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Chair

Mr. David Sweet

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● (1105)

[*English*]

The Chair (Mr. David Sweet (Ancaster—Dundas—Flamborough—Westdale, CPC)): Good morning ladies and gentlemen. *Bonjour à tous.* Welcome to the 50th meeting of the Standing Committee on Industry, Science, and Technology. We continue our study of disruptive technologies.

We have some great witnesses today. First off, from CEFRIO, we have Jacqueline Dubé, president and chief executive officer. From IBM Canada, we have Patrick Horgan, vice-president of manufacturing, development and operations. From the University of Waterloo, we have Pearl Sullivan, dean of the faculty of engineering. Finally, as individuals, we have Claude Gagné, and we have Bettina Vollmerhausen, co-founder of the Ottawa Tool Library.

Colleagues, I normally follow the agenda that you have in front of you, but because we have two presentations that will be on the computer, we need to synchronize them after the first presenter. I'm going to change it up so that you're not confused. Maybe I'll just tell the witnesses as well.

We'll begin with CEFRIO. Then we'll go to IBM, then to Ms. Gagné and Ms. Vollmerhausen, and then to the the University of Waterloo with Ms. Sullivan last.

I apologize. It's Dr. Sullivan. Is that correct?

Dr. Pearl Sullivan (Dean, Faculty of Engineering, University of Waterloo): That's fine.

The Chair: Well, we should give honour where honour is due, I think.

We will begin then. I believe the clerk has told you that you have six to seven minutes. Please stay within that, if you could. Then we'll have a round of rotating questioning after that.

Please, Ms. Dubé, begin.

[*Translation*]

Mrs. Jacqueline Dubé (President and Chief Executive Officer, CEFRIO): Good morning, ladies and gentlemen. Thank you for receiving me today.

I will try to stay within the six or seven minutes that I have, but since I am a little passionate about the subject, I might go over time. Please signal me if that is the case.

CEFRIO is a centre that supports research in social and organizational innovation. Simply put, we research and assess how technologies are used and implemented. We work with 80 associate researchers on how to change the ways of doing things using digital technology. We work in all industry sectors, whether in health, education, or with SMEs, in the transfer of digital competencies, for example.

For over 25 years, we have developed a research model that makes it possible to work systematically on the ground, that is, directly in companies, hospitals and schools. The transfer is continuous. Every time new knowledge is created, it is systematically integrated into the work process and professional practices. As a result, no change management is needed subsequently.

The researchers are experts in the area of the project we are working on. They need to stick to the expected “deliverables”, not to do broad research. We like to say that we have researchers who find, not just researchers who research. We have a network of experts and everyone works systematically together.

Today, let me give you our definition of the word “digital”. For us, digital technology is the Internet, the Internet of things, 3D printing, big data, the advanced manufacturer. When we talk about digital technology, we refer to all those aspects, not just the information and communication technologies.

I really like the two photos on slide 4 of the presentation. In the top right image, from the election of the pope in 2005, we can see only one smartphone. Eight years later, at the election of the new pope, what we see is not candles, but smartphones. Those photos show us the speed of the changes coming our way in the next few years.

The concept of disruptive technologies is captivating, because all these technologies are disruptive to the extent that they require a complete overhaul of the business models that companies have. They are very demanding for a simple reason: they require organizations to have a capacity for innovation.

The fascinating part is that citizens, users and consumers adapt very quickly. However, there is a problem. The digital competencies of individuals are not being used in businesses or institutions, which has a significant impact on Canada's productivity and development. The main reasons that explain this difference between citizens—

[*English*]

The Chair: I'm sorry to interrupt. Excuse me.

There are two things I should have mentioned beforehand.

When we're in process there are no photographs allowed, and your illustration with election of the popes reminded me that I should say that.

The second thing is, do all of you know you have an earpiece for French and English beside you? If you want the interpretation, it's there. Maybe you're all bilingual, because I didn't notice anybody who had their earpiece in. You can use that. On your microphone, you have the ability to go from floor to English to French.

[*Translation*]

I'm sorry for the interruption. You can continue.

Mrs. Jacqueline Dubé: No problem. Thank you.

Here is what mainly explains such a big difference between individual users and companies. We are seeing a real lack of financial capacity in SMEs; it is a reality. However, the main obstacle is organizational, in the sense that there is a resistance to change and to transforming the work process.

When we talk about digital skills, we are not talking about how to use a computer or tools but about how to transform what we do so that the technologies are effective. A major problem, whether in the private or the public sector, is that senior management has generally become more accustomed to outsourcing this responsibility. So little leadership comes from senior management in terms of adopting digital technology.

It must be said that developments in this field are moving very fast. Revolutions used to take place every 100 years. Now they happen every three years. Because of technology, things change very quickly.

The reality is that growth is exponential, which has a direct impact. This partly explains the delay in productivity in Canada. In terms of the GDP, there is a difference of $13 less per hour per employee in Canada compared to the United States. This is a very significant difference. This challenge with productivity will become more pronounced for a very simple reason. It has been shown that productivity is enhanced by the use of digital technology. The U.S. spends $100 per worker whereas Canada invests $53. As a result, the gap between the level of productivity in Canada and the U.S. will widen further if no prompt action is taken to adopt digital technology.

We often wonder what the government's role could be in this situation. Actually, the government must act more as leader or a mobilizing force. It has been shown that subsidies will not move things forward, but rather targeted initiatives supported by the government that are very well documented and demonstrate the benefits. These initiatives are supported by what is called a generalized approach. We can sort of compare generalization to commercialization.

I have only one minute left. There are several pages you can read for yourselves.

On the next slide, you'll see some examples I will not discuss. I will simply say that these are areas we are working on in terms of adopting digital technology. In the health sector, for example, we are working with doctors and pharmacists. Patients have their own personal health records. It takes a year or a year and a half for a clinic to accept the transformation of the work process and to take advantage of all the benefits that digital technology has to offer. In transportation, it's fascinating. Montreal loses $3 billion a year just because people are stuck in traffic rather than working. This gives you an indication of how digital technology can transform those aspects. You can check that on the slides.

Later on, I compare the data on usage in Quebec and Canada. We can say that Canadians are Internet and technology users. It's the same for Americans. From the perspective of its citizens, Canada is the second best in the world in terms of the use of digital technology, but for companies, it ranks 22nd. That too is quite a significant paradox.

● (1110)

[*English*]

The Chair: Madam Dubé, *merci beaucoup*.

[*Translation*]

Mrs. Jacqueline Dubé: I'm sorry I was not able to give you more information, but I will be able to answer any questions you may have.

[*English*]

The Chair: To the witnesses, by the way, if you don't get through all of your opening remarks because the time runs out, as we go through the questions, you can sometimes add those facts in response to the members' questions.

Mr. Horgan, please.

Mr. Patrick Horgan (Vice-President, Manufacturing, Development and Operations, IBM Canada): Mr. Chair, it looks as if the IBM person here is going to be the lowest tech person on the panel, but there you go. I'll try to make this succinct so I can get within the timeframe.

Thank you very much, Mr. Chairman, and members of the committee, for this opportunity.

As you know, IBM is one of the country's largest private enterprises in R and D, and Madam Dubé was pointing out how others maybe should do as much. We try to do a lot. We've spent $4 billion in R and D in the last 10 years and $500 million in collaborative investments. I want to tell you a little bit about that this morning. I'm going to talk about two different dimensions of disruptive innovation.

The first is it's happening to the IT industry itself, and I'll talk about that. The second is how this R and D in commercialization is a bit of the issue that we were just talking about and how we are trying to make strides to make that better in Canada.

Let's talk about the IT industry itself. Analysts are pointing out quite often that Uber is the largest taxi company in the world but owns no vehicles. Facebook is the world's largest content provider, but it has no content. Alibaba is the largest retailer, but it has no inventory. Airbnb is the largest accommodation provider and has no rooms, no real estate. Each of these examples is an example of disruptive innovation. They are rapidly transforming traditional industries, and there are more examples coming.

It's important to understand that these disruptive business models, whether you're discussing Airbnb or Uber, are enabled by a specific set of technologies and increasingly, technology services that are now broadly available to both large and small businesses alike. Let me explain five.

First is cloud computing. It enables anybody with a credit card to sign on to get a full range of computing resources from infrastructure to business processes to software to applications, all consumed as a service. It means no large capital investments are required and even a very small business or someone in a garage can access world-class computing.

The second is mobile platforms. Cloud-based services now allow everything to be delivered to your handsets, to your iPads, or to your PCs anywhere you are. We've noticed that even though we're out of the PC business, it's very important to us to see the iPad has IBM on it, because we're very linked now with Apple in terms of our ability to use their very nice devices and our ability to understand the enterprise and put the two together.

The third is social networks. There are nearly two billion users of social networks creating oceans of data across a vast range of issues. Harnessing that evolving ocean of data would not only facilitate real-time feedback loops, but also anchor predictive capabilities. You'll hear us talk a little bit more about that.

Fourth, especially with the government, is security. Cybersecurity is as important in today's economy as vaults were to protecting gold and currency in years past. Whether it's protecting commercial secrets or sensitive personal information, managing and measuring access to the consumption of data and digital products is paramount to ensure value in today's data-driven economy.

