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Chair

Mr. David Sweet

Standing Committee on Industry, Science and Technology

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● (1105)

[*English*]

The Chair (Mr. David Sweet (Ancaster—Dundas—Flamborough—Westdale, CPC)): Good morning, ladies and gentlemen.

[*Translation*]

Good morning, everyone.

[*English*]

Welcome to the 52nd meeting of the Standing Committee on Industry, Science and Technology where we're continuing our study on disruptive technologies.

We're grateful to have some very high-calibre witnesses with us. From the Canadian Nuclear Laboratories, we have Robert Walker, president and chief executive officer. From Information Technology Association of Canada, we have Karna Gupta, president and chief executive officer, as well as Kelly Hutchinson, vice-president, government relations and policy. From Mitacs, Jean-Marie De Koninck, special adviser for the scientific director, and Robert Annan, chief research officer, research and policy; and from Pratt & Whitney Canada, we have Walter Di Bartolomeo, vice-president, engineering.

We'll begin with Mr. Walker and we'll go in the order in which I introduced everyone. Please try to keep it to six minutes. We'll go to rounds of questions after that, and anything you weren't able to say within six minutes, I'm certain you'll be able to squeeze into some answer somewhere along the way.

Please go ahead, Mr. Walker.

Dr. Robert Walker (President and Chief Executive Officer, Canadian Nuclear Laboratories): Thank you, Mr. Chair.

[*Translation*]

I want to thank the committee for this opportunity to share my perspectives on disruptive technologies.

These are rooted in my 38-year career, first as a scientist, and then as an executive of science and technology organizations and programs that, in one way or another, have been intimately connected to matters of defence, national security and public safety.

[*English*]

Ladies and gentlemen, the early indicators of disruptive potential of technologies often appear long before the disruption occurs, though history shows we often miss these indicators for many reasons. I'll use some anecdotes to make this point.

As a young researcher at one of Canada's defence labs in the early 1980s, I was introduced to a somewhat clunky but fascinating new communications tool called “electronic mail”, or what we had started to call “email”, when our defence labs gained access to an emerging concept being pioneered by the U.S. military, called ARPANET. We immediately had a new, real-time method of collaborating with our Canadian and U.S. defence researchers. Our mindset towards collaboration changed quickly.

In the early 1990s, under a defence program I was managing at the time, we were approached by a group of engineers looking to spin out of Nortel. They had what appeared to be an effective and affordable way of encrypting email. This seemed like a great idea with a potential future market if email were to gain wide use. We agreed to help. The company was formed. Its name is Entrust, now recognized as a world leader in information security technologies.

In the late 1990s, as the ARPANET had moved into civilian mainstream, now known as the Internet, we began to be concerned that as the military became more dependent on information and communication technologies, it would be vulnerable to potential adversaries' disruption of these systems. We formed a group to begin researching information security, including the potential of information warfare and how to defend against it.

In 2008 the world witnessed the first use of cyberwarfare during the Russia-Georgia war. The world had been disrupted.

Here's a second example. In the mid-1990s our defence scientists were examining the potential to bring together two space-based technologies. First, what were the military and civil implications of the U.S. military agreeing to make available for civil use the signals from its newly operational space-based global positioning system? What if low-cost GPS receivers were available commercially? The second was the potential military and civil applications for high-resolution imaging obtained from space-based systems, such as Canada's then recently launched RADARSAT. What if these massive digital images of any location in the world could be made available to users in real time?

Now, couple this with the real-time accuracy of GPS location information and we have enormous potential. We thought these could be game-changers, but we were daunted by the challenges to commoditize them. A decade later, companies such as Apple and Google had made low-cost accessibility to these integrated technologies ubiquitous. The world had been disrupted.

On September 11, 2001, we all watched in horror as the terrorist attacks in New York and Washington unfolded before a global audience. Terrorists had used existing technology—civilian aircraft—in an unconventional way to a massively disruptive effect. Were the warning signals there in advance? Arguably, our cultural bias that suicide was unacceptable, no matter what the commitment to a cause may be, made it difficult to contemplate such a scenario. The month following, the world was introduced to the spectre of biological terrorism when laboratory-engineered anthrax spores were sent to individuals using the U.S. postal system as the delivery mechanism.

What's my point in reciting these incidents? Yes, both were cases of innovative application of existing technologies. However, the real disruptions have been in the way governments and societies have responded to these events through the implementation of new and more stringent security legislation and measures.

Let's look at some of the key issues that are before Parliament legislators and regulators today. In the late 1940s, the oil and gas industry had proven a new and innovative technology, called hydraulic fracturing, or fracking. Over the past 15 years it has been applied on large commercial scale to shale-oil and gas deposits.

● (1110)

What's the disruptive effect? Arguably the most significant is that within the coming decade, the U.S. is forecast to go from being a net energy importer to being a net energy exporter. The geopolitical implications are far-reaching. In Canada, we are presently dealing with the economic implications of a dramatic drop in the price of oil, tied in part to a global oversupply enabled by fracking. The world has been disrupted.

