24 buildings in Detroit, second only to General Motors[7], totalling 7.6 million sq ft[8] through his holding company Rock Ventures. These properties are concentrated around downtown, with 16 of the properties along Woodward Avenue—the main commercial/downtown section of Detroit.

Through Quicken Loans, Gilbert is also attracting people to stay in Detroit in collaboration with other companies. Homeowners in downtown and midtown Detroit can receive a US$20,000 loan for the purchase of a primary residence[9]; renters receive US$2500 in allowance for the cost of their apartment, and then US$1000 for the second year[10].

Gilbert is encouraging entrepreneurship through a business accelerator, Bizdom that has been described as being "astronomically charitable"[11]. Bizdom currently has 23 companies in its portfolio[12], that can get access to Rock Venture Partners' family of companies.

Downtown Detroit will also benefit from a US$137 million light rail transit that is being funded mostly through private means.[13]

Las Vegas Downtown Project

Tony Hsieh is the CEO of Zappos[14], an online retail firm which has been acquired by Amazon for US$1.2 billion, but continues to be run independently.[15]

Like Gilbert, Hsieh is also undertaking to reshape Las Vegas' downtown (called the Downtown Project) in ways that, in his view could benefit both Zappos employees and the city[16] in under five years from 2012.[17] Hsieh has leased the old Las Vegas City Hall for 15 years to house the Zappos headquarters (Zappos moved into the premises in September 2013). The Downtown project has a heavier emphasis on community building, in comparison with Opportunity Detroit.

Hsieh has bought a total of 80 parcels of land in downtown Las Vegas totalling 28 acres, for about US$93 million.[18] He wants to create "a walkable city" around Zappos headquarters of "retail, parks, restaurants, bars" with a dense urban core of "100 people per acre".

Hsieh is investing US$50 million to attract owner-operated, unique (non-franchised) small businesses to build community on the street level. Available downtown space is featured online and businesses are invited to submit a business plan. A panel of judges selects the top five submissions and the final submission receives investment funding. Hsieh expects to invest in a total of 60 small businessess by end 2013.

Hsieh has started the US$50 million Vegas Tech Fund[19] to build a vibrant, connected community of tech start-ups and (as of September 2013) the fund has invested in 32 companies so far[20]. Hsieh has also started Container Park (official launch in November 2013) for entrepreneurs to start small businesses in.[21]

Another initiative is the launching of Project-100 in Spring 2014 to improve downtown transport. This involves sharing 100 Teslas, 100 on-demand drivers, 100-plus shared bicycles and 100- plus shuttle bus stops. These services will be available to monthly subscribers via a smartphone app.

Furthermore, Hsieh has launched a private pre-school Ninth Bridge in Sept 2013, funded by the Downtown Project, targeted at families living and working downtown with discounts for Zappos, Downtown Project employees and downtown residents. Future plans are to expand the school to other campuses for elementary, middle and high school students.

Hsieh is also creating a regular roster of events[22] to get different groups of people to come together to spark serendipitous encounters (he tracks these as "collisionable hours") to make Las Vegas into the "most Community-focused large city in the world", and the "co-working capital of the world".

The efforts of these billionaires resemble the efforts of America's Gilded Age industrialists, using their private wealth and corporate skills to change their hometowns. In the early half of the 20th century, the Rockefellers, Chandlers and Carters ruled[23] New York, Los Angeles and Fort Worth respectively. It is not historically unusual for very rich people to wield enormous influence behind the scenes of urban planning. However, the role of private wealth in US municipal politics was reduced in the upheavals of the late 1960s/70s, with municipal meetings and urban development proposals opened to public scrutiny. The pendulum may be swinging back, with many major US cities in financial distress. The scale of what Dan Gilbert and Tony Hsieh are doing however, is by comparison much larger.

What Next?

Have Gilbert and Hsieh been able to catalyze an inflow of businesses, attract talent and create good jobs in Detroit and Las Vegas? If their efforts are successful, how many powerful individuals with the same means and ambition are there in the USA and elsewhere in the world? Is this a new form of competition among cities?

Hsieh is a man in a hurry; he wants results in under five years (from 2012). The Downtown Project has created nearly 500 jobs in a space of two years (October 2013 figures) and over 30 tech start-ups have started or migrated to the Downtown project with some high profile start-ups like Romotive (maker of personal robots). The provision of affordable primary healthcare, pre-school education and public transport may accelerate the recreation of the Las Vegas downtown. Like Hsieh, Gilbert is also a man in a hurry, but by comparison, there are few visible early wins yet for Opportunity Detroit. With more than half a century of economic decline, Detroit has a much larger built base of abandoned buildings. Gilbert's immediate focus is to tear down 78,000 derelict houses, fire stations, churches, schools, commercial buildings and train stations (no deadline has been announced), then parcel these essentially free pieces of land out to real estate developers to jump-start and rebuild a new Detroit. Gilbert's real-estate play is a markedly different philosophy from Hsieh's focus on community. It is worth tracking to see how both approaches play out in the next two to three years.

This trend of private money and powerful individuals revitalising and potentially recreating distressed cities into competitive ones is not a uniquely American phenomenon. Denis O'Brien, an Irish billionaire, is just as involved as Hsieh and Gilbert in turning around earthquake hit Port-au-Prince, Haiti[24]. O'Brien is Haiti's largest foreign investor through Digicel, his telecommunications company, and is also Haiti's largest taxpayer and employer. O'Brien has put in his own money to redevelop parts of downtown Port-au-Prince after the earthquake, and is actively involved in attracting foreign direct investment into Haiti, and ongoing rebuilding programmes e.g. Digicel has built more than 50 primary schools in Haiti. The Port-au-Prince mayor and other city officials' offices are also housed rent-free in Digicel's office buildings. Closer to home, newly minted Asian billionaires like Pham Nhat Vuong[25] are starting to invest time and money to revitalise once great Asian cities (in Pham's case via Vingroup, a real estate development firm and Vietnam's fifth most valuable company, to transform "Ho Chi Minh City into Hong Kong or Singapore").

But, to go back to our primary concern, is this a new form of competition among cities? For now, the evidence is mixed. What we observe so far is the staying of rot in a struggling city, and a mild revival jump-started with supply-side measures in a short span of time by a determined, ambitious business mogul. But Las Vegas and Detroit are arguably such distressed cities that, even with a private "takeover", may not be able to vault up to the top of competitive rankings anytime soon.

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HUFFINGTON POST
CORNELL
TECHNION
GIVE ME YOUR
CODERS, YOUR
VENTURE CAPITAL,
YEARNING TO
BREAK FREE

NEW YORK CITY: NEW TECH CITY?

—Lawrence Wong

Reinvention

How well do cities bounce back from crisis? Since the 2007 financial crisis, New York City (NYC) has demonstrated remarkable economic resilience in reinventing itself as a tech hub. Post-financial crisis, the number of private sector jobs actually rose[1] by 4% despite the decline of the financial sector, compared to a 3% national decline (2007-12 figures). The tech sector contributed significantly to NYC's rebound—accounting for one-third (~26,000) of the jobs created, and two-thirds of the growth in private sector wages.[2] Many cities, including NYC[3], have tried to become a tech hub or the next Silicon Valley in the past few decades. NYC is now regarded as the second leading tech hub in the U.S. after Silicon Valley.[4] How and why did it succeed this time?