The fifth is analytics. Make no mistake, we're living in a data-driven economy. A full 90% of data in the history of humans has been created in the last two years. That is continuing to grow. However, these large datasets really require understanding and deriving knowledge from them. That is really the secret. What we're talking about now is how to get those tools in front of everyone so we can get on top of this new data and knowledge economy.

I'm sure this committee will hear numerous disruptive business models and technologies, but I'll venture to say that many will be included or be enabled by secure cloud, mobile and social platforms with a strong component of big data and analytics. That's why we're investing so heavily in these areas.

It's a good segue to the second part of my discussion, world-class research, development and commercialization of disruptive technologies that's taking place in Canada.

Canada has a tremendous competitive strength, including the five technology areas I just described, and I hope to illustrate a bit of that with one of the projects we're working on.

Specifically, I'm going to focus my comments on the southern Ontario smart computing innovation platform, known as SOSCIP. It's an excellent example of how government, business and academia can collaborate to stimulate made-in-Canada disruptive technologies and the new companies and jobs that these technologies can support.

SOSCIP is a consortium between IBM Canada and seven research-intensive universities in southern Ontario—Pearl is from one—with financial contributions from the federal and provincial governments. The foundational idea behind the creation of SOSCIP was that Canada could lead the world in development of disruptive technologies as we establish a dedicated world-class technology platform to focus our efforts in areas of national and regional priority.

● (1115)

In turn, SOSCIP put Canada's fastest supercomputer in place, as well as the largest analytics cloud in the world. With that platform you now have the ability to tackle the toughest and most complex challenges in the areas of health care, energy, water, and cities. This initiative represents an investment of over $200 million, of which 85% came from IBM. Access to this platform is governed by the consortium members with specific focus on producing commercial outcomes. In turn, we proactively bring together some of Canada's most renowned researchers, relevant entrepreneurs, and small businesses. In fact, priority is placed on projects that are led by small business. In these cases, we can connect them directly with principal researchers. Very important in this is that the IP is open. Researchers bring in their projects and they become richer by doing so.

Since we launched in 2012, we've launched 50 game-changing projects. We've materially enhanced the skills of over 300 post-doctoral fellows that were hired for this purpose, with 88 research jobs and over 1,000 jobs that are in the network of the small businesses and researchers that are involved. We've established a pipeline of close to $2 billion in revenues for these growing SMEs just from three years ago.

One example—and I won't be able to go through the detail at length—with Synchronicity in Motion is Dr. Carolyn McGregor, who's working with SickKids in the neonatal unit and looking at all the medical devices attached to a patient. She is now able, because of real-time streaming analytics from those machines, to predict sepsis and many other ailments for those patients 48 hours in advance of anything happening to that patient; in other words, saving babies, but also saving all of the downstream effects of affected babies that take place in a very high-cost unit, but also a very high-value unit. She's taking this not only to the rest of the Canada in the cloud, but also to leading hospitals in the U.S., China, and Australia, where she's from. That's one example. It's a compelling one, but I have 49 others we could talk about and the disruptive technologies that are coming from here.

Based on these outcomes, FedDev Ontario recently announced another $20 million investment for SOSCIP 2.0 of which it unleashed another $65 million of investment from IBM. It's very exciting.

In conclusion, Canada has the capacity to produce disruptive technologies, as well as the entrepreneurs required to build companies around these new technologies. In SOSCIP, I submit, we have a proven model that can bring the critical ingredients together to facilitate such activity. In this model, we do believe there's an important role for government to set national and regional priorities, and to provide some financial incentives, including direct funding to support collaborative initiatives such as SOSCIP right across the country.

Thank you very much, and I look forward to your questions.

● (1120)

The Chair: Thank you very much, Mr. Horgan.

Now we go to Ms. Gagné and Ms. Vollmerhausen, please.

Ms. Claude Gagné (As an Individual): Thank you, Mr. Chair. We're very honoured to be here as ordinary citizens. I'm Claude Gagné from Ottawa. I'm an entrepreneur in social innovation.

Ms. Bettina Vollmerhausen (Co-Founder, Ottawa Tool Library, As an Individual): Mr. Chair, and members of the committee, I am Bettina Vollmerhausen, co-founder and tool goddess at the Ottawa Tool Library.

Ms. Claude Gagné: Last November, Mr. Chair, you met Abigail Capannelli, a young lady from your riding who was very pleased to show you her new hand. She had a new prosthetic hand. Abigail sent me this clip to express her appreciation. This is a hand that was done with 3-D printers by volunteers here in Ottawa. You should look at the images. You'll see Abigail wearing her prosthetic hand.

[*Video presentation*]

Thank you, Abigail.

As you can see, Abigail uses her new hand to prepare meals, work in the garden, and play sports.

This happened as a result of the e-NABLE network. Last summer a news report about a boy in Hawaii who was equipped with a similar hand prompted Abigail's mother to send pictures of Abigail's arms and a request to the e-NABLE network.

The e-NABLE network is an ecosystem of researchers in prosthetics and 3-D printing, passionate volunteers, makers, and end-users and their care providers. In a matter of days, the e-NABLE matchmaker contacted a volunteer, also based in Ontario. It happened to be me.

I had signed up with the e-NABLE network because I thought I would have easy access to a 3-D printer here in Ottawa. That was in August 2014. I knew that there were two 3-D printers at the Ottawa Public Library in Nepean. Unfortunately, they didn't use the right kind of filament. But then the engineering department of the University of Ottawa opened a makerspace and they made it open to the public on Sundays, so I was able to access their printers. Throughout September 2014 there was a lot of trial and error with materials, sizing, printing quality, and the assembly of the prosthetic.

I was able to send by courier a prosthetic to Abigail, who was in Waterdown, Ontario. I had never met Abigail. She received the prosthetic and she was quite pleased with it. One month later, she came to Ottawa. She met with you, Mr. Chair. She was here for the official launch of the makerspace at the University of Ottawa.

So 3-D printed prosthetics can provide desired functionality at a fraction of the cost of similar prosthetics supplied by industry. It cost less than $100 to produce this. In industry, it would be over $20,000. It's not exactly the same, but it provides the functionality. Ordinary people like me with no particular training can access 3-D printers and make functional assistive devices, whether in Ottawa, in Timbuktu, or in a refugee camp.

Open source designs, creative commons licensing, and enhanced public access to the results of publicly funded research are key for sustaining local resilience, for more innovation, and also for more equitable wealth distribution in the digital age.

I think there's a role for governments to help accelerate the spread and growth of makerspaces, fab labs, and tool libraries that are managed by and for the community. This is an astute way of promoting local resilience, innovation, and entrepreneurship.

Bettina.

● (1125)

Ms. Bettina Vollmerhausen: That's where I come in.

The Ottawa Tool Library is actually part of a sharing economy and a movement that started in the United States in the 1970s and has moved up to Canada, with Vancouver opening the first tool library in this country four years ago. We will be location number 12 and we are aiming to provide access to tools in four categories: hand tools, power tools, kitchen tools, and garden tools.

As Claude Gagné has pointed out, we are also planning and offering access to workspace, maker labs, where people can be using 3-D printers, CNC routers, and laser cutters.

This is a very important community resource that we're trying to establish. We're currently looking for space in Ottawa and are very much looking forward to support in the community, which we have received already during our recent crowdfunding campaign where we have surpassed our set-up goal. With the support of everyone around, we're looking to open, hopefully very soon, to provide this community resource to Ottawa as well.

Thank you very much.

The Chair: Thank you very much for your testimony.

We'll now go to Pearl Sullivan.

Dr. Pearl Sullivan: Thank you very much, Mr. Chairman.

We have an eight-page presentation. There are some copies here. Because of the time, I will just go through some parts of it.

First, Mr. Chairman and members of the committee, thank you for your invitation to speak with you today. I'm here on behalf of hundreds of researchers and students developing new and emerging technologies at the University of Waterloo in collaboration with colleagues across Canada and around the world. As dean of our country's largest engineering school, I'm also fortunate to work alongside some of Canada's brightest young entrepreneurs and to consult with many of our country's industry leaders.

Harvard Business School professor Clayton Christensen coined the term “disruptive innovation” in 1995. Twenty years later, we fully appreciate how new technologies can shake up industries and create completely new markets. We see the consequences of two major 20th century innovations, aviation and telecommunications, in the full force of globalization and the information revolution. The difference today is speed of adoption. It is moving faster than ever before. You can no longer speak in terms of speed but acceleration.

So how does Canada stay on the fast track? With half a per cent of the world's population, we can't do everything, but where we excel, we can lead.

The federal government's recently published science, technology and innovation strategy identifies several disruptive technology areas as priorities, including information and communications technologies, energy and advanced manufacturing. This demonstrates a strong will to prepare our country for the future. I think 21st century disruptions will be led by organizations with the agility to react quickly to new opportunities. We'll develop entirely new technologies, but equally important, we'll adapt technologies in powerful new ways. Those who can stay ahead will be those who can build off and integrate multiple innovations to engineer practical solutions to some of the world's most pressing challenges.

Two research areas that promise enormous economic impact are ICT and energy storage. As you have heard from Industry Canada, the disruptive impacts of ICT spread far beyond IT and the communications sector. Inexpensive new sensors wirelessly transmitting data for analysis will revolutionize environmental monitoring and personalized health care. Aside from the potential health care savings, this technology will be particularly critical for rural and remote Canada. Another ICT impact will be in the connected car.

