The Future Economy:

Digital, Jobs and Education

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Ladies and Gentlemen

1. I am pleased to speak here today about the Future Economy and the impact on jobs and education. But at the same time I am quite apprehensive: talking about the future is always a challenge. The professor who taught me forecasting, used to remind me that there was only one certainty about forecasting the future: you are always wrong. Thus you will have to take my remarks with the appropriate grain of salt. You should see them more as stimuli for your own reflections and thinking than as accepted facts or wisdom.

2. The popular press is full of sometimes extreme and challenging statements. On my first slide you will see a few that come out of a recent study on the Future of Work.

Fast Forward 2030: The Future of Work and the Workplace

SMU
SINGAPORE MANAGEMENT UNIVERSITY

- *"50 per cent of occupations today will no longer exist by 2025 as people will take up more creative professions*
- *Workspaces with rows of desks will become completely redundant, not because they are not fit for purpose, but simply because that purpose no longer exists*
- *A growing proportion of jobs in the future will require creativity intelligence, social skills and the ability to leverage artificial intelligence*

➢ **True or Not, but change is coming**

I am always intrigued by that first statement that 50% of jobs today will no longer exist by 2025. It is true that many of today's jobs did not exist ten years ago: who would have thought in 2005 to be an Uber or Grab driver, to be a Big Data Miner, to be an App developer for iPhone (introduced only in 2007. Whether these statements about the creation of new jobs or the trend towards jobs with more creative intelligence are true, is frankly not that relevant. The point is that change is on its way. And we better prepare for that new reality.

3. In my speech tonight I want to focus on three themes: what are the drivers for this change? How will these changes affect work and workers in Singapore? And how do we educate our young and not so young people for this new world?

Drivers of Change

4. I will limit myself to four major drivers of change. The first one is the *influence of digital technology on jobs*.

5. Automation is not new. Technology has always destroyed jobs, but at the same time it created new jobs. On balance till today there were more jobs created than destroyed. But the type of automation that is happening today is different. Traditionally we divide tasks (and to some extent jobs) in four categories, determined by two dimensions: routine versus non-routine tasks and manual versus cognitive tasks. In short routine tasks are those that follow explicit rules that can be accomplished by machines, while non-routine tasks are not sufficiently well understood to be specified in computer code. Each of such tasks can be either manual or cognitive in nature. Historically automation has largely been confined to both manual and cognitive routine tasks, involving explicit rule-based activities. But automation is now spreading to domains and tasks that are non-routine. An example of that is computer assisted driving. Because this type of automation is very different from the traditional automation of assembly lines for example, I use the word "cyber"mation instead of automation to describe the use of intelligent machines and machine learning to replace humans in such non-routine tasks.

6. Two researchers from Oxford University, Carl Frey and Michael Osborne have attempted to calculate empirically the probability that particular jobs will be automated.   They worked on a list of more than 700 jobs.

The Economist, the London based political journal, published in early 2014 an excerpt from their research under the provocative title "Bring on the Personal trainers", because as you can see the probability that the jobs for recreational trainers, therapists, dentists or clergy would disappear is very low, while there is in the medium to long term limited opportunity for telemarketers, mathematical technicians, insurance underwriters, library technicians, clerks, umpires and referees, standardized engineering design, etc.

Probability that your job will survive
(The Economist 18/01/2014)

Bring on the personal trainers
Probability that computerisation will lead to job losses within the next two decades, 2013 (1=certain)

Job	Probability
Recreational therapists	0.003
Dentists	0.004
Athletic trainers	0.007
Clergy	0.008
Chemical engineers	0.02
Editors	0.06
Firefighters	0.17
Actors	0.37
Health technologists	0.40
Economists	0.43
Commercial pilots	0.55
Machinists	0.65
Word processors and typists	0.81
Real estate sales agents	0.86
Technical writers	0.89
Retail salespersons	0.92
Accountants and auditors	0.94
Telemarketers	0.99