Supply-Side Priming

The previous administration under Michael Bloomberg wanted to diversify the city's economy following the financial crisis, and identified that tech could be both a growth industry and an enabler of existing industries[5]. The administration sent a strong signal that it was serious about growing the tech sector and implemented a slew of initiatives[6] to stimulate supply and demand. Overall, the initiatives contributed to the development of a more vibrant ecosystem for tech in NYC: →

01

Funding

The Bloomberg administration established structured funding for start-ups, where there was none before e.g. NYC Seed in 2008 (US$2 million fund) and a larger NYC Entrepreneurial Fund in 2010 (US$22 million fund). Subsequently private sector capital came on board.

02

Incubators

The Bloomberg administration also funded incubators to complement funding. Varick Street Incubator, set up in 2009, was the first city-sponsored incubator for high-tech start-ups[7] and subsequent private sector-led incubators established their presence in NYC. These provided access to space, shared facilities and expertise/experience of mentors.

03

STEM Talent

One key initiative, Applied Sciences NYC, was to double the number of both full-time engineering students and faculty when new campuses are completed.[8] E.g. the US$2 billion Cornell-Technion applied science and engineering graduate campus on Roosevelt Island, which the administration committed US$100 million and 11 acres of land to.[9] The administration also collaborated with New York University (NYU) and Columbia to expand existing sciences and engineering programmes through NYU-Poly's Center for Urban Science and Progress, and Columbia University's Institute for Data Sciences and Engineering.

Credit: Kilograph 2012

04

Open Data

The Bloomberg administration hired NYC's first Chief Digital Officer in 2011 to spearhead NYC's digital roadmap which includes expanding public data sets and internet access. The city released large amounts of public city data through its NYC Open Data initiative and launched an annual competition NYC BigApps for developers to create free apps for New Yorkers using public data.

Demand Is King

The current wave of tech companies differs from NYC's first tech wave. Having learnt the lessons from the dot com bust, they concentrate on technology applications for NYC's dominant industries—advertising, finance, digital media, education, e-commerce and health.[10] At the same time, industry convergence with technology led to corporate investments in digital and mobile applications.[11]

[Box: Rise Of NYC As A Tech Hub]

Rise Of NYC As A Tech Hub

Tech Start-Ups And Exits

Over 1000 new tech start-ups were launched in NYC from 2008 to 2011.[12] It is not just the growth in the number of start-ups but in the size of the start-ups themselves. NYC tech start-ups have also experienced rapid growth within a few years.

- *Etsy's sales grew from US$170,000 in 2005 to US$526 million in 2011*
- *Foursquare's user base expanded from 100,000 in 2009 to 100 million in 2011*
- *The amount of money raised at crowdfunding site Kickstarter increased from US$27 million in 2010 to US$283 million in 2012*

There were also significant exits, mainly in the media sector. In 2012, 100 NYC tech firms sold for a combined US$8.3 billion[13], behind Silicon Valley and ahead of Boston.

- *Tumblr's US$1.1 billion acquisition by Yahoo!*
- *DoubleClick's US$3.1 billion acquisition by Google*
- *Huffington Posts' US$354 million acquisition by AOL*

Growth In VC Funding

NYC ranks second after Silicon Valley for start-up investments; before 2006, it ranked third behind Silicon Valley and Boston.[14] NYC saw a 32% increase in VC deals between 2007 and 2011, compared to a 10% drop in Silicon Valley in the same period, and it was the only one of seven leading tech regions in US to see an increase in VC deals.

Jobs And Pay

NYC's tech sector jobs earn more than the NYC mean annual salary (US$57,000[15] in 2012). Based on some estimates, the sector's mean annual salary is US$94,000, with developers being the most highly paid at about US$100,000.[16]

Presence Of Tech Heavyweights

Tech heavyweights have been establishing or expanding their presence in NYC, signaling their confidence in NYC's attractiveness as a tech hub.

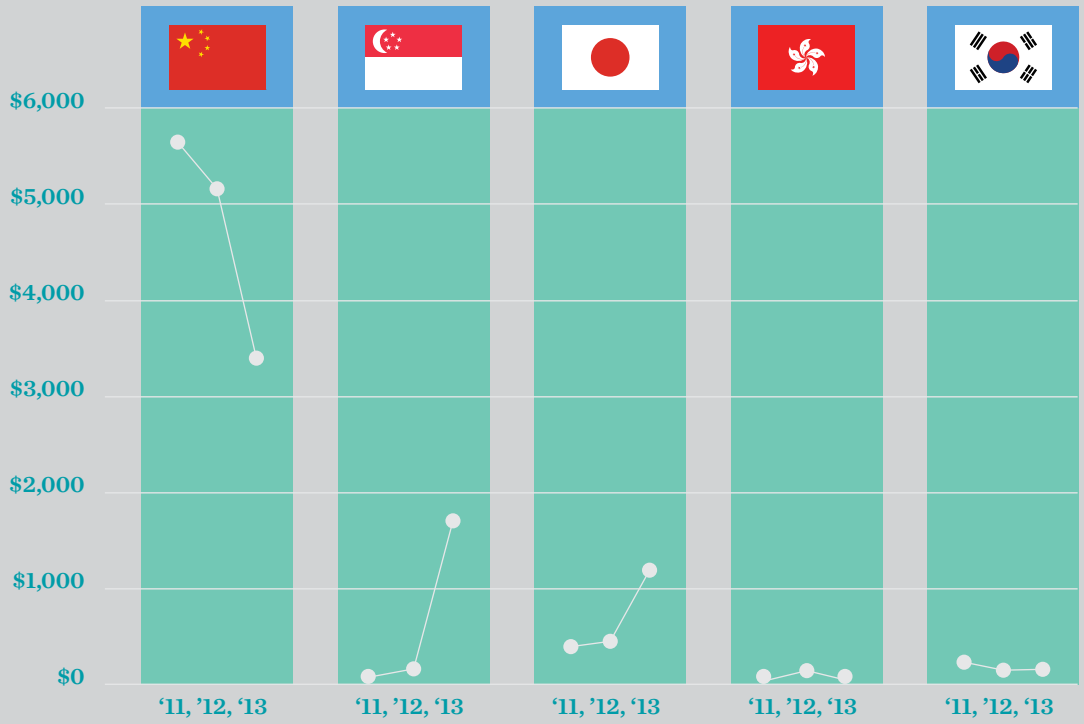
- *Facebook set up an engineering campus, its first major engineering office outside Silicon Valley in 2011 and doubled its space to 100,000 square feet in 2013*[17]
- *Yahoo expanded its NYC operations by 60%, with a focus on hiring more engineers*[18]
- *Google bought a large building for US$1.9 billion in 2010 for its office*[19] *and added 750 employees in 2011 to its NYC office*[20]

How About Singapore?

Singapore's tech ecosystem is becoming more vibrant. On the supply side, public sector initiatives that have been in place for years to address funding, incubators and talent seem to be on the right track e.g. *The Economist* highlighted the Singapore government's efforts to support start-ups and singled out Block 71 in Ayer Rajah as the "world's most tightly packed entrepreneurial ecosystem".[21] Block 71 is being expanded to become part of a new cluster for start-ups called JTC LaunchPad @ one-north, which will double in capacity to eventually house some 500 start-ups and 2,000 talents.[22]

Public sector initiatives have been joined by grassroots and private sector activities like tech meet-ups and hackathons, which create opportunities for interaction and cross-pollination of ideas. Private sector capital is augmenting public sector capital and has been growing rapidly *(see chart below)*.

Venture Capital Investment In Tech Sector, In Millions of U.S Dollars



Source: Asian Venture Capital Journal Records. The Wall Street Journal.