Now I suggest that the most disruptive technology that the world is experiencing today is social networking. This is profoundly changing the way that people interact. There are many upsides. There are also new ethical, security, and safety implications to which governments, legislators, regulators, and security organizations are scrambling to respond. Cyberbullying, identity theft, and ISIS recruitment of Canadians via social networks are examples of hot topics.

The world needs new technology to address many of the grand challenges facing humankind in the 21st century: climate change, population health, energy security, food supply, and urbanization. We can expect that technological solutions to these grand challenges will be disruptive to markets and to society, just as the consequences of humankind's inability to find technological solutions will most assuredly be disruptive to our current way of life.

However, I contend that the public's acceptance of new technology is taking on some troubling dynamics. The public's perception of the risk to society of new technology is being confounded by the inability to communicate in simple terms and build broad public trust in the answer to one question: what does the science say regarding risk? Regulators are frequently faced with public backlash, in effect that the risk is not acceptable, and in fact, that no risk is acceptable. Genetically modified foods, deep geological repositories for radiological materials, pipeline safety, windmill siting, and child vaccinations are each important case studies of how the public perceives and ultimately accepts or rejects risk, despite the significant benefits that these technologies will otherwise bring to society, the environment, and the planet.

The world will surprise us; of this, I'm sure. Many of these surprises will be rooted in the disruptive consequences of new technology or the innovative application of existing technology. Business will be on the front line, both in creating the conditions for disruption that leads to competitive advantage in the marketplace and in responding to others' competitive advantage. There is much that governments can do and must do to help the business sector in this regard.

On the other hand, governments will be on the front line when it comes to addressing the social, ethical, economic, safety, and security disruptions that occur from technological innovation. Efforts to forecast the potential disruptive effect of technologies on markets and society are important. There is much at stake.

Now I contend that to effectively address these challenges requires vigorous engagements of government and science and of the public and science. It's difficult to find a grand challenge facing Parliament that does not have a significant science component. Parliament needs to be a customer of science advice. New mechanisms have been put in place to address this gap—the Council of Canadian Academies, and the Science, Technology and Innovation Council, to name some—and more needs to be done.

One example of “more” is the government's initiative under way to transform Canada's largest science and technology complex located two hours up the Ottawa River at Chalk River into a multi-mission, national laboratory under private sector management. The government-owned, contractor-operated model has been proven to work very well in the U.S. and U.K.

What does this big idea offer by way of potential? It offers relevant and timely science advice and technology innovation for governments to help them understand future disruptive technologies and to address public safety, security, and health needs; the potential to be a key player in meeting the G-7 goal to decarbonize economies; commercialization support for small to large companies seeking to build competitive advantage through technology; and access by academic and industry researchers to large publicly funded science infrastructure. It's a big idea whose time has come.

Thank you.

● (1115)

The Chair: Thank you, Dr. Walker. It's comforting to know that there are still plenty of us around who remember a time before email.

Mr. Gupta, please go ahead.

Mr. Karna Gupta (President and Chief Executive Officer, Information Technology Association of Canada): Thank you, Mr. Chair, and honourable members. Thank you very much for having ITAC at this session.

Just to introduce ourselves, ITAC represents the technology sector of the country. With over 300 companies, we produce about $160 billion in revenue and one million jobs. Most importantly, we spend about $5 billion on R and D, so the disruptive technology discussion is very apropos.

There are several disruptive technologies that are unfolding at the same time. They range from robotics to the cloud to genomics to 3-D printing to renewable energy. However, we need to address them not only as discrete technologies but also look at how these innovations collide and create a new world, because they are and they will be always connected and intelligent.

A McKinsey report recently talked about several disruptive technologies. Today, I will speak about one that falls in the top three, and it is often referred to as the Internet of things, or IoT. The Internet of things, or IoT, is the online interaction between different technologies. All of the disruptive technologies you have heard about and you will be hearing about over the next little while through this committee will essentially dovetail into IoT as they all become interconnected and in some part reside online.

As ITAC, we look at technology through the filter of public policy. We understand the benefits of innovation but also its implications. For our members this is a major issue in the technology sector: how to deal with the policy and the new business models that will emerge. Today I will comment on what it means, why it is important, and what the impacts are.

ITAC wants this committee and the government to recognize IoT and develop a national discourse, ignite a must-have dialogue amongst academia and private sector and public sector experts, and start a discussion to begin developing a policy framework to proactively deal with it.

IoT creates the ultimate connected world where intelligence is shared between machines, applications, and services, and therefore creates data models that will significantly improve the way we make decisions. In fact, sometimes the decision may not even require human intervention. Simply put, technologies will connect, work together, and communicate online. It provides us with capability rather than technology. The solution comprises technology and telecom hardware, software, services, sensors, applications, security, radio frequency, etc. Most of it will be cloud-based and mobile-enabled.

Just to give you two examples, recently a company in Alberta, called GrowSafe, used RFID tags for their livestock. What that means is that it allows them to measure many factors related to wellness of the farm animals. This gives farmers the visibility on health and development to proactively deal with the animals, and this makes our food supply safer. This is an example of the Internet of things, a capability that resulted from multiple things communicating one with the other through technology and the Internet without human intervention.