Source: "The Future of Employment: How Susceptible are Jobs to Computerisation?" by C.Frey and M.Osborne (2013)

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7. This is to some extent an illustration of the paradox that Moravec formulated in 1988: "it is comparatively easy to make computers exhibit adult level performance on intelligence tests or playing checkers,

and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility." Frey and Osborne concluded that the jobs that would be difficult to "cyber"mate require three characteristics:

a. Either they are about perception and manipulation in an unstructured environment, e.g. as a construction worker on a difficult construction site
b. Or they require a high level of creativity and intelligence, e.g. as the job done by a designer
c. Or they require a high level of social intelligence, e.g. for clergy or professional recreational trainers.

Others have also argued that computers have difficulties with jobs that require values and ethics, though some have argued that you can program values in decision-making.

Have you already asked yourself whether your job falls in one of these categories? Because if it does not, your job may well be cybermated in a relatively short time.

8. Let me turn now to the second driver: *what if we all live up to 100 years*? This is not such an improbable future-focused statement. Indeed, 50% of the babies born today in the UK will live to 103 and this increases to 107 for Japan. Singapore is closer to Japan than to the UK. And it is not just babies that are likely to reach the age of 100.

If you are 60 and have not suffered any serious health concerns, you are well-positioned to reach that 100. What will this demographic trend mean for the world of work? Lynda Gratton and Andrew Scott from London Business School have spent quite some time on this question and they have come to the conclusion that gradually we will work till we are 80. And they also observe that the marginal value of money becomes less important for those above 55 to 60. These elder workers and employees are more interested in what is a "good" job: one that stimulates you, offers opportunities to develop yourself and is non-routine (in order to avoid to be cybermated!).

9. My third driver is that we see a ***gradual obsolescence of the traditional organization***. We may not realize this but the hierarchical, somewhat pyramidal, organization that we are used to, is actually not so old. Its roots probably date back to the mid 1800's, and its current form was firmly established in the late 1920's with the creation of General Motors. Without going into details, these organizations exist to reduce transaction costs. It is a very simple statement, but so powerful that Ronald Coase received the Noble prize for it in 1991. Economists and organizational theorists have often wondered why large organizations actually exist and why they are not replaced by markets in which we would trade with each other for our respective skills. Coase and others have shown that such markets would entail a lot of transaction costs, and therefore we are better off working in organizations which are determined by rules and procedures. But the interesting evolution is that thanks to internet and the pervasive availability of information without geographical or organizational boundaries, transaction costs

have gone down considerably. And as one could expect we see to some extent the demise of the traditional large organization and the emergence of new forms of organization e.g. the human cloud, platform organizations e.g. Uber, Airbnb or Taobao (Alibaba).

10. The fourth driver I want to mention here is ***the shift of the economic point of gravity to East Asia***. I don't need to convince you of that. But I want to show you a table with the size of the middle class, as estimated by researchers from the Brookings Institution in Washington, in 2009, 2015 and 2030. The conclusion is simple: middle class will grow and will live and develop this side of the world. -- And that has significant implications. Yes, consumption will grow here, but more importantly, it is well known by scholars of innovation, that the middle class is the source of innovation: middle class people provide ideas for innovation through their consumption patterns and preferences. This opens up incredible opportunities for innovators and entrepreneurs in Southeast Asia who are prepared to embrace the region.

The size of the middle class (Kharas 2017)

