Leading in a Digital World:

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Canada is winning the digital race. Although we are concerned about our productivity and the ability of our largest corporations to remain competitive, we are actually doing very well in digital. Over the past few years, Canada has been recognized for it's digital capacity. The Waterloo – Toronto corridor is ranked as the second largest ICT (information communications technology) cluster in North America and one of the top ten places in the world to start a company. We are the most significant alternative to Silicon Valley.   Multinationals have recognized this. Recently, the Prime Minister welcomed Thomson Reuters back home to Toronto and earlier General Motors, CISCO, Microsoft and Google have all made major investments in the Waterloo – Toronto corridor.

We are building a strong eco system with domestic corporations. CGI, from Quebec, has more than 60,000 IT professionals and is one of the largest firms in the world that deploys digital solutions in every country. Open Text, a University of Waterloo startup is one of the largest software companies in the world.   Constellation, Enghouse, Blackberry, Descartes, Shopify, and Hootsuite and the Communitech, DMZ and MARS incubators have thousands more startups coming up. That is quite an achievement.

Our private sector has created digital capacity. However, our public sector may not be moving fast enough to keep pace.   There are productivity challenges in education, healthcare that no longer exist in the private sector. Future governments may not be able to govern effectively and remain relevant to society.

As a country, Canada is winning the digital race but we need to do more.

Digital has transformed our lives mostly for the better. However, Digital may have negative impacts in the long term.

What happens in a society where many people can no longer work for value? How do we achieve inclusive growth then? Some Digital observers question whether our very survival as a race might be eclipsed by a new race of machines that we created. That is profound.

Do we really understand the changes that Digital is driving in society both here in Canada and throughout the world? Do we understand the implications when the brain of a millennial is physiologically different than that of their parents? Something that once took tens of thousands of years of evolution to shape has been modified in one generation. That has never happened before. That has implications. For one, our education system has been organized for a different type of human brain.   Let's consider these implications in terms of the major public policy issues that face Canada in the economy and in society.

Let's start with our economy. The world is in a global race of innovation. This year at the World Economic Forum in Davos, the next technology wave was considered as the fourth industrial revolution. It is estimated that we will grow from 5 billion connected people to 1 trillion connected devices within 10 years with a combined computing ability that will surpass the human brain within 5 years.   Digital has a possible negative economic impact: massive unemployment in some

sectors. If you are a truck driver, a taxi driver, an uber driver, even a banker, an accountant, a lawyer, all of these jobs might be eliminated in the next 10 years by Digital Analytics. We are now automating so many jobs that there is now a race between the old ones being replaced by machines and new ones being created by new capabilities. So far, humanity has been able to take advantage of these productivity improvements and create better quality of life and standard of living.

But something is changing.

Our ability to create those productivity improvements and benefit society has slowed down and in some cases reversed. Why? It may be that in this next Fourth Industrial Revolution, the machines are thinking so fast they are moving beyond our capacity to keep pace and thus we are losing the race to remain relevant. This is the opposite of the Model T Ford effect of the last century.

If you recall, Henry Ford made history by selling a low cost automobile, the Model T Ford that would be bought by the very workers that were building them and this created a virtuous circle that lifted the quality of life for the middle class in America and this pattern was soon repeated elsewhere.

The problem with digitization in its current form is that we are not replacing the lost jobs fast enough. We are not organized to retrain our human employees on the scale and the speed required. We need to think about that more deeply while we still have time.

Our creativity is currently the last vestige for humans contributing to the overall productivity of society. We cannot just be consumers of the goods and services that machines produce but rather we must also produce something or the virtuous circle first created by Henry Ford as the economic pillar of our modern society will be forever broken. This has profound implications for social order across the world. Recent elections and polls indicate the unease throughout society. Our modern economics will require a re-think in terms of the distribution of wealth and the balance and value of work in our consumer society.

Consider another aspect of our economy and society: infrastructure. This usually means the creation of jobs and better and safer roads, railways, bridges and so on.   This is a well known method for building our society and we have a great history at doing this in Canada. But, have we modeled the impact of the sharing economy and the driverless automobile? This may have a dramatic <u>reduction</u> on our need for infrastructure as we may take current road utilization and quadruple it thereby creating a "holiday" for road building for decades right at the same time that we seek to build it out.   As we use more of uber and airbnb type services we may find that we have a radical reduction in our demand of infrastructure. We should think about this carefully before we spend $1 Trillion over the next decade.

Indeed, the very best societies may wish to consider the virtual infrastructure that we will need for the Fourth Industrial Revolution. We know for instance that if you have a 3D printer (a printer that creates objects instead of documents) and an internet connection, you don't need to move goods around since this will be on demand and you don't need to have an elaborate warehousing and transportation system. We also know that we may have drones that will effectively fly your product to your door or a self-driven truck will deliver them.

The world will be a different place.

Let's think about the infrastructure that this new digital world would need and look forward and not backward. It's actually very simple. It needs communications with a LOT of bandwidth.

Think about infrastructure but this time digital infrastructure. Let me give you an example of how another nation state approaches this issue. A 5 MB communications network is what you needed to livestream something from Netflix on a TV. But countries that are concerned with productivity invest in much faster networks at the 1 GB level since cities need to be able to receive a 3D printing file from a city on the other side of the world to remain competitive and that requires the latest in computers, software, and 3D printers.

Connectivity is everything. Recent consumer research indicates that Millenials rank WIFI as just as important as food and shelter! Wow.