The overarching impact of ICT is encapsulated in the emerging Internet of things, or IoT, whose potential is highlighted in the government's STI strategy. Expect a future of cyber-physical systems. Technology titans such as Google, GE, Cisco, Intel, Microsoft, IBM, Qualcomm, BlackBerry, Telus, and Samsung are investing billions of dollars to own the Internet of things podium.

The most significant advance in addressing global energy challenges may come in energy storage, a real game-changer for the utility and transportation sectors. Research into energy storage demonstrates the interconnectedness of innovation, linking to other disruptive areas such as smart materials, nanofabrication, and 3-D circuit printing. Over the coming decade, countless IoT sensors, microprocessors, and wireless nodes will need new low-cost, longer-life batteries and energy harvesting technologies.

Already we're seeing commercial energy storage systems with the potential to dramatically change our traditional approach to electricity. Tesla Energy recently announced that Powerwall and SolarCity systems, for example, are rapidly building towards reliable 24-hour solar power for homes and businesses, and they're available off the shelf. ln the longer term, new battery materials like lithium-sulphur will power electric cars three times further than current batteries and at a much lower cost. Both these technology movements will impact horizontal markets creating new services and sectors. They will transform our manufacturing base.

I'll turn now to the heart of innovation.

As a teacher, researcher, and administrator for the past 25 years, l've observed that innovation ecosystems matter, but original ideas provide the essential fuel. Disruptors of the future will be those who can tackle truly difficult technical problems and produce solutions with significant scale-up potential.

● (1130)

If people worldwide can access the new technology quickly, global markets will be transformed. Over time, new technology will itself be disrupted. Of course, we need to maintain a continuous flow of new ideas.

Curiosity-driven research is essential; it is the ultimate source of all new technologies. Strategic initiatives targeting areas with high potential are equally important as they offer competitive differentiation. The roots of truly disruptive innovations, in my view, lie in exceptional technical talent, with men and women who have great ideas and who can execute them. If we can incent them to take ownership and translate their ideas into prototypes with real market potential, we can create a deep culture of innovation.

Global competition for highly skilled talent is very real, dividing the future's technology leaders from the followers. Technology hubs are rapidly emerging in major cities around the world, but the Silicon Valley remains at the frontier, particularly in the area of ICT. However, there is an interesting Canadian story behind it. Last year more software engineers and developers in the Silicon Valley were hired from Waterloo than from any other school in the world save U of C Berkeley—more than MIT, more than Stanford. For these young minds, the world is their oyster. We must build a thriving home for this generation so they can reach their aspirations here in Canada. They are the future of the country.

Deploying new technology can be risky for industry, and it's particularly challenging given the risk and the current pace of change. The infrastructure investments and resources needed are very large. Canada's geography poses unique challenges, but we can create critical ecosystems that cannot be readily reconstructed by competitors.

The co-operative education program at the University of Waterloo provides such a model. Imagine a parallel system whereby the university acts as an anchor for experiential technology innovation. By bringing in companies of all sizes to innovate with our students, we capitalize on infrastructure, talent training, expertise, equipment, tools, information networks, and business support. This approach will enable and accelerate the first critical iteration of product innovation. With over 1,600 co-op partners and over 1,000 research partners, Waterloo engineering's experiences may offer some insights on its feasibility.

I will use the manufacturing sector as an example to end this presentation.

ln the automotive industry, the production life cycle is increasingly shorter. ln the aerospace and medical sectors, the payback periods can be significant.

As regards corporations, in today's environment, even large companies need to collaborate in open innovation ecosystems. Toyota, for example, our major research partner, has forged a recent partnership with Mazda on technology development. This is the future of shared risks.

SMEs employ over 90% of Canadians in the private sector but have scarce resources. They generally don't operate within an innovation ecosystem, but have the greatest need for support for new technologies. One disruptive technology, as you heard earlier, is 3-D printing, or additive manufacturing. lt will enable quick prototyping, proof of concept testing, and small production runs particularly suited for SMEs. This is a technology domain where Canada needs to succeed or else we risk being left behind. Waterloo is partnering with five other Canadian universities and scores of SMEs to create the Canadian additive manufacturing network. It is the future of innovation in product development.

● (1135)

The Chair: Dr. Sullivan, that will have to be the last word in your opening remarks. It won't be the last word today, though, because we have rounds of questions now.

Colleagues, you have eight minutes each.

We'll begin with Mr. Daniel for eight minutes.

Mr. Joe Daniel (Don Valley East, CPC): Thank you, witnesses, for being here.

Mine is probably a little bit of a weird question. Madame Dubé, you talked about the social need, and as a government we need to look forward and see what's happening, and we have all these disruptive technologies. Where do you think our society should be going, or is it going to be determined by these disruptive technologies? How will we as a society move forward in terms of training and making sure we have the skills to support these disruptive technologies in the future?

I hope you can all have a go at answering that.

Let's start with Mr. Horgan.

Mr. Patrick Horgan: Okay, I'd be happy to.

We were talking earlier about some history about our company. When I started, even in my time in the company we were the best typewriter manufacturer in the country. Some people would remember the Selectric, but our new employees wonder what that thing is with a label on it.

Voices: Oh, oh!

Mr. Patrick Horgan: We've disrupted ourselves so many times forward and yet our employment rate is the highest it's ever been. I'd say that one of the things we need to say, and it was expressed by many of the speakers here, is we have to move to the future and skills are necessary to do that. It's partly why the ecosystem comes into play in making sure that we don't just think about ourselves and our own domain, whatever organization we're in. We have to think about the adjacent spaces, and especially from that people and skill development point of view.

If I was in a way being selfish as a business...analytic skill is at a huge deficit. Canada is in the middle of that deficit, frankly, although we have some of the best higher education. So we're dragging some of our students to Silicon Valley. Shame on us. We have to think about ways to bring them here, really incent our students to want to thrive here. The way to do that is to do some of the things we're talking about in a collaborative way.

● (1140)

Mr. Joe Daniel: IBM is unique in the sense that they actually invest so much back into research and development in their own company.

Mr. Patrick Horgan: That's correct.

Mr. Joe Daniel: That's not the case in many other companies, frankly.

Mr. Patrick Horgan: Yes, but let's take advantage of where we do that. We do it far more in Canada than we do in other countries, frankly, for some of the ratios that were being applied here.

I was trying to get it to $100 per employee, Madam Dubé. We're at some $35,000 per employee on our R and D spent. You're right that we are a little bit unique, but I think in a way we are dragging others too; we are hearing of other investments coming into Canada. By the way, even Silicon Valley companies, many small ones, are now coming to us and saying, “Why are you there in Canada?” And, “Gee, I hear you have running water. We don't have that in California.”

Voices: Oh, oh!

Mr. Patrick Horgan: By the way, to get an engineer in Silicon Valley right now the price is three times that it is in Ontario or the rest of Canada, and the cost of living is four times as high there.

We have some competitive advantages here. I think we not only just have to be our Canadian selves—and I've been a worldwide employee for a long time, and I'm very Canadian—but we also have to say we can do it here and start to create those opportunities and those ecosystems to drive success.

Mr. Joe Daniel: Madam Dubé, do you have any comments?

[*Translation*]

Mrs. Jacqueline Dubé: Yes, absolutely.

You are wondering whether we will always have to adjust and how we will be able to do so. I would say that individuals adjust fairly quickly to what they need. Businesses have no system to transform work processes. Sufficient thought has not been given to transforming professional practices. Digital technology is not used enough in Canada.

Canada-wide studies were done to see whether companies, such as SMEs, buy enough customer management systems. The answer is yes, but the problem has to do with how they are used. Their use is not effective and, all too often, companies struggle to determine the size of the system that they really need. They invest a lot of money, get discouraged and give up, which is unfortunate.

The Government of Quebec is asking us to regularly assess the digital skills in some companies. Employees have digital skills as individuals, but in the workplace, they must automate and transform their work. For the rest of our lives, we will have to do that with all systems. In education, for example, not every student needs to have an iPad or computer to improve their digital learning ability. It is a mistake to want to equip everyone, but teachers need to take a different pedagogical approach. Therein lies the problem. In our daily lives, the transformation is not enough.

I am very familiar with the Government of Quebec, but I know that the Government of Canada has good tax measures to encourage technology development. The fundamental question is whether companies, be they private or public, make optimal use of the technology. The answer is no. The gap is now widening. Canada's situation is becoming worse every year in these sectors in terms of adopting the technology because it does not make sufficient effort in this area.

[*English*]

Mr. Joe Daniel: Thank you.

Dr. Sullivan, do you have any comments?

Dr. Pearl Sullivan: I think we all know that we cannot tell our children where to go. What we need to do is to incent our young people to stay home.

I think that critical ecosystems which are highly differentiated are very important because of the geography of this country. In my view we have a system, and in engineering we have three levels of huge engagement: the major companies, the small and medium-sized businesses, and the start-up community.

The start-up community should look to and work with all of IBM, Toyota, GM, and Magna equally to be part of this non-linear process, because for the deployment of disruptive technology, first you have to develop it and then deploy it. There is a chain of events that's highly non-linear and very complex.