I'll give you a second example. Dr. Carolyn McGregor, Canada research chair in health informatics at the University of Ontario Institute of Technology, leads a project that significantly improves the survival of premature babies. The combination of cloud computing, wireless technology, and data analytics has provided their team with the ability to detect infections in preemies earlier than before, and this has saved a lot of lives. Again, it's an example of the Internet of things, whereby a multitude of hardware, software, services, and centres that come together without human interaction will truly usher in a new world we have not seen before.

Unfortunately, not all great things are devoid of consequences. There are several things we need to address. Privacy is one of the greatest concerns. Canada has been at the forefront of global leadership on safeguarding privacy and with the evolution of our digital age this could be compromised. Safety and security is a problem. While these new technologies have benefits, IoT will dramatically increase the attack surface available to bad actors. With the capacity issues, bandwidth and network capacities in rural areas, regardless of infrastructure investments made, will become a scarce resource and their governance even more complex.

● (1120)

Economic and commercial and public policy issues are very far-reaching. There are intellectual property and trade issues. Who owns the data that's being generated? Standards and legal frameworks issues: what regulations can be put in place for competing technologies to work together and what kind of governance is required to be ethical? There are workforce implications. A recent study done in the U.S. demonstrates that robotics may replace up to 40% of their workforce. The policy implications are very serious and we need to address them.

As the Information Technology Association of Canada, we strongly recommend that the standing committee continue this discussion into new sessions and beyond. IoT will be a truly disruptive force, moving faster than you can see it happening.

For our part, ITAC is starting to create a white paper with several top leaders and as soon as it's ready, we'll have it translated and sent to all of you. We have established an IoT round table of leading industry experts who have pledged to contribute and provide perspective, insight, and knowledge on this important factor.

We ask the standing committee and the government that a national discourse be created with a proper secretariat and facilities so we can do a deep dive, have further investigation done, and have the policy framework that prepares for the IoT that is coming. Much like the information highway in the 1990s, it needs that level of attention from the government of the day.

Thank you very much, Mr. Chair.

The Chair: Thank you, Mr. Gupta; we look forward to that white paper.

Now we'll move on to Dr. De Koninck.

[*Translation*]

Dr. Jean-Marie De Koninck (Special Advisor of the scientific director, Mitacs): Thank you, Mr. Chair, for this invitation to appear before the committee.

I would like to begin by introducing myself and the person accompanying me. As some may know, I am a mathematician and professor at the Université Laval. I am also the Special Advisor of the scientific director of Mitacs. I identify myself as a researcher, educator and communicator.

I will now introduce Dr. Robert Annan, Chief Research Officer at Mitacs.

[*English*]

Rob has provided leadership at Mitacs in various roles for the last five years and he's a passionate advocate for the role training and innovation must play in Canada's economic success.

I will provide an opening statement and Rob will be available to assist in answering questions, particularly those related to Mitacs' philosophy and activities.

First, here's a short explanation of what Mitacs is and what it does. Mitacs is a national not-for-profit organization that delivers research and training programs in Canada. Representing over 60 universities, it works with thousands of companies and both federal and provincial governments to build partnerships that support industrial and social innovation in Canada. We do this through research internships and skills training programs. We do this because these internships and other forms of experiential learning can integrate academic strengths with public and private sector innovation needs. They also give graduate students and post-doctoral fellows the opportunity to gain essential professional skills and non-academic experience.

Disruptive technologies are having a huge and positive impact on our Canadian economy. I'd be surprised if anyone you speak to over the course of this study would disagree with that statement. However, I'd like to use my time today to focus on two specific ideas that I see as critical to this discussion. First, I believe the vast majority of disruptive technologies are driven by advances made in fundamental research. Second, in order to maximize the impact that disruptive technologies can have on our society and our quality of life, we must also focus on the concept of disruptive learning.

First, we are surrounded by countless examples of applied science in our lives. There's no doubt that applied research and development is essential to the creation of disruptive technologies. Unfortunately, we sometimes forget that many of these had their origins in fundamental research. One such example is the way we exchange confidential information and communicate data. For this we need modern cryptography techniques.

It turns out that one of the most powerful encryption methods, which ensures in particular that important financial transactions are totally secured, was created in 1977 by three young mathematicians from MIT. Their research was in the field of number theory, an area of mathematics with results that are, for the most part, of theoretical interest. Today, this most secure data encryption system, which has fundamentally changed our lives in the way business is done online, exists because mathematicians indulged in pure mathematics without being concerned about the applications it might have in our daily lives.

The second idea I would like to touch on is what I call disruptive learning. Some of you may have heard of Sir Ken Robinson. He is an English author who argues that education systems should foster curiosity through creative thinking. He sees education as an organic system, not a mechanical one. He even claims that our current education system is archaic and outdated.

While we don't necessarily endorse all of Ken Robinson's ideas, we are challenged by them. Given that we all live in a technology-driven world, one that would have been unfathomable even a generation ago, doesn't it make sense to reconsider or at least re-examine how people are being educated? I would suggest that it's at least worth asking the question: can we do more to provide broader and more relevant training experiences and opportunities for our children and students?