VC investment in Singapore tech sector has increased significantly since 2011, totaling US$1.71 billion in 2013, a 60-fold increase from 2011.[23] Surprisingly, Singapore leads Japan, South Korea and Hong Kong in VC funding, while lagging behind China. Total funding for Singapore tech firms accounted for 19% of funding for Asia's in 2013, up from 0.3% in 2011.[24]

On the demand side, if we use successful tech buyouts as a proxy signal, tech companies seem to be addressing industry needs. Some examples include: Rakuten purchased video site Viki for US$200m, Singapore Press Holdings bought sgcarmart for US$48m, Singtel bought HungryGoWhere for S$12m, Silicon Valley-based Ruckus Wireless bought YFind (indoor positioning) and Gemalto bought DS3 (internet banking security) for undisclosed sums. The spate of tech exits took place in 2013 (except for Singtel's acquisition in 2012). Nothing succeeds like success, and current and future tech exits are raising the stature of tech entrepreneurs.[25]

While it is likely Singapore's own tech development path will be different, the supply and demand signals mirror NYC's path. We are cautiously optimistic that Singapore is coming to its own as a tech hub in the region. Perhaps given time, Singapore may be regarded as Asia's "Silicon Valley".

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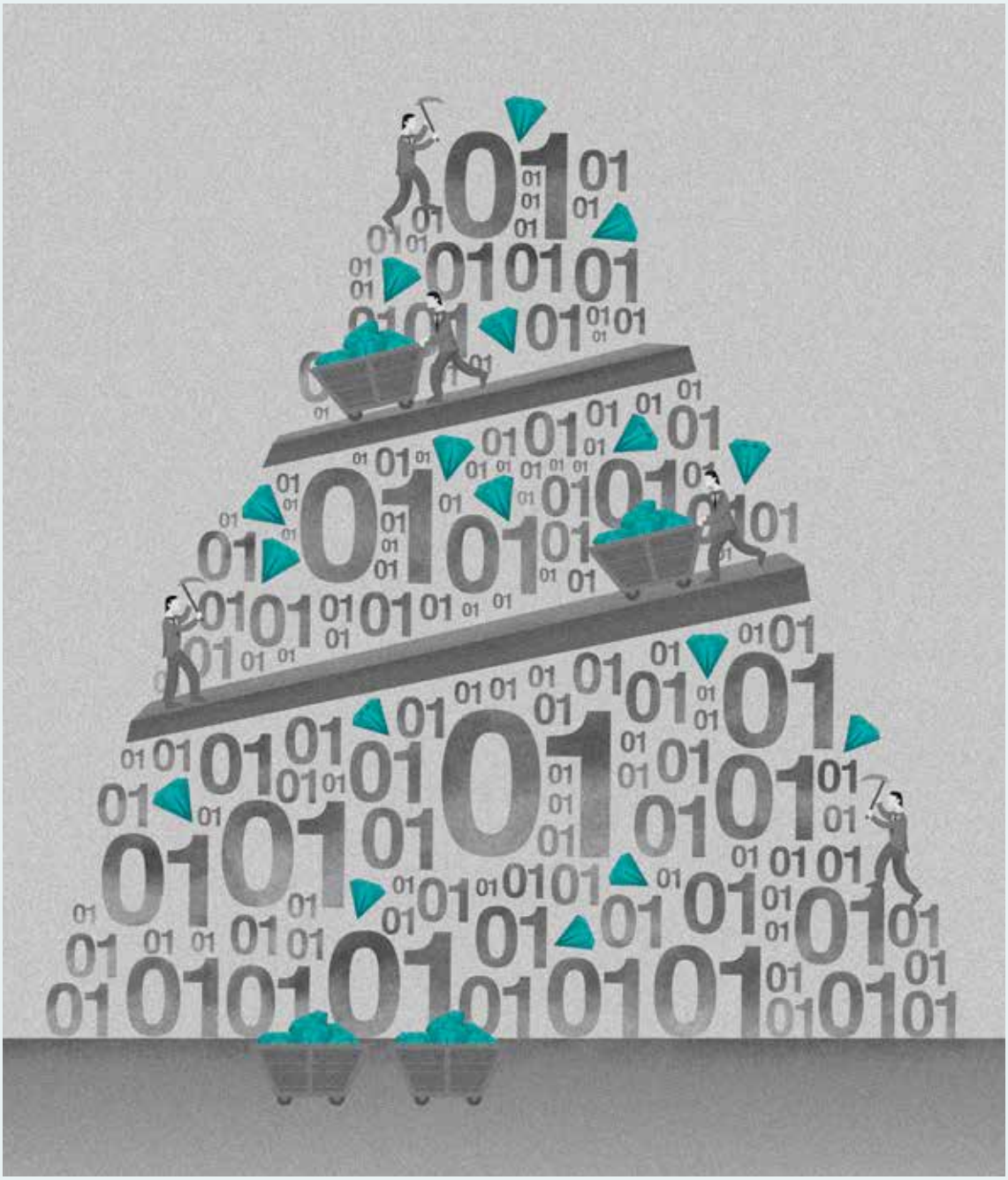
BIG DATA UPDATE

—Auyong Hawyee



The Futures Group first wrote about the emerging phenomenon of Big Data[1] in 2010 as it was about to enter the mainstream. It was envisaged that Big Data would create a demand for new skills (Google has identified statisticians as the "sexy job of the decade") and generate new industries. Since then, the technology has matured further, and business opportunities and business models have become clearer. This report updates on the industry value chain and business models for the data analytics industry, latest developments as well as the opportunities for Singapore.

Background

With increasing pervasiveness of digital technology, we have entered into an age of "Big Data", where data (and the insights generated from data) will become a crucial factor of production[2]. Data is increasingly important in the design of products and services, in the optimisation of production lines and supply chains, in targeting marketing efforts, and in the collation and sense-making of customer feedback. This collation of data and generation of insights is the role of the data analytics industry.

Since 2010, the structure of the data analytics industry has solidified further and the business models have become clearer. The opportunity for Singapore is two-fold: first, in becoming a hub for the provision of data analytics tools and services; and second, in using data analytics to drive innovation and productivity in the industries in Singapore.

What Is Data Analytics?

Data analytics refers to the discovery and communication of meaningful patterns in data. Data analytics relies on the simultaneous application of techniques from statistics, computer programming, and operations research. Data analytics uses descriptive and predictive models to extract knowledge from data, which can in turn be used to recommend action and to guide decision-making. While data-driven decisions have been an important part of businesses, especially since the rise of scientific management (also known as Taylorism) in the late 19th century, the convergence of more powerful computers and cheaper data storage allows us to efficiently analyse data sets of unprecedented scale, complexity, and diversity. This is what gives rise to the phenomenon of "Big Data".