Figure 4. The size of the global middle class, 2000, 2015, and 2030 (billion people)
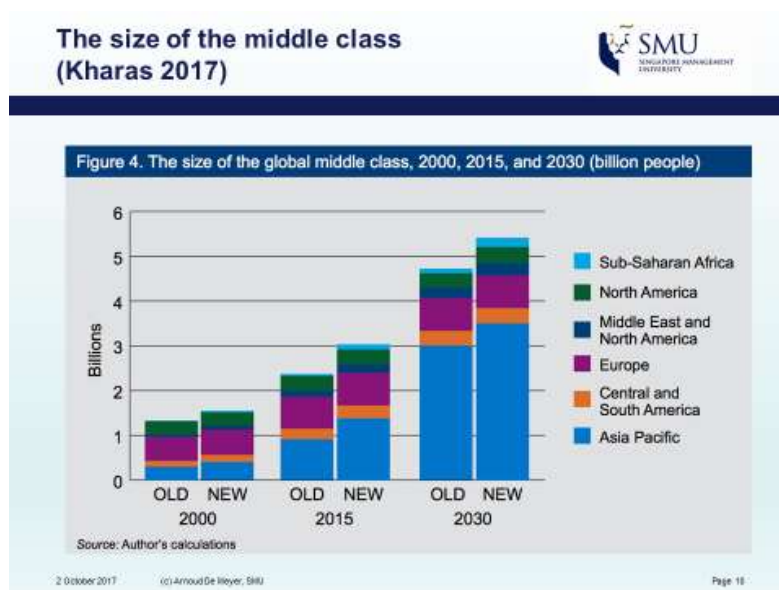
Impact on Work

11. What is the impact of these *four drivers on work and the workforce*? I have already indicated a few evolutions while I was talking about them. But let me summarize them in *7 statements*.

12. I have indicated the risk of automation of non-routine manual and cognitive tasks. These are usually the tasks and jobs carried out by mid-level skilled workers, i.e. many of the students we train in the polys and the universities. Frey and Osborne have calculated for the USA how many jobs risk being "cyber"mated, or computerized as they call it. Their observations are scary: they calculated that in the USA 47% of the current jobs have a high probability of being computerized and 19% have a mid-level chance of being computerized. ***Two thirds of all current jobs can disappear in the next 15 to 20 years***. And these are good jobs, like jobs in transportation and logistics, office and administrative workers, retail. These scholars provide as an example that already today the market for personal and household service robots is growing by 20% per year. And we all know that retail sales jobs, which are often expected to require a relatively high level of social intelligence, are rapidly replaced by online sales. Or even jobs on construction sites, which do require a capability to manipulate in an unpredictable environment, are rapidly replaced by pre-fabrication of building elements in automated factories.

13. A second consequence is the emergence of what we call *"co-botization"*, or the co-existence of people and intelligent machines. You may have seen pictures of robots in automated assembly lines or even have had the opportunity to visit some of such factories. You may then remember that in many cases such robots are behind fences, because they could be dangerous for humans. But we see now a lot more investment in the co-existence of humans and intelligent machines. And this does not happen only in factories. Take the example of a design engineer in construction or mechanical engineering. 95% of what these engineers used to do is now taken over by sophisticated Product Life Cycle Management Systems and vast databases of design suggestions in the cloud computers. But the real edge in innovation comes still from the creative and innovative design that a human being, stimulated by what is available on the cloud, can propose. It is the interaction between human beings and intelligent machines that lead to innovation.

14. A third consequence is that we will see *alternative forms of organization*. I mention on the slide only two of them:

15. The first is the human cloud, i.e. the vast group of individuals who offer their capabilities to the highest bidder over the web. Often their location, whether it is Manila, London or Buenos Aires, does not matter: they provide their services over the net. Companies are gradually converting to this and are starting to chop up white-collar jobs into hundreds of discrete projects or tasks, then scattered into a virtual cloud of willing workers who can be anywhere in the world,

so long as they have an internet connections. Some of these tasks are simple e.g. typing data into a spreadsheet. Others are complex such as producing a piece of software code or completing a short term consultancy project. The common element is that these are not jobs but tasks, performed by remote and on-demand people who are independent workers. The most visible of these human clouds are of course Uber or Grab, transport companies without own taxis, Airbnb, a hospitality provider without hotel rooms, or Alibaba, a distributor without warehouses. But the movement towards this new cottage industry, organized by platforms is much more pervasive than these broadly published examples would suggest.