This idea of embracing a new disruptive education paradigm is likely beyond the scope of this committee, but it's an important concept nonetheless. What is relevant, however, given the ongoing changes in technology and how it is used, is the question of how we invest in talent and in Canada's greatest resource, its people, in order to take full advantage of the disruptive technologies that exist today and that will exist in the future. We need to reconsider how we train and teach our students to function optimally in a world full of disruptive technologies.

Mitacs gets this. By delivering programs that look at research and experiential learning in a different way, they are demonstrating that they get how innovation really works.

● (1125)

I understand that in previous meetings you discussed the importance of investing in disruptive technologies, and that is clearly important. The question of which ones are worthy of such investment is far harder to answer. However, we at Mitacs believe that even more important is investment in talent and the training of our next generation of innovation leaders. With support from the federal and provincial governments, Mitacs delivered more than 3,000 internships across the country last year, and with the commitment in the recent federal budget we are on track to double this number by 2020.

Let me take one minute to tell you about one recent Mitacs funding recipient, Andre Bezanson. While impressive, Andre is by no means a unique case as Canada is full of young, ambitious researchers like him. Andre is a Ph.D. student in the school of biomedical engineering at Dalhousie University. His research focuses on developing technology to miniaturize ultrasonic probes to about the size of a pencil eraser so that they can be used for endoscopic imaging applications.

During his undergraduate degree in mechanical engineering, Andre discovered a passion for the engineering design process and for being able to see a project evolve from an idea to a tangible product. As part of his Mitacs-funded internship, Andre worked with Daxsonics Ultrasound Incorporated to develop high-frequency ultrasonic transducers and electronics for use in medical imaging. This new technology was adopted by Daxsonics and Andre was offered a key position in the company as a result of the success of this work. Upon completion of his degree he hopes to turn his new technology into a commercial product, opening up benefits of ultrasonic imaging to new clinical applications.

Andre's story is an example of how internships can have a profound impact on students and their success by expanding the way they learn. By investing in new models of experiential learning, we indirectly promote the creation and development of disruptive technologies.

I believe that the integration of experiential learning in graduate studies can change the landscape of research and innovation in Canada in three main ways. First, it builds collaborative research projects to leverage academic strengths and boost the innovation activities of the partner organization. Second, it expands the scope of research and development opportunities on Canadian university campuses. Third, and perhaps most important, it supplements traditional scholarships and training with experiential opportunities designed to expand creativity and innovation.

At Mitacs we use experiential learning to address complex issues and research challenges. At the same time, we provide Canadian students in post-docs, just like Andre, with opportunities that will broaden their skills and research experience.

We applaud the efforts of this committee in tackling such a challenging and complex issue. It will only be through such collaborative and cross-sectoral efforts that we can take full advantage of disruptive technologies here in Canada.

● (1130)

[*Translation*]

Indeed, there is a role for all of us to play if we truly hope to harness the power of disruptive technologies, and properly prepare our young Canadians to use them to their full potential and to develop the disruptive technologies of tomorrow.

Thank you for your attention.

[*English*]

The Chair: Thank you very much, Mr. De Koninck.

Now we move on to Mr. Di Bartolomeo, please, for six minutes.

Mr. Walter Di Bartolomeo (Vice-President, Engineering, Pratt & Whitney Canada): Thank you, Mr. Chair and committee, for this opportunity to speak today.

Disruptive technologies are an important element but not the only element of an innovation process. They can lead to true breakthroughs in the design, function, and costs of products, and contribute to significantly increasing our competitiveness. They must be recognized and even encouraged as part of a company's, an industry's, and a country's innovation strategy.

That being said, I'll take a few minutes to provide a brief overview of our strategy at Pratt & Whitney Canada, which has led to a number of game-changing products and technologies that we like to say spark the imagination and move the world. Over 87 years, we have demonstrated a deep commitment to research and development. This has enabled us to emerge not only as a world leader in our markets but as a key player in the development of Canada's aerospace industry. We've produced 85,000 engines to date, and more than 50,000 are still in service today. We have 12,000 operators around the world, in more than 200 countries and territories—probably more than recognized by the United Nations, at that.

Every second, a Pratt & Whitney Canada powered aircraft takes off or lands somewhere in the world. These flights have a real and positive impact on thousands of human lives each and every day: humanitarian missions, emergency medical services, search and rescue, reuniting families, and creating jobs, to name a few. To that end, it must be realized that the most critical characteristic of the product that we design, produce, and service is reliability. As part of the flying public, we, our families, all count on successful flights every day.

To that end as well, we operate in an industry framework that is highly regulated—appropriately so—and for which the time scale for demonstrated innovation is measured in many years. In the last 25 years, we have successfully certified and brought to market over 100 new engines, a record that is unmatched in the industry. We've also forged strong R and D collaborations with universities, research institutes, and other partners across Canada to develop these technologies and products. No fewer than 9 of the 13 research chairs supported by NSERC in aerospace are in association with Pratt & Whitney Canada.

On our innovation journey, we've also been able to count on the support of the Canadian government and Industry Canada, which have shared our vision to build a strong and prosperous aerospace industry. These investments in cutting-edge materials, high-efficiency technologies to enhance engine performance and reduce fuel consumption, and combustion systems to reduce noise and emissions are a big part of our development.