The activity chain for the data analytics industry is shown in *Figure 1* along with indicative examples of industry players. As data moves through the layers of the activity chain, it gains more structure, and more insight can be extracted from it. The final part of the activity chain consists of end-users which can act upon →

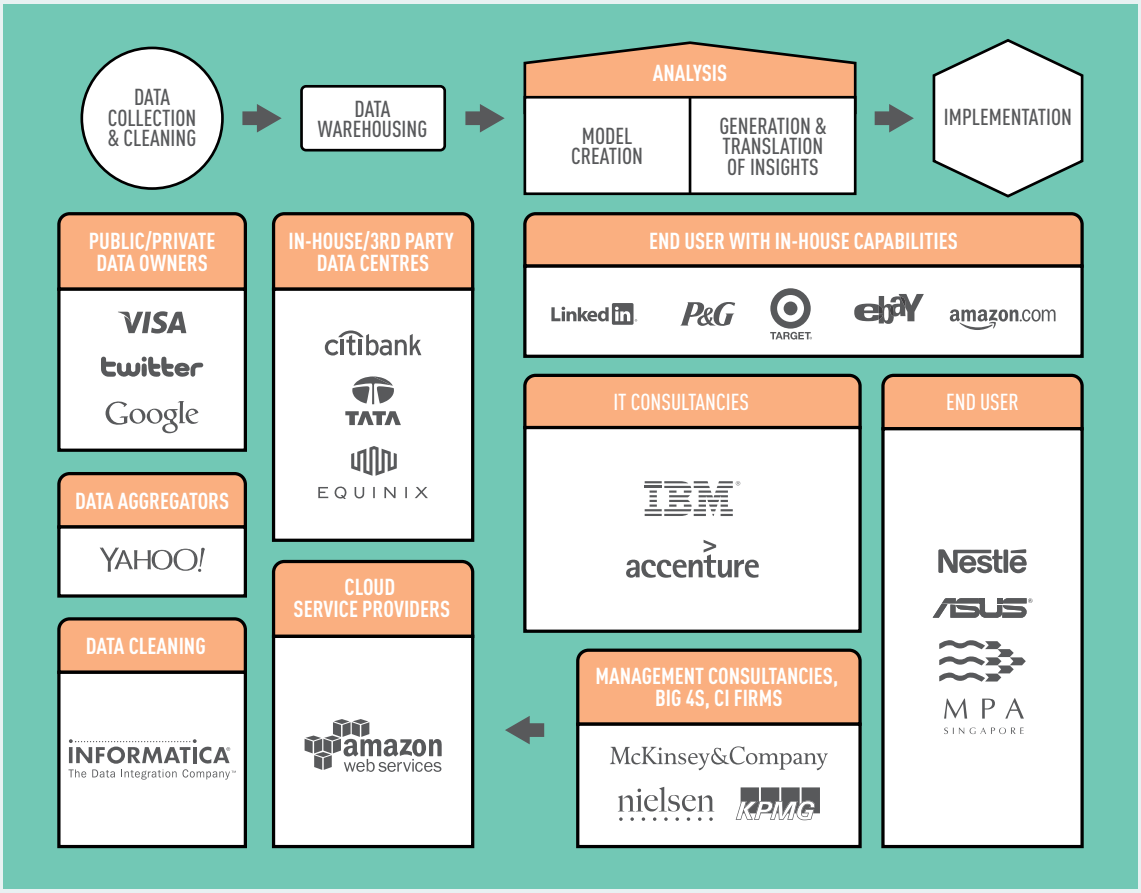


Figure 1: Data activity chain and examples of industry players[3]

the insights gained from data analytics to improve their processes, products or services. Companies can operate in one or more parts of the activity chain. For example, Google, whose entire business model depends on its ability to collect, manipulate, and make sense of data, operates in all parts of the activity chain. Other companies like P&G whose business in fast-moving consumer goods depends on responding rapidly to consumer tastes, have built up significant in-house capabilities to analyse business data. On the other hand, specialized third parties like Amazon Web Services (in hosting services and cloud computing) and IBM (in IT infrastructure and consultancy) focus on the provision of services of products in specific parts of the data analytics activity chain.

Data gains structure and value as it moves through the chain. The anchor link in the activity chain is data collection and cleaning. Data is captured and stored at great cost even though it has the least value at this stage and only serves as "raw material" for further processing.[4] The collection stage could also include cleaning up the collected data by identifying and labelling, giving it some structure and making it ready it for further processing. After this stage, the data is stored until it is needed for further processing. The analysis stage attempts to first identify patterns and relationships by generating models that explain historical data, and then seeks to generate insights from the data that can predict future scenarios and aid in decision-making. Finally, the insights from data analytics need to be integrated with business processes.

Data Analytics Industry Growth Potential

As recently as 2009, there were only a handful of large-scale data analytics projects worldwide and total industry revenues were less than USD100 million. However, by the end of 2012, more than 90% of Fortune 500 companies had some data analytics initiatives underway, with industry revenues in the range of US$1-1.5 billion[5]. The data analytics industry is also expected to grow at 40% per year through 2015, a rate that is seven times the growth rate for the overall information technology and communications sector[6].

The growth of the data analytics industry is driven by several factors. First, there is an ongoing exponential increase in the data collected and stored because of pervasive sensing and data collection technologies, thus increasing the demand for services and tools to make sense of data. For example, the amount of business data being collected today is growing at an average of 36% a year[7]. Second, the competition to differentiate products and services is driving the adoption of analytics. Third, the increasing number of successful use cases in both the private and public sectors is spurring more users to adopt analytics in their own operations.

Trend Of Increased Adoption Of Data Analytics

Due to the data-centric nature of their businesses, IT/Internet companies have obviously been early adopters of data analytics. For example, Google collects and analyses data on internet searches and advertisement "click-throughs" to deliver better search results and to deliver more effective and targeted advertising. Amazon.com uses demand and supply data for books to automatically adjust its book prices to maximize profits, among other things.

In the last 3 years, however, more companies outside of the IT/Internet sectors have integrated data analytics into their business operations as tools for data analytics have become more mature.

Global private sector examples include Ford Motor Co., which used text mining algorithms to trawl car enthusiast websites to aid the design of new features for its vehicles; Caesars Entertainment Corporation, which used analytics on health benefit claims of their 65,000 employees to target cost savings efforts; and the Argentinean bank Banco Itau Argentina, which increased revenue from existing clients by 40% with predictive models that identify the clients most likely to respond to marketing offers[8]. In fact, companies that use "data-directed decision making" consistently enjoy a five to six percent boost in productivity.[9]

Public sector examples include the Italian city of Bolzano, which saved 30% on elderly care by monitoring individuals in their own homes and targeting the delivery of healthcare services; the UK Department of Work and Pensions (DWP), which increased the number of successful interventions annually from 123,000 in 2009 to 1 million in 2010; and the New York Department of Taxation and Finance, which used predictive modelling to prioritize tax refund applications for human audit, increasing refund denials per year from $56 million to $200 million without increasing staff levels.[10]

In Singapore, examples of private sector analytics initiatives include Visalabs, which entered into a collaboration with A*STAR to analyse credit card transaction data for fraudulent activity; Citibank, which set up a Global Transaction Services Asia Innovation Centre that develops tools to manage intra-day liquidity positions and risks. Statistics for the impact of these initiatives in Singapore are sparse because these efforts are still nascent.

A preliminary survey of global examples seems to indicate that the coming wave of analytics adoption will be more impactful for services industries (urban services, retail, security, supply chain/logistics to name a few) than manufacturing industries. This could be because manufacturing processes have traditionally relied heavily on measurement and performance metrics and are already highly optimised, leaving less headroom for improvement from the increased adoption of data analytics. →

Enablers For Growth Of Data Analytics Industry

As the ability to store and manipulate data at a large scale is a relatively recent phenomenon, many of the necessary tools are still in their infancy. Hence access to data as raw material will be crucial in helping companies develop and refine these tools. A number of governments have recognized this and the fact that they can play a crucial role in facilitating growth of the data analytics industry by opening up access to government data, since government is often by far the holder of the largest data sets in many countries. These initiatives are usually given the label "open data", which refers to data that is free to use, re-use, and distribute[11]. It is important to note though that the size gap between government-owned and private sector-owned data is shrinking rapidly.