If we put them all in the same ecosystem, they learn from each other and they can have a common platform to build off each other, and they complement each other. The new products and services will come from the complementary connection.

● (1145)

Mr. Joe Daniel: Thank you.

Madam Gagné, do you have any comments?

Ms. Claude Gagné: I think the government could do a lot to develop a culture of innovation here in Canada. In fact, it starts very early. It starts with young children.

Young children should have access in their community to tools that enable them to make prototypes, make toys, whatever, and for this we need, of course, at least some minimal infrastructure. Whether it's in public libraries, in community centres, in tool libraries, or wherever, it needs to be accessible, and the more accessible it is, I think, the more Canadians will embrace these new disruptive technologies.

The Chair: Thank you, Madam Gagné.

[*Translation*]

Thank you, Mr. Daniel.

Ms. Liu, the floor is yours for eight minutes.

Ms. Laurin Liu (Rivière-des-Mille-Îles, NDP): Thank you, Mr. Chair.

My first question is for you, Ms. Dubé. Your presentation was very interesting. I would simply like to know whether you think open data plays an important role in disruptive technology and whether the federal government should play a role by developing a national strategy or taking a concerted approach in terms of the availability of open data.

Mrs. Jacqueline Dubé: You are absolutely right. Open data is essential. The important part is to find out which data must be released and how they can be used. We must measure how they are used, what return on investment that can produce and how that can change our society.

For example, I can tell you that we are doing a study for the Quebec Treasury Board measuring the impact of open data and figuring out whether only society will use them, or whether the data will be open between departments. We have also done it for cities in Quebec, again at the Treasury Board's request. Open data will change the way we do things because they contain information that, if we use it intelligently, can lead to very disruptive technologies and software that are also very productive for society.

Ms. Laurin Liu: Yes. In the discussions I have had about open data, I found that it had tremendous potential, but also a number of challenges, especially since there is no real communication between the databases of the provinces.

In your view, should the federal government play a coordinating role?

Mrs. Jacqueline Dubé: I am sure that the federal government has a role and a responsibility to support all the provinces so that they interconnect their ways of doing things and develop a common approach with the necessary algorithms to go find the data, without there being a new initiative or experiment in each place. Yes, the federal government could play a major role in that sense.

[*English*]

Ms. Laurin Liu: The next question is for Ms. Sullivan from the University of Waterloo.

You say in your presentation that curiosity-driven research is essential. Would you have any recommendations for the federal government regarding finding a balance in terms of funding curiosity-driven research and industry-oriented research? Do you think there should be federal funding specifically towards discovery research?

Dr. Pearl Sullivan: NSERC has been very important for scientists, engineers and mathematicians in this country. There is a core program called the discovery grants program which is absolutely important.

They're not large in a sense; they are about $20,000 to $50,000 for each professor, but they allow you to seed big blue items, big-vision items, and the things that professors who are interested in pursuing, they can pursue. I do think it is a program that all professors across the country will agree we need to expand. There are collaborative research and partnership programs, a swath of them, many of them. They are also very important, because they engage companies, and because of those programs we have engaged over 1,000 companies. We know that every time a new program comes along, NRC, NSERC, Mitacs, all of them are working very hard to try to connect industry with the university. All the officers on the ground are really working hard trying to make it happen. I do think that there is still a fear of risk. These things are very important as enablers, and it will take time, but with time you can overcome the fear of risk.

● (1150)

Ms. Laurin Liu: I think it's important, because we've heard from other stakeholders how important the discovery grants program has been and we've seen over the past few years a lack of investment in this program. I think on the NDP side, we'd certainly be in favour of reinvesting in discovery research.

Moving on to another subject, the status of women committee is actually doing a study on women in STEM, which is really an interesting topic. Although your presentation didn't touch on this, many witnesses in the status of women committee noted that in order to encourage women to enter engineering, it's really important to portray it as a helping career, so really to further educate those who would go into those careers.

How do you think we could encourage women to be part of innovation ecosystems? How could we further encourage them to create future disrupters? Do you have any recommendations, either for industry or for government, in terms of increasing the participation of women?

Dr. Pearl Sullivan: That is a very important question, so thank you.

About six years ago we started a portfolio in the dean's office. The associate dean for outreach, Professor Mary Wells, has been working on a program for seven or eight years now on how to improve gender representation in technology. One thing we've done is we've collected data. We run a program called engineering science quest, in which 2,000 students from all over Ontario come to campus to learn about technology, starting from wee young all the way to grade 12. What we've learned is that girls are very excited up to grade 7, but in grades 8, 9 and 10 something happens. I don't know if it's hormones, but something happens.

We've also learned that physics is the showstopper. I think physics teachers are extremely important. All the schools in Ontario require students to take science, which includes some physics, but they do not necessarily enrol in physics classes at grades 11 and 12. In most universities in Canada, you cannot really enrol in an engineering program without physics. Physics needs good teachers. Physics needs a lot of support. Mathematics is not the showstopper. In fact, female students are topping a lot of the mathematics competitions.

I do think it takes years. After six or seven years of effort.... She's also the Ontario Network of Women in Engineering chair, and is helping all the schools of engineering in Ontario to promote engineer education. For the first time at the University of Waterloo, the first-year entrance class is 27% female. The limit, I believe, is 33%, simply because of the physics enrolments. We launched a biomedical engineering program last fall for which we had 900 applicants for 50 seats. We turned away hundreds of very strong female candidates, so it's a tough situation. We have to keep working at it.

The Chair: Thank you very much, Ms. Sullivan and Ms. Liu.

Now to Mr. Warawa, for eight minutes.

Mr. Mark Warawa (Langley, CPC): Thank you, witnesses, for being here. It is very interesting. I was looking forward to today. It's a high quality of testimony we've heard.

We are in a time of change, and it's happening very quickly. Madam Dubé showed us those pictures at the elections of the pope, and after eight years the use of smartphones. What a difference. Change will happen, whether or not we want it to.

Mr. Horgan, you said that your have disrupted yourselves, referring to IBM, and you found it to be very successful. Business has to do that. When we were in Hawaii years ago, there was the Kodak hula show. There is no Kodak hula show anymore, because they didn't adapt to change. IBM has and has done it very successfully, creating a great business enterprise in Canada, benefiting Canada with jobs and investment, lots of investment.

A year and a half ago I was on a flight and I was talking to an IBM employee who talked about Watson and the diagnostic use of supercomputers. Maybe a year before that my GP had computers in his medical practice office and everything was done digitally. When you went for an X-ray, a blood test, or whatever, the information, the X-ray or whatever, got to the doctor almost immediately. So the timeframes....

Now, we have one of the best health care systems in the world. It's not perfect. There never is enough money to do everything, so we have to use the limited resources we have, provincially, federally and locally, smarter. My question for all of you is: how do we use the limited resources that we have smarter?

I believe all levels of government realize that we have to invest, we have to partner, and we do. How do we do it smarter?

Mr. Horgan, maybe you could start. I think we have great potential in that we have IBM in Canada. We have one of the best medical systems, but how is this going to change? In the meeting I had on a flight a year and a half ago, the IBM employee was so proud and was bragging that there was a test where they had Watson diagnosing treatment, as opposed to doctors' human diagnoses. The success rate for Watson was...well, as you said, they can even diagnose much quicker, know what's coming down. How is this going to change our medical system?

● (1155)

Mr. Patrick Horgan: That's an excellent question, and it actually has a very big application for the public sector to think about. To give you an updated version of that, we are now very heavily invested in oncology in this cognitive computing we call Watson. I was with one of the federal ministers in our labs in New York—unfortunately, it was in New York, but we'll have it in Canada soon—where we were looking at an oncology patient. What it does is it looks at thousands and thousands of medical records, including the individual's, but also all applicable cases, and it asks what the best outcome would be for the patient. They think about the patient when they do it.

It has a ranking of diagnoses that you could use. The doctor does the diagnosis in the end, but the interesting thing is that the third best diagnosis and treatment, which was the most conservative, was full radiation and full chemo. That was the third best according to Watson, 55%. There was a 90% and an 85%. With hybrid versions where the patient does not lose her hair—the patient was a young mother—she has better outcomes. Actually, the best part is that, at the end it cites out of all those millions of medical records that they're looking at the exact trusted cases to explain why it says this.

The doctor can decide whether that's what they want or not. By the way, it does it in three seconds. It doesn't do it in years. It does it very, very quickly and prevents many other invasive tests of other types that patients generally have to deal with.

I'll give you one other example for disruptive purposes. We put it out in a competition to a bunch of universities. U of T came in second in the competition about two months ago, and they actually applied it to the legal system. The legal system wasn't what we were thinking about, so this is an example of where we said to put it out in front of people and see what people will do. They took 20 years of family case law, put it out, and asked Watson to look at the case against all of the 20 years of Ontario family case law and come up with the right precedents for that case. Of course, doing it very, very quickly, it had five relevant cases, the killer cases, where now the lawyer has to convince a judge.

The interesting thing is that it now disrupts the whole legal system. It's not a thousand-person law firm that wins; a two-person law firm or a one-person law firm can actually get the same information. By the way, it takes months and months and months out of that legal system, if you will, and all of the discovery and so on. You can think about this for policy use and other things that we can talk about at length.