We're also creating world-class centres of excellence for advanced manufacturing. These will be dedicated to manufacturing highly complex components and to supporting small and medium enterprises. The unique high-strength properties of the very complex materials that are used require fully integrated and ultra-efficient production lines equipped with automation, closed-loop process control, and high-precision machining technologies.

If we look back, our very first engine, which was first delivered in 1963, was the iconic PT6 engine. It was developed after numerous false starts, and at one point we had well over the net worth of the company invested in the program. That engine was game changing, and it was a step up from the traditional piston engine powered aircraft. It essentially created a new brand and market. Since that first model, we've developed more than 50 variants, and within the same size of engine we have increased its power by more than 400%.

Disruptions in markets can also lead to opportunities for innovative technologies that are technology ready. This was the case in the mid-eighties, with our PW100 turboprop market. In the eighties, we shifted direction in response to opportunities opened by airline deregulation in the United States, a deep economic recession, and a big spike in aviation fuel prices. These factors suddenly made fuel-efficient turboprops more competitive vis-à-vis jets, and we were there to leverage that. Today, those engine families are by far the leaders in that market.

Finally, I'll talk about the example of one of our most powerful disruptive technologies, and it's in our newest engine family, which is called the PurePower PW800. The genesis of this engine is the revolutionary and disruptive geared turbofan or GTF engine that powers the C-series aircraft. It was developed in concert with our parent company, Pratt & Whitney. This disruptive technology suite was more than 15 years in the making, and it reflects the rigour of effort, development, and validation that is sometimes required for flight critical technologies.

In the aerospace industry, disruptive does not necessarily equate to fast. Nevertheless, the geared turbofan increases efficiency and delivers significantly lower fuel consumption, emissions, and noise. The advances in aerodynamics, in materials, in combustion, will set a standard for many generations to come.

● (1135)

I'll speak more generically about disruptive technologies. They have an important place in our value stream, whether it's engineering, manufacturing, or services. However, there are many barriers to adoption, particularly in engineering and manufacturing, due to the regulation I spoke of, or market and economic contexts.

While fuel burn performance will continue to be a key indicator in the future, speed indicators such as speed in design, speed in manufacturing, and speed in service are dramatically evolving. Key future focuses will include disruptive technologies that address speed in manufacturing, for example, and we hear a lot about 3-D printing as an example of a dramatic evolution in such technologies.

You just heard about innovation and the Internet of things. Speed in customer service is another example where customer feedback and problem-solving will turn a new leaf with social media, and customer data will be transformed with evolving intelligence and predictive analytics for revolutionary service, offering a more connected world.

With respect to the basic propulsion technology, we firmly believe that we're starting to be at the cusp of cheating physics, and as such disruptive technology at this end will be more a rethink of the aircraft's system and architectural optimization. Though still very theoretical, the future is bright.

To conclude, it should be clear that Pratt & Whitney Canada has no intention of resting on its laurels. We already are well into the design of a new turboprop engine to replace that engine we started in the mid-1980s. We have several disruptive ideas still on the drawing board, from more electric solutions to significant architectural design innovations targeting 35% fuel burn improvements over current architectures. To put the number 35% in perspective, the industry considers that a 1% per year improvement in fuel burn is a general measure of successful innovation.

The future holds plenty of opportunities for more disruptive innovations. If we remain flexible in our technology choices, encourage our academic institutions and industry to collaborate closely, and continue to promote our industry, we'll continue our legacy of innovations and successful products and services within the country.

Thank you.

The Chair: Thank you, Mr. Di Bartolomeo.

We're going to go to rounds of questions now. We are absent Liberal members, colleagues, so maybe I'll just warn you that I might shuffle it up a bit if no one still arrives so we make our meeting more streamlined. Maybe I'll give Ms. Papillon a warning that I may put you in a Liberal slot if nobody shows up. Right now it'll go Lake, Ashton, Gallant, a Liberal member if they show up, Carmichael, Papillon, Daniel, Masse, and Maguire. But like I said, that will shift if no Liberal member shows up.

Mr. Lake, please, you have nine minutes.

Hon. Mike Lake (Edmonton—Mill Woods—Beaumont, CPC): Sounds good. Thank you, Mr. Chair.

Thank you to all the witnesses.

I'm going to zero in, if I can, on Mr. De Koninck. I was interested in all of your presentation, but there was specifically a small part of your presentation that caught my attention, that education should be organic, not mechanical. I thought that was an interesting statement. Given the nature of the panel that we have, I'm curious as to what the research actually shows on that statement or where we ought to go in terms of education.

Dr. Jean-Marie De Koninck: It's not me who says that, it's essentially Kenneth Robinson. He sees education as a more organic system instead of a mechanical one. We might say today that the education system is very rigid. It tells you at what age what you should learn and so forth, and it doesn't give much room to manoeuvre in innovation, for instance. There's not much room for innovation.

He gives a specific example of a study that was done in kindergarten. They examined the creativity potential of kindergarten students, and they realized that 98% of the kids were showing signs of creativity. They followed those kids along their school education evolution. In primary school they started with this potential for creativity. Then in high school it was down to 20% or something of the students instead of 98% who showed signs for creativity. That's why he says that education systems should be reconsidered, re-examined, to allow more room for the potential of creativity.