In 2012, the UK government helped to set up the Open Data Institute (ODI) with a grant of £10m. The non-profit and non-partisan ODI will champion open access to private and public databases, help the public sector use its own data more effectively, and help foster entrepreneurial efforts around open data.[12] Earlier in 2010, the UK government had officially launched Data.gov.uk, an open data portal for government data. The portal contains more than 9,000 data sets from various UK government departments. All data is non-personal and provided in a machine readable format that allows for easy re-use.[13]

In May 2013, US president Obama signed an Executive Order that required data generated by the government to be made available in open, machine-readable formats, while appropriately safeguarding privacy, confidentiality, and security. Part of the motivation for this executive order was to encourage more start-ups and entrepreneurs to invent data-based products and services[14]. This comes on top of the US$200 million in funding that was already set aside in 2012 to establish the Big Data Research and Development Initiative, which was intended as an "all hands on deck" effort to achieve breakthrough advances in data analytics.[15]

Hence access to data as raw material will be crucial in helping companies develop and refine these tools.

Initiatives To Leverage Big Data

Singapore has a strong base[16] of companies such as SAP's Research & Living Lab and Deloitte's Analytics Institute from which to grow an analytics industry. To grow the industry, EDB is working closely with IDA to tackle the 3 challenges of:

- global shortage in analytics talent,
- need for continuous innovation to handle data diversity and address domain-specific needs and
- lack of access to relevant data to verify models and uncover insights.

The responses to these challenges are outlined here. To meet expected local demand for data analytics manpower, EDB is partnering with Singapore tertiary institutions to design industry-relevant programs, with the aim of developing a pool of 2,500 analytics professionals by 2017.

To meet the need for continuous innovation in the analytics industry, EDB, IDA, NRF, and A*STAR are coordinating their efforts to focus public-sector funding on high-impact application-specific analytics research, and stimulate lead demand for analytics from both public and private sectors.

To facilitate access to open data and seed the development of new applications by industry, Singapore launched Data.gov.sg in 2010. This public portal brings together 5,000 data sets from 50 government agencies.

Unlike Data.gov.uk, however, where all data sets are hosted on a unified server and provided in machine-readable formats, Data.gov.sg redirects users to agency-specific websites for many data sets, where the data is sometimes provided is available only in non-machine readable formats. This is an area that needs to be improved on and is under active consideration by the Data Special Interest Group under PSD.

Notwithstanding the areas which still require improvement, useful results are beginning to emerge. For example, Singapore's Mass Rapid Transit (MRT) rail network has been experimenting with an adaptive platform known as INSINC[17] to shift commuters from peak to off-peak trains. The aim was to optimise public transport capacity to meet transient, short-term demand fluctuations (i.e. peaks). INSINC uses incentives, games and social networks to attract commuters to set up individual INSINC accounts, analyses the travelling behaviour of each INSINC account through the unique ID number of the fare card, and makes personalised recommendations via a "magic box offer"[18] to encourage peak to off-peak travel behaviour shift. For example, a commuter who travels consistently during peak hours may get extra credits for travelling off-peak in the next week. A strong social element can also help induce a larger behaviour shift. INSINC participants that invite friends via social networks (e.g. Facebook) earn bonus credits, and if they travel off-peak as a group, they earn even more bonus points. The tightly coupled feedback loop between the INSINC platform and the user allows more targeted, real-time personalised offers to modify their behaviour. As of May 2013, INSINC has over 103,000 registered users, of which over 70% were invited by friends. Travel patterns have shifted from peak to off-peak in the range of 8 to 15%.

There are also ongoing agency efforts to promote living lab platforms (for public data) and co-innovation platforms (for private data) to ensure that analytics initiatives in Singapore have a steady stream of fresh data to validate and develop new analytics models.

Singapore's plan to become an analytics hub will need to take into account international developments in trade in data and data services, especially for personal data. Singapore's Personal Data Protection Act[19], while enhancing protection for personal data, does not place restrictions on the flow of data based on where the data is stored. There are however signs that other countries are taking an increasingly protectionist stance towards data usage and flow. Regulations could be enacted which potentially prevent or restrict the transfer of such data to international service providers for analysis, impacting Singapore's ambition to develop into a data analytics hub. Below are two examples of global data regulations in the Philippines and the EU that we need to monitor. →

Singapore's plan to become an analytics hub will need to take into account international developments in trade in data and data services, especially for personal data.

International Developments

Philippines

The Philippines Data Privacy Act came into force on 15 Aug 2012. One of the purposes of the Act is to support the growth of the Business Process Outsourcing industry in the Philippines[20]. This Act is one of the toughest in the region and is based substantially on the EU Information Privacy Framework. The Act places stringent requirements on personal information collected within the Philippines, but exempts personal information collected on non-Philippine residents from such restrictions. Although the Act does not prohibit the overseas transfer of information for processing, overseas service providers must be subject to the same security obligations as required under the Act.

EU

The EU Data Protection Directive may probably force all companies that collect data on EU citizens to abide by EU law. The proposed direction has such strict requirements that an economic officer in the US Foreign Service has commented that it could provoke a trade war with the US[21]. The proposed protections under the directive include a requirement for data breach notifications within 24 hours, the right for users to delete their data ("right to be forgotten") and the right for data portability between online services. Many US technology companies have opposed the Directive, arguing that it will affect the viability of their business models. Although the EU has scrapped the part of the legislation that would have protected EU citizens against US spying, the rest of the directive could remain intact.[22]

To address the challenge of data access, EDB, IDA and MTI are working to ensure that trade negotiations take into account the free flow of data across borders. For example, under the e-commerce chapter of the Trans-Pacific Partnership (TPP) negotiations, Singapore is proposing that countries do not impose restrictions on cross border transfers of electronic information and location of computing facilities. The forward looking tone set by the TPP may be a template for other multilateral bodies like ASEAN to follow in the future, and Singapore could use the TPP headstart to grow into a regional data analytics hub.

Buyer's Remorse?

Notwithstanding the benefits of a "Big Data"-ed world, there is rising discomfort from citizens and consumers who are the originators of data.

Take urban services, a sector which promises to be transformed by analytics adoption. Big data is being used to bring about urban transformation (Rio de Janeiro by IBM) or create cities from scratch (Songdo by Cisco/Gale). Critics of the smart-city bandwagon[23] are not anti-technology or against the benefits of a smart city that is "hyper efficient, easy to navigate, free of waste, and is constantly collecting data to help it handle emergencies, disasters and crimes". Rather, they are concerned with "buyer's remorse": the un-assessed risks[24] of rushing into building a new, intelligent urban infrastructure that locks

the city into development patterns for decades, much like investing in highways and subway systems. Many of the algorithms embedded in software systems and networks that city governments depend on, form "de facto laws" and lie mainly in private hands that citizens have little oversight[25] or recourse to. Differences in these codes could result in the emergence of very different cities.

Similar concerns apply too to other sectors like healthcare, security and consumer/retail. It would be an irony if, in leveraging big data to optimise supply chains, target user needs and ultimately improve the lives of consumers and citizens, we lock ourselves into development patterns which are difficult to unwind, codes that become entrenched "rules" with little recourse and a populace that in general does not trust businesses or governments to use their data for the common good.