I'll just come back to your point. We're very proud of it because it is something that is there, but when it sits in a back room, it's not useful. Bringing it out and actually having it apply to things that are really important, that's what we're up to. Canada can lead, maybe because of our footprint, but actually because we have a point of view to build this in this collaborative way.

● (1200)

Mr. Mark Warawa: Does anyone else want to comment on how do we use our limited resources smarter so that we can help?

[*Translation*]

Mrs. Jacqueline Dubé: Take health for example. Canada has a great health care system. It is very expensive and, with the demographic changes, the cost will not go down.

In some provinces in Canada and in the U.S., the approach being increasingly used is that citizens are placed at the centre of managing their health. They become more proactive. That is done with the help of what we call a “personal health record” on an iPad. People learn to manage their health information, such as a diagnosis, and they always bring the digital information to health professionals.

In the U.S., Kaiser Permanente has 15,000 doctors. This non-profit organization has 8.8 million patients. Systematically, exchanges are done digitally. The patient data are transmitted directly on a daily basis, for things such as sugar levels and blood pressure. That makes it possible to significantly reduce doctor appointments and hospitalizations. This is a global trend that can allow the health care system to survive. Ours is excellent, but it's a matter of placing individuals at the centre of management with the help of the digital tools.

Other provinces have already bought the necessary tools and are in the process of implementing them. We are carrying out experiments in Quebec.

[*English*]

The Chair: Thank you very much. That's about all the time we have.

Now Madam Sgro, for eight minutes.

Hon. Judy Sgro (York West, Lib.): I certainly welcome all of the witnesses. This continues to be a fascinating study, and I think we're all learning an immense amount about the different initiatives and what's going on.

Mr. Horgan, given the fact that IBM operates in a lot of countries and is no doubt, as we're talking about today, in partnership with many bright people around the world, do you have any unique insights on how Canada might move itself forward faster?

I think I mentioned to you in a previous meeting that my own son is now in Silicon Valley, a great sadness to me. There just wasn't enough to keep him here. He's just one, but he tells me that 75% of the people he's working with in Silicon Valley come from here. I'm afraid they're never going to come back. They'll all stay there because there's a bigger investment, less adversity to risk, and so on. I want them to come back here.

What do we need to do as a country? SOSCIP is a great initiative, but are we 20 years behind? Is it going to take us that long? We can't wait that long, because we'll have too many of our young people being displaced.

Mr. Patrick Horgan: I have a point of view, of course. Our company was there at the very beginning of Silicon Valley, and I have good friends whom I deal with every day who are in Almaden and other of our labs there as well. But I compete pretty aggressively with them, as a Canadian, to win more missions here. I won't say that in my corporation side; I'm sure you're taking notes but this is in camera for that. That is the way we have to think of ourselves as Canadians.

I've been a global player. I've been growing things in emerging geographies for half of my career. When I came back to Canada, probably seven years ago, and now that I have this responsibility, we've learned some techniques. One of the things I would say is that we are truly Canadian in our approach. We're quite modest and we know how to say sorry a lot. We actually have some competitive advantages that your son may not...and by the way, in the environment, that's an intelligent choice. Not everyone understands the environment but it is starting to grow, and there are more and more cases of young generation people out of the University of Waterloo or with the other incubators across the country. We don't speak about it enough.

I've noticed even in this city many of our officials quickly go to discussion about great success stories they've seen in Silicon Valley. I think, “Really? Couldn't you come up with some lexicon that talks about the great things that are going on here in Canada, started from here in Canada?” All of us, regardless of our role in the country, need to start thinking like they've been doing for so long in Silicon Valley, which is, “we're the best.” I would say that's the most important lead they have on us, because we have all the other ingredients and more to help us build that here.

I agree that you can't tell a young person where they should go next, but if they knew about all the possibilities here, the international nature of how we work in Canada, and the global nature of how we work, they wouldn't have to go somewhere else to find it. They could find it here, and from this space do things around the world, and lead around the world.

We're going to continue on the theme of doing that, just as my little competition within my little company, by building the ecosystem here on these dimensions that are new. They're not old. By the way, California has no edge on us on the dimensions of some of the things that we've talked about.

If we get it together here faster, we can win. I am totally convinced of that.

● (1205)

Hon. Judy Sgro: What do we need to do to get it together?

Mr. Patrick Horgan: We have to have more willingness. The open data question was one.... There are ways of protecting data, and you start with that. Once you do that, open it up.

Stop thinking that you have to protect everything. It's almost like the same thing on free trade. You could put blocks on borders, but I think we're all past that, and we're thinking that the best way to be a global player is to have open access and open free trade. It is the same at the data layer. We have to put protection on it. We have to learn how to do it properly. Once we do that though, we have to open it up. We have to get to step one, and then quickly to step two, to say how do we now build the ecosystems and those key ingredients so that people can really lift up.

There are a number of ways like that, but there's a central theme that can be built upon from the central government, of course.

Hon. Judy Sgro: Ms. Sullivan, again I have to tell you how impressed I am with the University of Waterloo. I have visited and have seen a lot of what is going on. Just to hear you speak today about the number of women in those programs and all of the other issues demonstrates that you're right on top of all of this. I can hear it in your voice and in the comments that you make.

I'd like to give you a moment for some comments, please.

Dr. Pearl Sullivan: Thank you for your kind words, Ms. Sgro. I really appreciate them.

First of all, I love education and I love students. I think I represent thousands of academics who feel the same way. But I have to echo what Patrick just mentioned, that open data is really about sharing things.

What is unique about Waterloo is that it was founded 57 years ago with a very unusual IP policy. Whatever you think of on campus, you own it. The dean has no control over what you want to do, which is very nice.

Most of our students start companies in their second year of engineering. I believe the fact that we have 500 engineering companies in the Waterloo region hiring thousands of people is due to the IP policy and core education. When students go out to work for four months in a company, they see what the needs and the technology gaps are, and then they come back and they start a company.

What is very important for us is to support them. The early innovation is happening. We have to support and to incubate them while in school—it's very important—and teach them a little bit about business, because they are taking risks while they're studying.

The IP policy is important. They must own it. What we're doing in engineering school is we're supporting them all the way past graduation. Next week is convocation. We have 1,200 engineers graduating and we probably are in touch with all of them. If they want to start a company, we offer the campus, labs, equipment, the library; they are open to them. We have started an entrepreneurship alumni program, which allows them to access anything on campus.

That's really important. The role of university does not end after you have received your diploma at convocation. You walk across that stage to get your diploma, but it doesn't end there. We have to help them past their graduation.

● (1210)

Hon. Judy Sgro: I would like to say to Ms. Gagné and her partner today that listening to you was fascinating.

I want to congratulate you on that initiative. Who knows where all this is going? It was fascinating to hear about it. I'm sure that young woman is able to do a lot of things now that she couldn't before.

Congratulations to both of you on your initiatives.

The Chair: Thank you very much.

Ms. Gallant is next, for eight minutes.

Mrs. Cheryl Gallant (Renfrew—Nipissing—Pembroke, CPC): I'll go first of all to our individual witness today to ask about using the 3-D printer. How was it that you were able to get the ingredients for that 3-D printer to where they needed to be on Sunday?

Ms. Claude Gagné: First of all, I had access to the Internet through the e-NABLE network.

The first thing is the design. It's open source design, so it's available through Creative Commons. It has been developed in universities by teams of researchers. For me that was the first thing. Then, for buying the filament there are various suppliers, but again the e-NABLE network provided specifications on what kinds of materials could be used.

I also had access to local support. People who know about 3-D printing here in Ottawa helped me. In fact, this is not the work of an individual. It's the work of several individuals. I had a lot of help to produce parts of suitable quality and also for the assembly.

The University of Ottawa is building an ecosystem. What is fantastic is that it's open to the community. This is quite new. In the past, universities catered to students or to their own communities, but now there's an open university. That's good. We'd like to see more of it.

Mrs. Cheryl Gallant: The reason I ask is that it would be a good idea to emulate what has been done there and in libraries as well, but it's the nitty-gritty of how you get what you need to that library, and of the procurement process.

Mr. Horgan, you gave an example of a hospital participating in the uptake of technology. It's such a challenge just to have SMEs get their own website. Even if you plop $5,000 in front of them, they don't have the time or the interest and they don't see why they need to do it.

What can government do to foster an environment that would be conducive to accelerating the adoption of these five segments of disruptive technology that you described?

Mr. Patrick Horgan: You're right, especially if you choose a hospital as the start of your question. There are a number of great entrepreneurs who are making interesting...because of the Internet and the cloud services and mobile applications where patients can take their data with them and understand it. Yet there's a bit more of a block, I think, in Canada to allow for that than there is in the States, as an example. The examples we were using were from the States. I've been there as well, discovering what they're doing and trying to figure out how we could do it here.