It's my interpretation that in the schools you're told, you have to learn this, you have to do that, but don't do that, and so forth. You have these kinds of *balises*. You have a path that guides you through the system and kills your creativity in a sense. Maybe we don't endorse that completely, but we should be challenged by that and saying, “Can we do better?” Can we allow some time in school for activities that exploit the creative potential of these kids? That's what we're saying.

Maybe you want to add to that, Rob.

● (1140)

Mr. Robert Annan (Chief Research Officer, Research and Policy, Mitacs): Yes, maybe I'll just layer on top of that the Mitacs' perspective.

I think traditionally our university system has been set up to produce professors, especially as one moves through the graduate system. That model has always existed. The reason you're doing Ph.D.s is to gain the scholarship and deep knowledge necessary to then ask a professor if could it be done on the research side and pass that information on to the next generation.

The reality is that the vast majority of Ph.D. holders, not just in Canada but worldwide, don't become university professors. They contribute in very meaningful ways to society through acting in management and industry, contributing to R and D in companies, and acting in government and the social and not-for-profit space. What they've learned doing that Ph.D. is very useful and contributes productively to society but we haven't yet reflected that reality in the training they receive.

What we've been trying to do at Mitacs, with some success, is to layer on top of what exists that works really well around scholarship and deep learning to open up alternatives and different sorts of pathways so that students can see that what they're learning has applications in the private sector, in the not-for-profit sector, and that they can take their research and apply it in a variety of ways and not simply in the traditional academic path.

Hon. Mike Lake: I don't know if anyone else wants to weigh in on this, but I know some of you would be employers or companies who are employers. How does that thinking impact the type of person you're looking to hire or get involved in your industry moving forward? How would that change things for you?

Do you want to weigh in on that, Walter?

Mr. Walter Di Bartolomeo: Sure.

For one, perhaps a bit more generally, certainly the encouragement of STEM programs, early learning, high schools, and the like, and getting the industry to be involved in such things to encourage young individuals to like the sciences, I think is a way forward.

In terms of the implication of industry in school systems, FIRST Robotics is an excellent example of a program where universities, collectively with industry, get in and just encourage young individuals. To your point of being able to understand the type of individual you want to hire, I think what has worked well in the aerospace industry over the last 15 years is to forge and push curriculums to be more in line with what the industry would need.

The last thing is that if I look at the last 15 years, we have more Ph.D.s working on the shop floor than one would expect. That's because of the science of manufacturing and the materials we use. The advances in the technology around manufacturing means the level of science on the shop floor requires Ph.D.s, which is not something you necessarily would have thought of certainly when I started in this industry.

Those are three points.

Hon. Mike Lake: Thank you.

Robert.

Dr. Robert Walker: I've observed that companies that succeed today have two types of individuals. They have deep subject matter experts. They also have people with the skills to look in an integrated way at how ideas come together to make a difference. The space of entrepreneurship tends to be on the latter. The issues that I highlighted span the constructive side of disruptive technology, and the negative side of disruptive technology needs those spanners.

Our education system has been tuned to deliver the former. Can our education system also be tuned to deliver the latter or is that only a skill that can be developed through practice, through the actual conduct of the business?

I think that's a bit of an open question. My observation is that people tend to demonstrate with time in a career that they have the attribute for the second, and great companies identify that quickly and put those people into those roles quickly.

● (1145)

Hon. Mike Lake: It's interesting because I think that's what Mitacs tries to do. That is, take people with that expertise in a specific subject matter but give them life experience working with a variety of different organizations that might broaden their horizon a little earlier in their progress.

Karna, you wanted to weigh in on this too.

Mr. Karna Gupta: Yes.

I think one of the things we're finding in our sector is that the industry is getting more involved with academia to design what's needed. We are involved in a process of developing a national occupational survey as to what type of skill set young people should have going into the workforce. There are certain programs, when you specialize in cybersecurity or anything else, where it's not only the technology but also the infusion of business understanding that is needed because at the end of the day you're trying to solve a problem and it requires both sides.

More and more we're finding out that by having these surveys we're creating programs and learning outcomes with universities and colleges where kids will learn not only the technology side but also how it's applied from a business point of view. That program is quite active with the government's help. We're now rolling it out to 50 additional universities and colleges. It's called business technology management. It brings together the technology and business issues through national occupational surveys with the help of the ICT sector.

Hon. Mike Lake: It's interesting. Actually, I had a whole bunch of other questions, but we kind of get on that path sometimes.

I think as a parent of two kids.... I have a sixteen-year-old daughter who is just brilliant, and she could do anything she wants to do. I've taken her to see the WISEST program, the women in the STEM areas, because I want that world to be open to her. I want her to look at all of the options and understand everything that's available to her.

On the flip side, I have a 19-year-old son with autism, who is in many ways like a three-year-old or four-year-old in a 19-year-old's body. When you take a look and give him an opportunity to contribute, he has skills and abilities that are hard to find sometimes but that we need to take advantage of.

You got me thinking along those lines in terms of what you had to say. Thank you for that.

The Chair: Thank you, Mr. Lake.