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BUSINESS P2P NETWORKS

—Lawrence Wong

Peer-to-peer (P2P) platforms today act as centralised clearing houses, aggregating and matching supply and demand. They have become very popular with consumers and are gaining mainstream adoption[1], especially for sharing personal assets like rooms e.g. Airbnb[2] and cars e.g. Zipcar[3] The rapid rise of P2P platforms is potentially disruptive for traditional sectors. For instance, with 550,000 rooms listed in 192 countries, Airbnb may be considered as the world's largest hotelier[4] today with an estimated US$10bn valuation that is higher than Hyatt's[5].

In contrast to consumer P2P platforms, business P2P platforms are much less visible even though benefits like increasing asset yield (for sharing companies), reducing capital expenditure (for renting companies) or reducing transaction costs are clear. This may be about to change. We are observing weak signals of business P2P platforms like FLOOW2 *[see Box]* with users from industries like construction and agriculture that experience cyclical or clumpy demand and hence can lease out equipment during periods of idle capacity for extra revenue.

FLOOW2—Sharing Company Assets And Personnel

Founded in 2012 in the Netherlands, FLOOW2 is a business P2P sharing platform for companies to share equipment, skills and knowledge of personnel. Most of the listings on FLOOW2 (about 20,000 as of October 2013) are heavy equipment in construction, agriculture and transport such as building site equipment, aerial platforms, and trucks.

Companies benefit from the platform through additional revenue amidst slower growth in Europe by sharing their spare capacity or lower investment costs by renting. A larger environmental aim is to reduce the depletion of raw materials.

FLOOW2 charges a fee for listing (90-day free trial) and no transaction fee. Additional services such as invoicing, rental agreement, online payment are facilitated for free. The intent is to get more companies to try the platform. Users have the option to create their own open or closed groups and determine who they share their items with.

FLOOW2's co-founder Kim Tjoa opined that increasing the adoption of business P2P sharing requires greater awareness, mindset shift and time. Businesses need to shift their mindset from ownership of assets to access and to understand that this is a key source of resource efficiency. There are plans to scale the platform beyond the immediate markets of the Netherlands and Germany to other EU countries and the US.

To promote adoption of business P2P production and asset sharing, FLOOW2 has launched pilot projects for different companies located in the same industrial area to share equipment, space and even manpower. For example, five Dutch hospitals now use FLOOW2 to share their capacity operating rooms, MRI-scans, medical specialists etc. The Dutch government is exploring industry-wide sharing of tangible and intangible assets e.g. transport equipment, heavy and light equipment, facilities and knowledge.

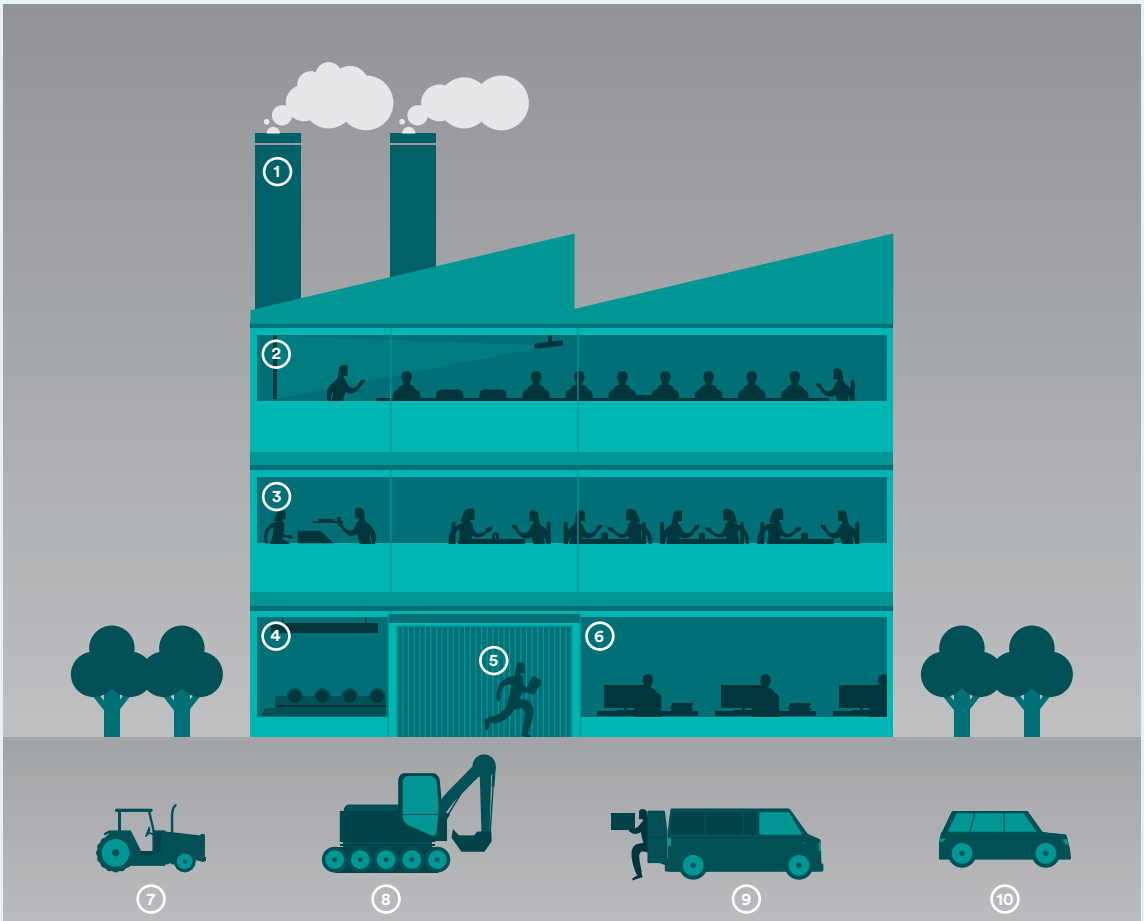
Source:

www.floow2.com, Sep 2013
FG interview with FLOOW2

Future business P2P platforms may extend beyond simple asset and personnel sharing and we can look to recent innovations in consumer P2P networks such as Bitcoin to sense how this future might look. These P2P networks, with no central co-ordination or control node, are not new. Earlier forms were based on file sharing (e.g. Napster, BitTorrent), and recent innovations have taken the form of cryptocurrencies like Bitcoin.

What makes this interesting beyond the success or failure of cryptocurrencies like Bitcoin are the underlying decentralised network protocols that enable the creation of new business P2P networks like Ethereum. Ethereum is a decentralized, cryptographic ledger that allows users to encode transactions, contracts and applications, including custom currencies and financial derivatives. These protocols create a "digital basis for trust"[6] that need not be centrally controlled, and they offer a range of potential applications like payments, voting (e.g. BitCongress,[7] Agora Voting[8]), cloud storage (e.g. Datacoin)[9] and autonomous vehicles.[10] It would be useful to keep a watching scan on emerging business P2P networks like Ethereum, and business P2P adoption of new business products like "digital self-enforcing contracts" which are binding contracts outside of the legal system without the need for lawyers.