There are many hospitals that are trying to break that paradigm as well. To the earlier question, they're looking for how they can bring down their health care costs, and if it's not an enabler, it'll be a derailment factor for the country, because we can't afford it. We have to think about doing things in a different way. Some hospital presidents and the hospitals I'm involved with—I'm on a board of one locally in Toronto—are completely open to thinking about new ways. The problem they often have is that there's a procurement network they have to break through and some other criteria they have to meet to do things. I understand that in a pharma world, believe me, the clinical trials, and the process of doing that, but in the world of medical devices, neuroscience, the areas where you can start to make discoveries very quickly at the rapid pace of the way we can do discovery in technology, those things can help us win. There's the recognition of those key areas that don't have all the strings attached, if you will, for the clinical trial period and so on. Many areas are disruptive in some nature, very proactive in ability for us to move ahead of the country in this precious asset that we have in health care. We're finding areas where we can do that. That's what I would encourage, to think of the whole thing not as one big claw, but of the areas where we can move forward very quickly.

● (1215)

Mrs. Cheryl Gallant: Looking at businesses outside the government-funded sector, looking at the SMEs, at a previous meeting we also heard about the need to have an ecosystem/education such as those in Boston where they have a community of ecosystems.

We're told Canada is lacking the risk takers. The big money isn't here or if the big money is here, it's not willing to participate in one of these types of ecosystems. How could big government be incentivized in a way that taxpayers will not be seen as providing corporate welfare to big investors?

That question is for anyone to answer.

Mr. Patrick Horgan: I'll take a quick shot at that.

I think you need an ombudsman in the group. In other words, you need somebody, and with SOSCIP which we talked about earlier, the Ontario government placed the Ontario centres of excellence on the board. We encourage that. There are only two IBMers and there are 12 members of the board run by the university. If you have someone in the middle who's looking to make sure that this is all done the way it's said it's done better than it was intended to be done, then you protect everybody's interests and it is at the ground floor all the way through.

To the other point, we are starting to work together with Boston and other areas to give more access to tools to more small businesses so that not only do they get the tools as was described earlier, but they also get the mentorship in understanding how to take it to the next step and how to get past this gap.

I'm finding at the other end, and I'm talking about these small businesses that own their IP and now are starting off, we are getting the VC community, the *Dragons' Den* people, and others who are former *Dragons' Den* people, knocking on our doors and asking to see the 40 companies that we've launched. We said yes and we'll make sure that we set up an environment for that. They have the big money, but they just didn't think.... If you go to the early stages too much—there are too many percentages where this doesn't happen successfully—if you get to a stage where they understand they're working on something that's a world-leading prototype, the money will follow.

Mrs. Cheryl Gallant: We have two segments of society whose unemployment rate is accelerating. We have the 50-plus whose jobs are becoming obsolete, at least in part due to disruptive technologies. We also have our recent university graduates for whom these five types of disruptive technologies are first nature to them. They're graduating; they're $50,000 in debt, and they don't have the skills to match the jobs that the businesses are crying out to fill.

Perhaps this would be a question for our educators. Not everyone has the capacity to be an engineer. As I mentioned, they do have these disruptive technologies as first nature. They have an edge over somebody who perhaps has been working in the manufacturing sector and not using disruptive technologies. What could government, business, and educational communities be doing to better match these new skills that are going to be in the future to the people who are looking to work?

The Chair: The job description of a chairman is the person who is willing to be a bad guy. I apologize. The time ran out on that. If you can think about that question, and then at somebody else's rotation if you can jam an answer in on that, it would be great.

Now to Madame Papillon, for *huit minutes.*

[*Translation*]

Ms. Annick Papillon (Québec, NDP): Thank you, Mr. Chair.

My thanks to our witnesses for being here this morning.

I would like to start with Ms. Sullivan.

A number of experts said that it is difficult to connect university research with the needs of research and development companies. However, CEFRIO seems to have developed a level of expertise in the field. In your view, what solutions could Canada develop on a larger scale?

● (1220)

Mrs. Jacqueline Dubé: Is your question for Ms. Sullivan?

Ms. Annick Papillon: Yes, I will give you the floor afterwards, Ms. Dubé.

[*English*]

Dr. Pearl Sullivan: Thank you very much for the question.

First, I think the DNA of the University of Waterloo from day one has been that we were founded together with the industrial sector. One of our founding fathers was a businessman. I think it started that way, and with the co-op program we've always had strong links with industry.

For instance, we do research with the five automotive companies: GM, Ford, Toyota, Magna, and Honda. How is it possible all these companies will come to campus and not feel in any way that intellectual property will be threatened? I think it's because of what we have done. We protect information. We do the projects and they feel very safe. They're confident their knowledge is secure. I do think there's also a lot of shared work. I think a lot of results get deployed very quickly.

I think it's the agility of the environment. The professors and the students work very closely with industry. I think part of it is our IP policy and part of it is our co-op program. A lot of companies come to campus to hire students and also do research. Part of it is that is the culture of the university campus.

[*Translation*]

Ms. Annick Papillon: Ms. Sullivan, must our universities provide better incentives to researchers for commercialization?

[*English*]

Dr. Pearl Sullivan: There is quite a bit being written about this. One of the reasons professors do not commercialize their research is the reward system. When they go up every year for promotion, or for merit review, they are judged based on their peer-reviewed journal publications, conference proceedings, and their teaching performance. Also, about 20% of their review is based on service. There is a perception that nowhere in the formula of 100% is commercialization considered.

We have a very similar review process at Waterloo. We don't give you extra marks for studying a company. We consider your patents, but I think it's the culture. We basically say to the professors with students, “If you want to commercialize, you go ahead and you do it. It's very important you make sure you teach your classes and you treat the students well.” I don't think we do anything differently in terms of a reward system. I think it's basically our ingrained culture that we encourage and foster our innovation and commercialization.

[*Translation*]

Ms. Annick Papillon: Thank you.

Ms. Dubé, I see that you want to respond to those comments.

Mrs. Jacqueline Dubé: I endorse Ms. Sullivan's comments. In large part, the reward system for researchers is related to publications. The CEFRIO model is very useful for the research done by university researchers who carry out projects on the ground. Since they keep the intellectual property of the research, they can publish. However, in practice, CEFRIO ensures that the “deliverables” are adopted, that the practices are implemented in companies and that they are generalized in companies, which can be demanding in that respect.

We work with university researchers every day. What interests them and what pays off for them is only the opportunity to publish new knowledge. The CEFRIO model is quite rare. The government had the idea 27 years ago. It allows us to act in all sectors now, primarily at the government's request, in SMEs where there is little understanding and knowledge about university research. We are therefore the link that gets the research done.

Ms. Annick Papillon: I find that interesting. Since you are from my riding, I would like to take this opportunity to find out more about how CEFRIO is funded.

Do you receive money from federal programs? How can the federal government help you more?

Mrs. Jacqueline Dubé: Right now, we have no financial support from the federal government. We have an operating subsidy from the Government of Quebec that equals 20% of our business. The various mandates that we receive can come from big private businesses or from the various departments of the government funding us.

We discuss with Canada Economic Development for Quebec Regions, since the Quebec government's latest budget recognized an approach called Carrefour de l'entreprise numérique. The Quebec government has just invested $3 million. We have presented the model, which is a very structured diagnostic and supportive approach for adopting digital technology and transforming company practices. I'm not sure whether we will have positive results, but the reception from Canada Economic Development for Quebec Regions was very good.

● (1225)

Ms. Annick Papillon: Yes, that could be a partner. I find it very interesting that you are raising this point today.

Ms. Dubé, in your PowerPoint presentation, you indicated that the cost of access to the Internet and to cellular networks was too high and was affecting Canada's economic vitality.

How does Canada compare to the rest of the world in that respect?

Mrs. Jacqueline Dubé: I am trying to remember a quote. We are sort of like the third world, because the cost for Internet usage in Canada is one of the highest in the world. Unfortunately, I don't have the numbers, but if you are interested, we can send you the information.

Right now, there are changes. The federal government has just adopted measures to ensure that there are more players and competition. However, it is still very expensive. Furthermore, it is very unequal. We are still talking about five megabits for high speed, but that's outdated. That is enough for individuals, but it's not enough for a company that wants to act. The very high speed is still not accessible everywhere in the regions, across Canada. The cost will be very high.

Ms. Annick Papillon: Since it is a matter of changing our way of thinking, I would like to direct the question to others, so that they can share their ideas with us as well.

[*English*]

The Chair: We're out of time, Madam Papillon.

[*Translation*]

Ms. Annick Papillon: Okay.

[*English*]

The Chair: I'm sorry, it happens to everybody.

Mr. Carmichael, for eight minutes.

Mr. John Carmichael (Don Valley West, CPC): I join my colleagues in welcoming all of our witnesses today. It has been a fascinating discussion. I, too, have been looking forward to today's session.

Eight minutes goes by in a hurry, so I'll be brief in the hope that each of you might support me and be brief as well so we can get through a few questions. I may be a little overly aggressive here, trying to do too much.

Madam Gagné and Ms. Vollmerhausen, I wonder if you could speak briefly to the cost structure. You mentioned the cost of the particular prosthetic that you demonstrated. What was the timeline, the cost structure and the engineering that was ingrained in the development of that product? Can you give us an idea? How did that change from the status quo?

Ms. Claude Gagné: On the cost itself, in fact, there are major costs to the development of a suitable design for a prosthetic. This is ongoing. This is why it's great that there is an ecosystem worldwide of researchers who keep working on this. I did have to absorb this. I had access through the Internet to a design that had been experimented on with many people before, so for me, the cost was really the cost of buying the material.