Now we'll move on to Ms. Ashton for nine minutes.

Ms. Niki Ashton (Churchill, NDP): Thank you very much.

Thank you to all of our witnesses for coming forward and sharing your expertise with us today. I'd like to direct my questions for the most part to Mr. Gupta and Ms. Hutchinson with regard to the work that you do.

Given that we're not here to just conduct this report but to formulate recommendations, and hopefully take these recommendations to the implementation stage, I'm wondering if you can speak to the situation today in terms of government support for start-ups in IT. Is there more that can be done? What can be done with respect to attracting investors and inventors to our country?

Mr. Karna Gupta: Thank you for the question.

I think if you look at the Canadian ecosystem from an information technology lens, if you use that lens to look at it, there is no shortage of innovators or entrepreneurs starting in business. Where we get into some issues as a Canadian sector is that we are unable to build companies of scale and size, partly because we're still a growing nation. We don't have the necessary infrastructure support and everything in place to help companies grow in scale.

Our market is very small. For any technology company to be of capacity and survive, it must have a global footprint. There is no such thing as “just a Canadian market” once you start to do that. We have always been tied to the north-south trade, which is the U.S., and it's a big market. But as the winds of trade change and east-west becomes more important, and the rate of growth is much more sharp in some of the emerging economies, it is necessary that we provide our companies with the tools and infrastructure to grow and enter those emerging markets.

On what is needed, we need to have the skill set, the talent, that can build the companies and grow companies of scale. It needs the funding, so it needs the capital market available to them as and when they need to grow, from working capital and everything else. Finally, it needs the access to the right market.

We need to use all of the tools that the government and others can marshal to help this company to the actual market. At the end of the day, the question you posed really comes under the three, what I call blood vessels that make a company successful: access to capital, access to market, and access to talent. For the first part, I think we need to address them from those perspectives.

I think more could be done. We have appeared at multiple committees in terms of IP regime in Canada, innovation culture in Canada. I think a lot needs to be done.

● (1150)

Ms. Niki Ashton: You mentioned infrastructure, and I know in your presentation you referred in part to broadband access, which of course is an immense challenge in large swaths of our country. I'm wondering if perhaps you could elaborate a bit. When you speak of infrastructure, where do you think the government could play a greater role?

Mr. Karna Gupta: I think the rural and remote broadband would be important to drive the innovation culture. In a technology sector, people don't go to jobs; jobs go to people. We need to get to the people where they are.

In a Canadian context, where most of our population is urban, around the cities and down the 49th parallel, I think the core population does have the broadband structure. But we are leaving out big parts and swaths of the country that we can't touch on. Particularly given the skill shortage, we need to find a way to touch on the aboriginal and northern population youth. To get to them effectively, we need to have a proper rural and remote broadband infrastructure and the plan that goes with it in terms of deployment and investment.

Ms. Niki Ashton: On that note I represent a northern constituency and a number of the communities I represent do not have access to broadband. It's truly a daily struggle for something as basic as kids accessing the kinds of opportunities online that any other child in another Canadian community would have. Unfortunately while initial commitments were made in terms of the physical towers, that hasn't materialized in broadband connections the way it should have.

I do want to note, however, speaking of Pratt & Whitney, there is a highly technologically intensive operation in our region, a cold weather testing site, just minutes from my home. I think that's an example of a positive investment, and all levels of government were part of that in connecting IT opportunities in northern communities in a much greater way.

Mitacs, thank you for your presentation but also your insight into what we could be doing with respect to education. Obviously the federal government is more involved on the research intensive front and we see the need for greater involvement in post-secondary education and restoring dedicated funding on that front.

I wonder if you could perhaps speak to how to create a culture of innovation that encourages both basic research and commercialization. Is Canada able to strike a balance? How can we do that without giving preferential treatment to commercialization, for example, over anything else?

Mr. Robert Annan: Yes, thanks for the question. It's a big question and it's one that we spend a lot of time thinking about and talking about.

I think the challenge is to try to reflect the reality. In science labs across the country people don't think about their research, necessarily, as applied and basic. The research is much more organic than that.

I did my Ph.D. at McGill in biochemistry, and we were working on mechanisms of protein folding inside of cells—how do proteins fold?—and there is a lot of mystery. Proteins have to fold and they do and we don't really know how. We developed certain tests to try different explanations and so on, and those tests ended up being really useful to screen for drugs for cystic fibrosis, which is a folding disease. So the tests we developed for basic science we started using to screen drugs, and we had an agreement with a major drug company to screen rapidly lots and lots of drugs to treat cystic fibrosis. Every time we'd get a hit from the drug screen we would then take it back to the basic side and ask, “What was the target? Does this explain why things are happening the way they do?” It was back and forth, and very fluid.

This has always been the way with science. It doesn't compartmentalize easily into these different areas.

Unfortunately it's tough to create mechanisms to reflect that kind of fluid reality. So we've been working with other research organizations like NSERC and SSHRC, the tri-council, and these other government-funded agencies, to try to find ways to integrate efforts to reflect that. Unfortunately I think we still have a lot of funding silos that say this should either be basic research or it should be applied research.