The Millennials need WIFI for the connection to the other part of their brain: the Internet.

Consider the impact of digital on society. Communications is at the core of digital infrastructure and if we define our needs solely as consumers, we are then hastening our demise as producers. We must keep up or be rendered non-competitive and thus irrelevant in the global economy. We need to imagine the future digital world when we plan but the conclusion is simple: low cost high bandwidth is an essential public good for any future society. We must recognize that digital infrastructure is a key factor in our future productivity as a nation.

Despite the fast pace and dramatic impact of the past few years, one can only foresee that the pace and impact are about to substantially increase and perhaps occur as a step function rather than a geometric progression. This is due to the shift from human intervened data collection and analysis to machine generated collection (FitBit, Apple Watch, Internet of Things) and machine generated analysis (robo advisor, high frequency trading, digital doctor). This shift has already happened in other industries (automated welders for example). We are moving to one Trillion connected machines. That is a stunning number. The world will be forever changed.

Many of our leaders are now leading the first generation of Millennials or Digital Natives. They are the kids that grew up with the Internet similar to the way the previous generation grew up with TV. As many parents will tell you, these kids appear to not be able to remember anything and also appear to be doing too many things at once. Guess what? Those observations are correct and supported by research that has been done into their brains. In California, researchers have been conducting CAT scans of digital native brains and they have found that the areas of the brain associated with memory are diminished while the area of the brain that "networks" between the right and left sphere, is enlarged. So, you are not imagining these traits, they are real and supported by actual physiological changes to the brain in digital natives.

After hundreds of thousands of years of brain development over tens of thousands of generations, in one generation we have made a massive impact on brain function. That is an acceleration like we have never seen before. That is profound and demands our attention.

What is behind this? Well, it's the impact of machines. Smartphones are just personal machines. The brain of a digital native is just efficiently handing over the memory function to a machine and

concentrating on the integration of information rather than just the storage of data. This has a huge impact on how we train and lead our next generation as they are not like us. If we force them to memorize things as we did, they will soon quit and go to somewhere more suited for their abilities. No wonder Millennials consider WIFI an essential need.

Now we know why many of them have such difficulty with their education as the courses they take rely on human memory without machines. The education system was developed for our brain, not theirs! How disappointing that must be for a digital native to realize, as they get older. There wasn't anything "wrong" with them they were just different and the system had not anticipated their lack of capability nor their enhancements. Unfortunately, this first generation of Digital Natives will just have to endure this! They are the digital pioneers and set the tone for all that follow. Millennials must drive the change in the education system. As the Millennials go through stages of their career this will happen again to them. The Millennials are the signpost generation and they are one of the most important generations in the history of human evolution. Probably on a scale with the first humans that walked out of Africa.   The "wearable" internet devices will get smaller to the point where they will be implanted into them and their idea of privacy, consciousness and social media will evolve in a way that none of us can predict. It will happen in their lifetime.

The innovation of machines also has an impact on governance. Remember the movie Terminator? The Cyberdine Systems machine became self-aware and then destroyed humans in order to protect itself. Sound farfetched? Think about what happened in the financial industry five years ago. It had a "flash crash". This happened one day when the nanosecond trading algorithms on bank computers decided that the market would go to zero and they all started automatically selling. The problem with machines is that they can operate much faster than we can. A nano second trade can make 1 billion trades within one second. We humans are lucky if we can react within one second to a complex situation. Think about that. 1 billion trades for a human is the equivalent of 32 years! A group of machines can do 32 years of trading before we humans are even aware of what they are doing. We have to think long and hard about the governance of that.

Time is getting short to react.

The impact of digital on our society will happen faster than any one of us can imagine.

The PACE of Innovation is very deceiving. Most of us believe that growth and change occurs in a linear fashion. So what happened in the last 5 years will be about the same as what will happen in the next 5 years and so on.   In fact, it does not. Studies show that the pace of innovation is geometric. In other words instead of 1,2,3,4 we are increasing the way we do things as 2,4,8,16, and so on. You get the idea. We don't notice change when it is early such as 1,2,3,4 but what about later when instead of step 8 on the linear scale we are now at 512 on the geometric scale!

We as humans have met these challenges before. We must be aware that a machine has had 1 million chances at thinking about something compared to each single chance we have. Our public policy must move from specific rule of governance to principles that are technology and time invariant.

What are the opportunities for Canada?

Although the digital agenda is daunting, we have many advantages as a country and we can lead the world with a nimble digital strategy for Canada. We must make digital a focus for our country the same way we did Youth or the Environment and that we create a Digital Department of the federal government and encourage the provinces to do the same – complete with a digital minister that has a seat at the cabinet table.   For example, Ontario recently created the first ever Minister of Digital (Deb Mathews).

We will find benefit in the following areas:

Our millennials that are getting frustrated will have somewhere to go to help them cope. A dedicated department would attract the best and brightest in digital since they would see a clear mandate and ability to make a difference.

Our citizens and our corporations will have somewhere to turn when they are dealing with out of date services from our Government. This department would help shape new legislation that would be principles based so that it would not be outdated by technology changes.

Now, creating another department is not a panacea. But what choice do we have? If we don't overcome these challenges and change for the future what legacy will we leave behind?

Canada is winning in the digital race so far but we must continue to pick up our pace if we wish to remain relevant in the digital world. Having a digital department can help prepare us for the enormous changes that are coming. That would give Canada a true competitive advantage for the dramatic changes to come.

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