The material is filament. In fact, it's resin that is used in a 3-D printer. The filament, maybe I used $10 worth. As for the cost structure, it's very difficult to say because a lot of it is embedded in the design.

Then I needed access to 3-D printers. I was fortunate that I could access a free one. I didn't want to buy one, because they are too expensive for an individual citizen to buy. This is why we're advocating a sharing economy where expensive tools are available and can be shared.

Mr. John Carmichael: On the timeline though, how long did it take from beginning to end for what we saw demonstrated on the screen?

Ms. Claude Gagné: On the exact timeline, I was contacted on August 14, 2014, and it took some time to go to the library and so on. Delivery of the end product was on October 21 in Waterdown, Ontario.

It took all that time, but in between I travelled and I did a number of things. I contacted many, many people and knocked on many doors to get, in fact, the know-how, and also to be able to produce that prosthetic. It takes a very long time to print also.

● (1230)

Mr. John Carmichael: No, it doesn't sound like a lot of wasted time. Thank you very much. That was very impressive.

Dr. Sullivan, when we began these discussions with universities on technology, R and D, and moving through the development stage to commercialization, I remember talking with a number of your colleagues over the years—and this goes back several years now—trying to find the right formula of how to share IP. How do we get to a place of who owns it, and how do we create great incentive and motivation in terms of coming to a commercialization of products?

You talked about the open campus, the labs, access, and whatnot. I wonder if you could speak briefly and expand on anything you might have missed in talking to the issue of how your formula is truly stimulating success.

Dr. Pearl Sullivan: The intellectual property policy at Waterloo allows the creator to own it. If a professor or a graduate student work on a project together, they co-own it. If one of them decides to commercialize, they sit together with the help of our commercialization office and decide how any profits and revenues from the project will be split. Not everyone wants to be an entrepreneur, but there's a lot of interest in creating new knowledge, so that's what's good about it.

In the case of start-ups, many of our undergraduate students, and increasingly more of our graduate students, are starting companies from their theses. We support them and provide them, again from the WatCo office, the Waterloo commercialization office, with opportunities for them to work. They do a project with industry. There are opportunities for agreements to be set up between the professor and his or her group together with companies.

In the field of technology, you don't really have to buy all IP, you need to license it because it's changing. In two years it's probably obsolete. What professors do is they license the IP for a number of years, and then they can license it to multiple different companies. The platform technologies can have different applications, so the core may be the same, the source may be the same, and you can just change it with applications.

Mr. John Carmichael: Thank you very much, Dr. Sullivan.

Mr. Horgan, I'd like to finish my time, if I can, with you. I appreciated your comments when you talked about some of the comparatives between Silicon Valley and Canadian talent, some of the advances, etc. You sound very passionate in your delivery of Canadian success.

On the adoption of advanced technology, it contributes to higher productivity; however, there is a feeling that Canadian firms lag behind U.S. firms in adopting these technologies. I wonder if you could speak to that. Given that IBM obviously has plants on both sides of the border, how do you manage that and how do you draw business to the Canadian side? What's the incentive?

Mr. Patrick Horgan: One of my insights is I was the chair of the Canadian Chamber of Commerce two years ago and immediate past chair. I really spent time on that question, wondering why Canadians were lagging and all the statistics showed that. My company was one that was sort of an outlier.

I do think it had something to do with the last 20 or 30 years when the dollar was at one time very reasonable, so people could just buy their services from us, and we didn't have to innovate necessarily that much, or we were becoming very much more resource-oriented, and although there's some technology advancement required for that, it's not as much as there is in other places.

If you did not believe that you knew where your competition was coming from—by the way, as the rest of the world believes—and if you did not know what the next technology wave was going to be—by the way, as the rest of the world really believes—you would be more motivated to make the change necessary. In other words, my premise is that if we stay in place as Canadians for the next five years, we're farther behind. You need to think about how you have to think in a more creative way, in a different way than before. This is why disruptive technology and adoption is really important.

I think that, as we were asking around the country, my comparative would be that in the States they believe very strongly that it needs to happen—by the way, even more so in Asia—and in Canada maybe a little bit less. We even have some empirical evidence that showed it.

That would be my answer.

● (1235)

The Chair: Thank you very much, Mr. Horgan and Mr. Carmichael.

Mr. Cash, you have eight minutes.

Mr. Andrew Cash (Davenport, NDP): Mr. Chair, this has been just a fascinating discussion.

Thank you all for being here.

I'd like to talk about the importance of cybersecurity in the context of emerging disruptive technologies. Maybe we could start with Mr. Horgan, and if I do interrupt, forgive my rudeness but you know we don't have a lot of time.

Mr. Patrick Horgan: Sure. In which way do you want to chat about that?

Mr. Andrew Cash: Well, I want to know whether we're on track in Canada to providing Canadian businesses with the—

Mr. Patrick Horgan: Here's a little-known fact. The best cybersecurity knowledge has been coming from Canada. Q1 Labs in Fredericton, which you may have run into in your time, is now an IBM company, but it runs our cybersecurity around the world, which is, in many circles, known as top-notch. One of the reasons is not a perimeter defence; it goes back to this point that it's not about putting up walls. It's actually understanding every day on every interaction and in real time what's going on in your network. It's also the realization that cyber-intrusions are happening every day; they're already there, and there's nothing you can do about them, even as interesting individuals. The average time that a cyber person is inside your walls is about a year before they exfiltrate the information they like, because they're looking around for more. That's a quick road that has taken place.

For briefness I'm just going to slow down now and talk about the more comprehensive steps which Q1 Labs have taught us about. They have this Q1 radar that actually overlooks all of your environment and sees anomalies, as you would in police work, and understands the anomalies in real time and then is able to circle the anomalies and eventually take them out of your system. That's the kind of cybersecurity you're interested in having, and frankly, I think it's really one that is world leading and you can take advantage of it. Once you start to take some of those steps, you'll be much more interested in saying, “Let's now open up our data and really encourage ourselves to go to the future.”

Mr. Andrew Cash: I'm wondering, Dr. Sullivan, if you have some comments around the larger question of data security in Canada.

Dr. Pearl Sullivan: I do think there are a lot of habits and ways we do things as a country. This is something we're all going to have to be extremely concerned about as we are moving into an era of the Internet of things. If it's true that our personal health, in the era moving forward...and I think there are a lot of economic benefits to monitoring and tracking elderly and vulnerable Canadians, people who are sick. Part of that is to make sure there's embedded security in all the systems. I think there is quite a bit of work being done in Waterloo. While I do not know what's happening across the country, I do know that in Waterloo, the areas of quantum cryptography and quantum information systems and security are very important. These areas are now being worked on by the Institute for Quantum Computing, the faculty of mathematics, school of computer science, and the department of electrical and computer engineering. In fact, I would say all researchers and users are highly alerted and the area of cybersecurity is front and centre for them.

I also want to talk a little bit about BlackBerry. I think the BlackBerry operating system is still the most secure in the world. It truly is. I think for instance that years ago they also purchased a QNX system, which is used right now in automotive applications and, in fact, right now in transportation systems. QNX is seeing a lot of applications, more than just the cellphone. That security will be the differentiator for the industry.

Mr. Andrew Cash: Both of you, Dr. Sullivan, and Mr. Horgan spoke a lot about and we share the concern about retaining talent in Canada. During the debates around Bill C-51, a number of business leaders wrote an open letter raising alarms around Bill C-51. I want to quote a small bit from the letter:

> Most importantly we ask for data security. We know that many of our clients, including our government, will only host services in Canada because of the invasive privacy issues in the U.S. The U.S. tech industry has already lost billions in revenue because of this, and we don't want it to happen here.

Is there a concern here in Canada around the sorts of invasive technology breaches we're seeing in the U.S? Is there a concern here in Canada around this and its impact on exactly what we're talking about here, retaining talent and building disruptive technologies?

● (1240)

Mr. Patrick Horgan: What's being referred to is not so much cybersecurity of data but the Patriot Act.

Mr. Andrew Cash: Absolutely.

Mr. Patrick Horgan: Some of my peers do not have a presence here in Canada. They have sales offices. We actually have a number of centres here where all the data stays in the country.

Now, there's a worldwide flow of data, there's no question. If you are somebody who has to be protected, you need to think about having a presence here, and some people are starting to build a presence so that they don't close off the ability for them to do business in a different way.

Mr. Andrew Cash: Basically, what we're saying is there is a competitive advantage if you're presenting yourselves, or ourselves as a country, as a safe place.

Mr. Patrick Horgan: Right. My comment before was to ensure that you have a security understanding and take steps if there are gaps. As the government, there are a lot of great steps forward but there's a lot of knowledge still to be gained. Once you get satisfied that you're working that very, very strongly, then start to work on the five open areas of the future. If you wait, or say you're not going to do anything, I'm afraid that's not a very competitive picture for our country.

I think this is a very important field. I totally agree that every new area we're working on is opening up data, potentially, but that's why you have to think about security, focus on it, learn about it, implement it, but then move quickly past it. Don't block it.

Mr. Andrew Cash: The point of the letter these business people wrote in opposition to Bill C-51 was comparing, essentially, the Patriot Act and the rabbit hole that the United States has gone down, and raising concerns that we are going down the same rabbit hole. Do you share those concerns?