The Internet was originally built as a decentralised network of interconnected computers or nodes. Today, a small number of larger nodes (or "stacks")[11] e.g. Google, Alibaba control a →



THE BUSINESS P2P SHARING MARKETPLACE

		AVAILABLE	RATE (US$)
1	MOULD MAKING	WEEKENDS	Enquire
2	MEETING ROOM	TUE & FRI, 1600 - 1900	$50 per Hour
3	CANTEEN	DAILY, 1200 - 1400	$15 per Pax
4	PRINTING	WEEKENDS, 1100 - 1700	Enquire
5	PERSONAL ASSISTANT	WED, 1300 - 1830	$20 per Hour
6	ACCOUNTANT	FRI , 1300 - 1830	$60 per Hour
7	TRACTOR	JUNE, JULY	$500 per Week
8	EXCAVATOR	WEEKENDS	$200 per Day
9	GOODS DELIVERY	DEC, MAR	Enquire
10	CAR	WEEKNIGHTS, AFTER 1900	$75 per Evening

significant flow of Internet traffic and disproportionate market power. Emerging P2P networks like Ethereum and FreedomBox,[12] can be seen as a larger movement to re-decentralise the Internet.[13] How the tensions between the centralising force of digital conglomerates and the decentralising countermovement created by P2P networks play out over the next decade should be observed closely.

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DIGITAL CONGLOMERATES

— *Lee Chor Pharn*

FG's ongoing interest is to observe the changing nature of competition and postulate, from today's drivers and weak signals, tomorrow's business landscape and jobs. Consulting[1] and business school[2] literature recognizes that the core competencies of Internet-based companies are different from industrial-era "Porter's five forces". Instead of cost/differentiation advantages, digital conglomerates such as Google compete through managing their ecosystem of digital assets[3], and the large amounts of customer data generated and processed in real time from these ecosystems. For example, the digital conglomerate Google includes assets such as Google talk, Latitude, AdSense, cloud services and mobile payments as seen in Figure 1.

Digital conglomerates are able to leverage off consumer data to enter new, non-adjacent industries. An unexpected effect arising from this is the potential provision of a well regulated market and banking system within economies marked by low trust, under banked consumers and incomplete financial infrastructure that may ultimately help emerging economies leapfrog underdeveloped sectors.

Figure 1

Source: "The Digital Ecosystem will reach US$1 trillion by 2015", Changing Engines in Midflight, Boston Consulting Group, Dec 2012

Entering New, Non-Adjacent Industries

While popular media focus[4] on the "Gang of Four"[5]—Amazon, Facebook, Google and Apple—as archetypal digital conglomerates, we think highly digitized East Asia[6] may have sharper examples to illustrate the changing nature of competition posed by digital conglomerates.

In contrast to the largely consumer and content-centric USA "Gang of Four", China e-commerce giant Alibaba successfully combines both business and consumer-centric digital platforms to become a major financial player challenging the state-dominated banking sector for consumer and business loan market share. Chinese consumers and businesses are monitored and mined for data on Alibaba-operated B2C/C2C/B2B and Aliloans payment platforms, to be credit ranked and financed by Alibaba *(Box 1)*. The Alibaba conglomerate is a huge concentration of market power e.g. its credit ranking system is superior to China's central bank, and Alibaba's lifeblood is data.

Box 1: China's Alibaba Group

Alibaba group operates some of China's most popular platforms (Alibaba and Taobao), supported by online payment processor (Alipay) and online loans (Aliloans):

- *B2B Alibaba (43% of China's ¥5bil SME B2B market, 2Q13 figures), B2C Tmall (51% of China's ¥179bil B2C market, 2011 figures) and C2C Taobao (90% of China's ¥595 bil C2C market, 2011 figures).*
- *The platforms account for 60% of parcels delivered in China, Taobao and Tmall account for more sales globally (2012 figures) than eBay and Amazon combined.*
- *Half of all online payments in China go through online payment processor Alipay.*
- *Online loans Aliloans has extended (July 2013 figures) more than ¥100 bil (US$16.3 bil) of online financing to more than 320,000 small online businesses and entrepreneurs.*

Alibaba has financial data on 80 million registered users who use its B2B platform, and 145 million users of B2C platform Taobao. The database also includes information from buyers' and sellers' utility bills, tax records and employment histories. This information, together with data from online payment processor Alipay, is converted into a credit evaluation system. The system shows the sellers' credit record, but more importantly, also help sellers get micro loans more easily from Alibaba's financing program (Aliloans).

From this data, Alibaba knows perhaps more than anyone about the spending habits and creditworthiness of the Chinese middle class, and millions of Chinese merchants. China Industrial and Commercial Bank's chief economist Lu Zhengwei has commented that Alibaba's database may be superior to the central bank's credit information system which only stores borrowers' credit records for the previous five years. Aliloans officers are able to approve or deny a loan within minutes, scanning an applicant's e-commerce transaction records before making a decision.

An example illustrates how the system works for businesses. A factory's growing energy consumption reflected in its utility bill (via Alipay) is combined with existing data of this factory in Alibaba's system

(e.g. the factory has booked more sales on Alibaba's B2B platform). The data is automatically processed to calculate the factory's default risk without any need for a human analyst. The factory's credit worthiness may be raised and Aliloans issues a loan offer. The turnaround time can be as fast as five minutes.

The NPL ratio is low (below 0.2%, July 2012 figures) because borrowers are afraid that missing payment to Aliloans would hurt their business on Alibaba's websites (there is a name-and-shame system). Aliloans' interest is around 18% (annualized) which is more favourable. Conventional banks may miss the data point from higher energy consumption because they still rely on labour intensive site visits that incur high manpower/time costs. Conventional banks are also not able to monitor the factory's performance closely over time.

Aliloans is expanding into consumer loans and insurance, in a joint venture with Tencent and Ping An, a Chinese insurer. While Aliloans acts essentially as a bank, so far the central bank has denied its applications for a bona fide banking license, also perhaps taking into account concerns raised by state-owned, conventional banks.

Source: Various[7]

Alibaba is not alone. Prominent Chinese digital conglomerate Tencent combines various digital platforms to drive users (700 million instant message QQ users and 400 million WeChat users, October 2013 figures) to its ecosystem of videogames and social-media sites where it makes money by selling virtual products, gaming fees and advertising. Tencent's 2012 revenue was US$7 bil. Tencent has recently applied[8] to PBOC to establish a private bank. Even if part of their user base converts into banking clients, it would establish a leading position in China's domestic banking industry. Baidu, another prominent Chinese digital conglomerate,[9] is also entering the financial sector despite meeting regulatory resistance.

Exporting A Walled-Garden Economic System That Works

The unexpected impact these Chinese digital conglomerates demonstrate is not that they enter seemingly unrelated sectors (one can say that too of Google and driverless cars), but that a well regulated market and banking system can operate within emerging economies marked by low trust, under banked consumers and incomplete financial infrastructure. Many emerging economies have struggled for years to get the necessary pieces of market and banking systems in place to jumpstart economic growth. Alibaba intends to bring its model international to the most promising low trust, under banked emerging economies[8] in Africa, Latin America and Asia. While Chinese foreign investment in basic infrastructure is laying the (literal) foundation for economic growth[9] in many emerging economies, Alibaba's model may help their economies to leapfrog underdeveloped sectors like retail, finance etc following the same pathway as in China.

Early signals of leapfrogging are available for online retail and payment platforms in neighbouring economies of Vietnam, Hong Kong and Taiwan. For example, e-tailing in China (which Alibaba accounts for a large proportion of) has reduced[10] overall retail prices, and raised retail sector productivity. Alibaba's recent entry[11] into the fragmented →

Vietnamese e-marketplace has helped lower costs though retail productivity improvement figures are unavailable. Alibaba already dominates the Vietnamese e-marketplace in terms of subscribers. An important future signal would be Aliloans taking off in underbanked economies like Vietnam, indicating a working walled-garden economic system. Alibaba's IPO is likely to help fuel a more aggressive international expansion.