16. The Financial Times had a "Big Read" article about it and they published a few interesting statistics about both the price per hour paid for some specializations, as well as the growth and decline in individual specialisms. As you can see IP law still attracts good pay, but also voice talent or Korean translation. What is perhaps more interesting is that there is a rapid evolution in the demand for specialisms, which is illustrated in the second set of statistics.
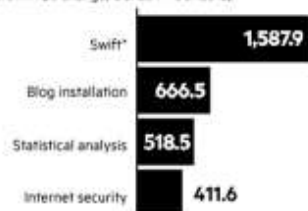
Selected average hourly rates
By task ($)

Task	Rate
Intellectual property law	121.73
Voice talent	56.78
Internet security	51.39
Korean translation	49.32
Book cover design	32.51
Financial modelling	32.46
Corporate taxes	31.90
Data science	29.58

Source: Upwork

Selected individual specialisms
Growth (% change, Oct 2014-Oct 2015)

Specialism	Growth
Swift*	1,587.9
Blog installation	666.5
Statistical analysis	518.5
Internet security	411.6

*Programming language for the Apple ecosystem
Source: Freelancer

Selected individual specialisms
Decline (% change, Oct 2014-Oct 2015)

Decline	Specialism
-14.5	Advertising
-14.7	Bulk marketing
-21.9	YouTube
-24.6	Bitcoin

Source: Freelancer

17. A less extreme example of the evolution of work is the potential rise of international tele-commuting. Working from home has a number of advantages, e.g. less time lost on transport to and from the workplace,

a better integration with the family life and the education of kids. It is not considered universally beneficial to the productivity and there are quite some detractors. But in some cases it has real advantages, in particular when companies work with international teams in different time zones, and where tasks and projects are handed over between employees in Europe, Asia and the USA.

18. I have provided these two short examples of new forms of organization. I am not sure how successful and important each of these will be in the near future. But I am sure that the relationship between an employer and the employee will change drastically over the coming years.

19. On my next slide on the impact on work and the workplace I have provided a few more consequences of the drivers for change. Perhaps they are less new or surprising but they remain strong imperatives for the future:

    a. As routine and non-routine tasks get automated, cybermated or computerized the *future worker will need to be more of a creative innovator* than she used to be. Our educational systems will have to emphasize more and more the need for creativity and innovation

    b. As I mentioned earlier we will have to think more about *what a good job is*. I referred then to Lynda Gratton and I want to repeat her comments that a good job is not only one that is well paid,

but also one that is interesting, with development potential and that is sufficiently non-routine to be sustainable for a quite a while.

c. Even in middle income economies here in Southeast Asia, we also have to constantly ask ourselves whether the current jobs are **'off-shoreable'**, i.e. whether they can be moved to India, Vietnam of Indonesia. Frankly speaking many jobs today are of such nature and can be off-shored and they will only stay here if we carry them out in a more productive way than elsewhere.

20. I want to finish this part of my speech by thinking about the design of jobs for elderly people. That may not be a problem for the Philippines but it is an issue in Japan and Singapore. As I mentioned, many of us have to be prepared to work till we are 80. We will need to think how we keep ageing people in high value added jobs. While we may argue that 60 is now the new forties, we all know that when we age we lose some physical or mental flexibility, we may not be as good anymore in lifting heavy items, or cannot stand the whole day in front of a class. It may well be that we need to customize jobs to our life cycle. There are some very interesting experiments in Germany and Japan that actually show that with a minimal investment employees above 60 can be as productive on a production line as those in their thirties. One of the well published examples is that of BMW where a group of 60 plussers redesigned a production line to adjust it to their capabilities. It did not require a big amount of investment to reach a similar productivity level as lines manned with younger people:

a few tools to help them lift up items, a few well designed stools so that they could perform their tasks while sitting, etc. The message that comes out of these case studies is that **it is possible to redesign the work environment to render seniors as productive as their juniors**.