Mr. Patrick Horgan: I share...anything that's protecting, putting up borders, in the same way I would on free trade. Commerce is being done globally. Every organization, whether they think so or not, is a global company because their customer base, their supplier base, and their competition are coming from around the world. Think of it in that frame of reference. Then I would say you have to figure out ways for yourself to be open on the data side as well in order to compete. That's our take and my take.

Mr. Andrew Cash: Did you have something to add, Dr. Sullivan?

Dr. Pearl Sullivan: Actually, I had spoken to one of the co-founders of the companies who signed that letter. I read it in the newspapers. I do not know Bill C-51 in detail, so I'm not going to say too much about it. I do not know enough about it.

I asked him, "Why did you do that? Why did you make that point together with the other colleagues?" This is at Vidyard, which is based in Waterloo. The co-founder mentioned to me that it's because that is our competitive advantage. That's why we are growing so fast in Canada, and we're getting a lot of business from Europe and Asia.

I think he feels that it can be managed. It's just that the conversation probably has to happen. We probably have to work on how to manage it. I don't know whether it's all black and white.

Mr. Andrew Cash: Nothing ever is.

Dr. Pearl Sullivan: Yes. So I think—

The Chair: I'm sorry, I tried to give you an extra minute to finish your answer, but we're way over.

Madam Gallant, please.

Mrs. Cheryl Gallant: I thank my colleague Stella Ambler, the MP from Mississauga South, for allowing me to take her time.

I must mention that Stella recently hosted the nuclear caucus in her riding at Sheridan Park. The business we visited there was Candu Energy. We all know Canada leads the way in non-proliferation nuclear energy. Indeed, we have the science and development for de-proliferation across the world.

One of the byproducts of nuclear energy is tritium. In my riding, Chalk River laboratories, now Canadian Nuclear Laboratories, is working on a low-powered, tritium-based battery. We're hoping that will be disruptive.

I want to thank Stella for her time and mention her riding is key to disruptive technology as well.

First of all, I will follow up in obtaining the answer to the question during which my time ran out. That had to do with our segments of society that are actively seeking employment, both the 50-plus who are way too young to retire, and then our newly graduating classes who lack the skills to fill the positions that are available. They're still smart. They're tech-savvy. They live and breathe these disruptive technologies. How can we work together—academia, business, government—to foster an environment where we can get those people working so that Canada as a whole can become more productive and be one of the leading-edge countries in terms of disruptive technologies?

● (1245)

[*Translation*]

Mrs. Jacqueline Dubé: First of all, it is true that 50 years is much too young for people to retire.

We have measured the fact that people between 50 and 65 years are the segment of the current population that is evolving the fastest in terms of adopting digital technology. Of course, there was a lag, but there is no gap for individuals. However, starting at the age of 75, there is a problem with the use of digital technology.

In traditional sectors, such as the manufacturing or retail sector, young people are essential, because of the skills they have. For the first time, the young generation that businesses are hiring is teaching 50-year-olds how to become more proficient in digital technologies.

It is essential to understand that we must not abandon anyone. Advanced manufacturers have some cutting-edge technology that young people did not necessarily learn how to use in university, but when someone joins the company, if the work processes are well defined, the technology is very easy to use.

One of the methods we have experimented with is to bring the training directly to the company. We were given a 53-foot trailer. We load all the necessary digital tools in it and we go to the companies to determine the work processes. Age or the ease in using digital technologies are no longer an issue because, in less than 20 hours, we are able to help the people who have a problem.

Often, those people are immigrants who don't understand the processes because they don't have a great command of the language. We work on the ground to determine the processes. Right now, high tech is no longer an obstacle, but a perfectly normal work tool.

[*English*]

Mrs. Cheryl Gallant: Go ahead, Dr. Sullivan.

Dr. Pearl Sullivan: I received today some data for Ontario. Let me share that with you.

Ontario university graduates actually have the lowest unemployment rates and the highest employment rates, according to data just released today. Ontario university grads have also the highest lifetime earnings, and 86% of recent graduates are working at jobs that require skills that require university. This is not just about engineering. University graduates overall, over time, are working maybe not in their fields but at jobs that require skills at a university level. It's much higher in engineering—I think this is well known—but the fact is that all university skills are required in the economy.

I'd like to address the question about 50-year-olds who may feel dispossessed by what's happening with our environment. I think there is some fear that this change could impact them and their families. To go back to one of the suggestions I made earlier, I do think we really need to have an ecosystem that's parallel to co-op. Rather than have students go out to work, we need to get experienced experts, experienced professionals, experienced non-professionals, to come back to campus, to be part of the ecosystem, to see what's going on, and to participate in the innovation process.

I think we need to have a two-way movement. We need to bring people in from the 50-year-old age group.

● (1250)

Mrs. Cheryl Gallant: Many of these jobs that are becoming obsolete are not situated close to a university environment where a naturally occurring ecosystem would occur. Mind you, we do have distance learning. In Chalk River, in conjunction with the Canadian Nuclear Laboratories, we have the Deep River Science Academy, which has gone above and beyond being a place to learn about science during the summer. They actually do the distance learning and teach it to different high school classes around the world.

What is it we can do to have these ecosystems in outlying areas as well? Are the universities willing to project their knowledge to clusters outside the beaten path of the 401 corridor?

Dr. Pearl Sullivan: Yes, absolutely. In fact, the University of Waterloo has the largest number of online courses in Ontario. We offer courses online completely right now. The access is across the country.

I think with the question you're asking, the ecosystem involves infrastructure, and it's not just about courses.

We've been thinking about this in my faculty. We said we need to bring in people for a month—companies and small businesses—and let the employees come to the campus for a month. We need to open our campus to the rest of Canada, to come in for a month and spend time to see how innovation works and how product development works.

Most of the things happen, we find, when people see opportunities based on seeing other people capitalizing on opportunities. Innovation is like an infectious disease. Once you see it's not so difficult, it's happening and people of all groups are involved, you will overcome that mindset and think it is possible.

The Chair: Thank you very much, Ms. Sullivan.

Thank you very much, Madam Gallant.

I'm going to take the liberty—I generally never do—because there is one very important question I'd like to have clarified on the record.

Mr. Horgan, you were talking about a different kind of cybersecurity in the sense of not creating a firewall, but having a monitor that's constantly looking at the traffic that's within your network, so if there are any kinds of anomalies then you can address them specifically. Is that going to be quick enough for the kind of cybersecurity we need for personal information, health, and for banking?

Mr. Patrick Horgan: As a matter of fact, those organizations, many of the banks, of course, but the government agencies and others, are working with us on that because of the level above.

Why I was even speaking as much as I was is that I was in a cybersecurity U.K.-Canada colloquium that was taking place with their cybersecurity experts, and some of us from Canada on the other side, about two months ago. Unfortunately one of the thoughts was that this is what you do after a cybersecurity attack takes place, this is how you try to recover, like the Tylenol scandal. I thought, “What?” It was amazing to me that that was a general thought, even from the U.K. Thomson Reuters was there as well.

We started to give them this view that this is how a number of other people are doing it here in Canada, and we are taking steps not permeated everywhere. Venus in Ottawa is now a centre of knowledge where people are starting to get the latest in the understanding of how to do this.

I'd say that we in Canada could have a leg up further. If you're going off in your own practices, going to an open Internet somewhere, and trying to put your personal information there, or answering questions when someone says, “Hey, check your bank account. Answer this question and put in your personal information”, then shame on you. That can happen. More education is required.

In terms of systems, to be able to do that thoughtfully, and to have it permeate through your system view of cybersecurity, that is what is required. That's what we have said, that you can take steps. It's not one vendor's view. It's a network of people. I will cite Venus here in Ottawa as one of the leading collaboratives that understands the different steps that are needed.

The Chair: Seeing these anomalies has to be lightning fast in order to stop an intrusion.

● (1255)

Mr. Patrick Horgan: Real time. Not lightning fast, but real time.

I would even go one step further. Predict it. That's where cognitive computing and this analytics.... You don't just look at the past or the present. You ask, “Where is it coming from next?“ It's like policing. Put the police where the next thing might happen before it happens, because you've seen these patterns in the past. That is where many places have started to take this dramatic step into the future. We can get on top of this.

The one thing I'll leave you with to put on the record is that we can get on top of this. We know as much as, or even more than, some of the bad guys do.

The Chair: Thank you.

Mr. Patrick Horgan: Don't lose hope on this, or protect everything by closing down.

The Chair: Thank you to all of you. On behalf of the committee, we're very grateful.

We've had good panels all along, but I think one of the things you've demonstrated here is some more uniqueness in regard to not only disruptive technologies, but also the great position that Canada has. Yes, there are things we need to do and places we need to grow, but we're doing some amazing things, like taking transport trucks to businesses and that kind of thing. It's extraordinary. Of course Waterloo's reputation is amazing, and so is IBM's.

Allow me one more liberty, Ms. Gagné. One of the things that's fascinating is that Ms. Gagné was a public servant for her entire life, and now she's totally a volunteer. I just found that very fascinating—and you're not an engineer, no, not at all. She got on this network and was able to help someone who did not have the capacity of a limb and now does.

Thank you very much, ladies and gentlemen.

Colleagues, the meeting is adjourned.