Looking ahead, with the emergence of a string of digital ecosystems straddling from West to East Asia, connected and operated by one digital conglomerate like Alibaba, we may see a curious development where Alibaba company policies have just as much, if more, impact on regional economic development than policymakers i.e. the code embedded in Alibaba's digital platforms may be just as important as the text in a multilateral FTA such as RCEP.

In additional to China's Alibaba and Tencent, it is worth monitoring the emergence of other digital conglomerates such as Flipkart and Snapdeal (both from India) if they succeed in operating a similar walled-garden economic system within their not-so-well-run national economies.

What's Next?

Digital conglomerates are flush[12] with cash and on a buying spree domestically and internationally[13] to build out the next iteration of their business model. In the near to medium term future, early signals indicate digital conglomerates may move into adjacent sectors related to municipal transit and pedestrian traffic e.g. Alibaba has bought an online-mapping firm (Navi for US$300m) and is integrating[14] offline shopping malls with its online B2C platform; Tencent bought China's largest taxi-hailing app (Didi Dache) and Baidu is expanding Baidu map functions to include indoor positioning functions in collaboration with top Chinese commercial and retail property operators like Wanda[15]. If urban road traffic data and pedestrian data can be successfully combined within their digital conglomerates, Alibaba/Tencent/Baidu will succeed in another adjacent industry sector and emerge as potential kingmakers of urban commercial and retail properties. By itself, this is not a cause for alarm to conventional city planners and citizens, as long as there is access[16] to aggregated data and recourse to question the impact of algorithms that form "de facto" laws. But on a broader note, as digital conglomerates enter more non-adjacent sectors, this feeds an undercurrent of fear of excessive control by digital conglomerates to nudge and change consumer patterns, and larger societal patterns.

There is some irony here as pundits have once lauded digital conglomerates like Google as enablers of personal freedom to constrain the excesses of government. In the post-Snowden present, we see instead how digital conglomerates enable government excess. Successful digital conglomerates are here to stay. It would be shortsighted for governments and digital conglomerates if the relationship stays at a level of mutual distrust or worse, deteriorate into global data balkanisation.[17] Instead, we need to explore ways for policymakers to work with digital conglomerates to use their data/algorithms/platforms to raise sectoral competitiveness (e.g. retail), to strengthen exports and achieve other economic development goals. E.g. a banking licence for digital conglomerates may include provisions for real-time business and consumer data access to guide real-time economic policy tweaking.

By 2020, the power and reach of digital conglomerates will increase as more physical things get connected[18] into the Internet of Things. Policymakers may likely rely even more on digital conglomerates that have domestic and cross-border data, and the ability to analyse data, as a basic requirement to economic policy making, evaluating sector competitiveness, evaluating industrial land usage, evaluating future trade agreements and so on.

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Eddie has lived through several lives. Once he was a sociologist in university, now he's learning text mining. He's waiting to do his masters at the National University of Singapore.

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Seow How, the nerdy guy-next-door was a former engineer-turned-policy officer. He has diverse interests ranging from astronomy to history and autobiography. When not swimming and doing half marathons in his spare time, he whips up edible meals for his family and loved ones. He is now mining data in the private sector.

Manoj Harjani | manoj_harjani@mti.gov.sg
Manoj likes searching for ways to make big ideas digestible. In his spare time, he enjoys science fiction, post-rock and watching cricket.

Lee Chor Pharn | lee_chor_pharn@mti.gov.sg
Chor Pharn hasn't changed his mind. He keeps four animatronics butterflies for company.

Ong Hao Yi
Hao Yi thinks of the world as an optimization problem. Currently, he is a junior majoring in mechanical engineering at Stanford and making autonomous cars smarter.

Wang Ning
Ning is a geek. The type of geek interested in technology and innovation, the future of business, cross-cultural interactions and how socio-cultural changes unfold. He is now part of National Research Foundation's strategy team.

Lawrence Wong | lawrence_wong@mti.gov.sg
Lawrence is a pragmatic optimist and believes Singapore is the best country in the world. He enjoys connecting dots between disparate trends and imagining new possibilities. When not thinking about Singapore's future, he volunteers as a tutor, explores new destinations and pursues a single handicap.

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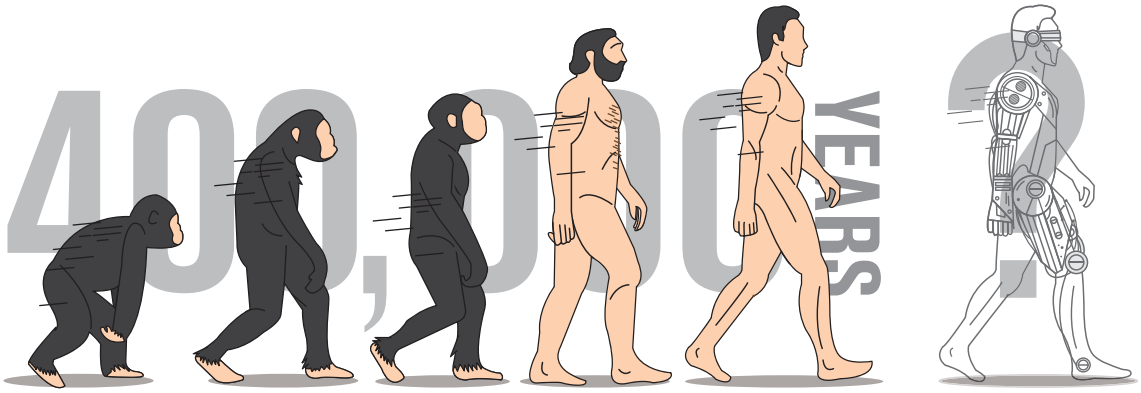
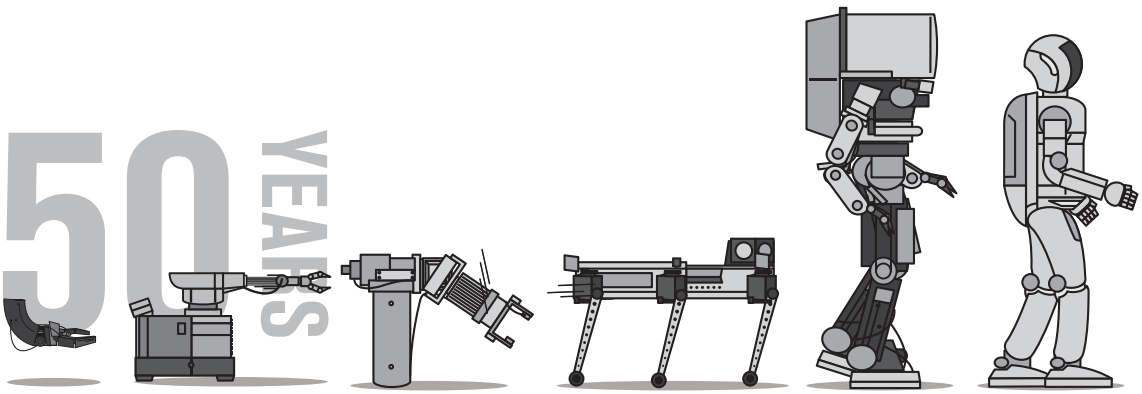
The Robots Take Over?

Homo sapiens took 400,000 years to evolve into modern humans. In merely 50 years, robots have gone from basic automated machinery to self-racing Audis, dancing androids, and legal advice software.

Low-skill jobs are being replaced by self-guided robots, and mid-tier knowledge work is being automated by machine learning programs. Unless we constantly upgrade ourselves, we will be quickly booted out from the race called survival.





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