Implications for education

21. I have now come to the third part of my intervention: what does this entail for our current students. I will do this in six brief statements.

22. My first observation is that due to the interaction of our students with technology they are different from what you and are used to be. Therefore the way we educate them has to change dramatically. We can argue that our students are actually different: they learn differently and act differently because of their entanglement with new forms of information and communication technologies. ***The student who is always connected, who has access to an overload of information, who wants to express freely his or her opinion on blogs, who combines living in virtual and face to face networks is a different person*** than the one who went to lectures to take notes, who studied from printed textbooks and wrote letters. If we accept this hypothesis we need to look for *a different learning paradigm that optimizes the learning of this new student*. This requires a deep reflection on how we organize the learning environment for the student. At SMU we are strongly engaged in experimenting with an environment that takes these differences into account and under the heading of SMU-X

(X partially because we are confronted with uncertainty, but also X because of eXperimentation, eXploration, etc.) we have designed a series of new courses and learning experiences that bring the real world into the classroom.

23. Secondly we need to prepare our students for a professional life that will not be a sequence of jobs, but may well be a ***portfolio of careers***. A typical professional life may be longer, and some of the jobs we are currently performing may disappear over time. Therefore the sort of linear progression that was typical in current organizations may well be replaced by a life over which we have actually different careers, no doubt interspersed with gap years, sabbaticals, continuing education, etc. In fact, and as usual, individuals adapt much faster to these new trends than organizations, institutions and governments. More young people are embarking on explorer phases, trialing different professions, and experimenting with different forms of entrepreneurship before getting started on the career ladder

24. Thirdly such a portfolio of careers may require a different approach to education, in particular higher education. Stanford's Design Centre recently made an exercise to imagine Stanford by the year 2100 and asked the participants to look back at 2015. What they argue is that in the coming years we will see the emergence of an "open loop university" in which students do not anymore receive a standardized four year college education, front-loaded at the beginning of

adulthood, but a lifetime of learning opportunities. They propose a system whereby a student would have a flexible 6 years of study over a lifetime, where knowledge is obtained across classrooms and practical settings, and where seasoned adults return to pivot careers and reconnect with the university community. And there would be no alumni anymore, but only constantly returning students, which they call "populi".

25. Fourthly the *opportunities in South East Asia are limitless*. But we need to prepare our young people for the cultural and infrastructure shock that they will experience when they engage with the neighboring countries. Our young students need to globalize their view of the world and remain open to the differences. That also means they need to be able to communicate with citizens from other countries. Language skills are thus very important.

26. The attractive jobs of the future will be those where we deploy our creativity and EQ. Therefore we need to prepare young people to be good at being creative and interacting with people. I am not arguing that we don't need "hard" skills. Physics, maths or biochemistry, finance and economics will remain important. But there will be a higher need for soft skills, and the ability to communicate.

27. Finally the previous four observations, if implemented, will create a lot of stress. I feel it is our responsibility to prepare our students for a world with high stress levels, with tough requirements to act speedily

and where we have to be very flexible. Perhaps some of us like jobs from nine to five, with very clearly defined targets, and well established procedures. Sadly those jobs are going to disappear, they are going to by cybermated. Innovation, creativity, social intelligence, productivity pursuit…, ***it will all require more resilience***. We need to mentally prepare and groom our students for such a world.

Ladies and Gentlemen, I told you that I don't have a powerful crystal ball, and that my predictions for the future may well be far off. But I hope I have given you some ideas of what I think the future of work and the workplace in the world can be.

[By coincidence the 4 drivers, 7 implications and 6 recommendations form the number 476. For most of you this does not mean a lot, but for a Western European this is a date we had to learn by heart, since it was the fall of the Western Roman Empire to the Lombard Kings. In our old history books that date marked the beginning of the Dark Ages. I truly hope that the suggestions that I made today will not be the start of a dark age in terms of employment in South East Asia, but rather the start of a rosy future, one that we can make together.]

I am grateful for your attention.