I think the more government can do to try to encourage either integration of effort and support, or to break down some of these silos and fund research, and encourage research to move in whatever direction is necessary to take us forward, that's really a positive step toward supporting innovation and getting away from this false dichotomy of it being either basic or applied.

● (1155)

Ms. Niki Ashton: That's great. Thank you.

Are there any final thoughts on that point?

Dr. Jean-Marie De Koninck: I know you mentioned that the federal government is not involved in education or in research, but innovation is in a sense closer to research, so if there—

Ms. Niki Ashton: I meant primary education, K to 12.

Dr. Jean-Marie De Koninck: Yes, but anyway, if it's possible to incorporate and support innovation at the lower level at school then it would be great. We would all be happy.

Ms. Niki Ashton: That's a good point. Thank you.

The Chair: We'll move on to Madam Gallant for nine minutes.

Mrs. Cheryl Gallant (Renfrew—Nipissing—Pembroke, CPC): Thank you, Mr. Chairman.

First of all, Dr. Walker, you mentioned in your remarks about indicators you and your team had seen that government could not commoditize it or the people in the research lab were not able to commoditize it. Google and another company put it all together.

What can government do to help commoditize or create an environment that would be conducive to disruptive technologies when these indicators appear?

Dr. Robert Walker: Ms. Gallant, if I had an answer to that, I'd probably be a rich man.

Let me say that among the issues that are out there, I believe one is that the tendency is for government to be engaged in a discussion of funding science, but there's another discussion around government being a customer of science. I think governments tend to be patient investors when they look at being a customer of science, which creates a platform where people have the opportunity to explore the what-if world of what might be around the corner, and with that to get those ideas socialized. If, in being a customer of science, the government also creates the opportunities for industry to look inside that science and to see what's emerging, industry will commoditize.

I think we're talking about new ways of connecting government science, not done inside government but where government's a customer, with industry that has the ideas to turn those emerging concepts into a bright idea that can enter the marketplace. It is the private sector that's far better to commoditize, but it needs to see the potential early on.

Mrs. Cheryl Gallant: Okay. Then let's talk about government being a customer of science.

You had mentioned September 11 and the anthrax attack, but in addition to kinetic and chemical threats, we also have radioactive threats, situations that are not meant for peaceful use. In what way has CNL contributed to tracking and detecting radioactive material for the purpose of keeping our country and its citizens safe and secure?

Dr. Robert Walker: Thank you for that question here.

This plays a bit to the theme I've tried to pull on. Disruptive technologies have, ideally, very positive effects on societies. Much of what we try to do, governments with industry, is to maximize proactively the potential for that constructive benefit. It's also the case that technologies can have a downside that has public safety and security consequences. How is it that we're able to get the early indicators of what the downside could be and engage, as opposed to reactively, rather proactively, how we can better address that issue? I would suggest that Dr. Gupta's comments around the Internet of things highlighted a number of the areas where we know there are likely to be security implications emerging. How can science be simultaneously helping us understand the upside and the downside, and address them both at the same time?

At CNL, for example, Canadian Nuclear Laboratories, we're heavily engaged with the security apparatus of government to help understand, for example, the illicit tracking of nuclear materials around the world, to make early detections of that material, for example in containers, and then to be able to provide a fingerprinting of that material to trace it back to source of origin, which allows the security community to intervene and deal with the criminal aspects of that particular activity. These are all technologies, of course, that were spun out of the civil application of nuclear technology for nuclear energy, the upside of it. But at the same time as being conscious of the negative side, and helping the security apparatus of government be ready for that, we're helping that technology be a net contributor to society.

● (1200)

Mrs. Cheryl Gallant: Okay. We had Isowater as a witness earlier in this study. The witness spoke about the disruptive technology that his company is working on. While CNL is well-known for the role in the development of the supply of medical isotopes, the labs at Chalk River are involved in developing other technologies based on different isotopes.

Could you describe some other projects involving other types of isotopes at CNL that have the potential to become disruptive technologies or give rise to disruptive technologies?

Dr. Robert Walker: Thank you for that.

CNL knows hydrogen intimately. The origin of that, of course, is in our development of the CANDU reactor, which is based on the use of a particular isotope of hydrogen called deuterium in heavy water, which is used for moderating the reactors, the chain reactions in CANDU reactors. The consequence of this is that we understand all of the isotopes of hydrogen intimately. Hydrogen is a potential game-changer when it comes to the energy storage dynamic, the energy storage dilemma, that is facing the globe as we move forward to decarbonize global economies, potentially coupling tightly to the vulnerabilities of renewable technologies, which still have this issue of intermittency to deal with.

There are also breakthrough technologies in the use of tritium, radioactive tritium, for low-powered, very long-life batteries for remote applications. Energy storage, batteries, catalysts that allow the introduction of hydrogen in the hydrogen economy, are all spin-out technologies that have come out of our focus, first on nuclear energy, but through serendipity we are seeing the applications go into a broader set of spheres. That is the innovative process, and certainly CNL is quite engaged in that, oftentimes trying to find that sweet spot with start-up companies in Canada that want to take those ideas into the market.

Mrs. Cheryl Gallant: What do you see now that will help Canada remain competitive in the nuclear power field, and in nuclear science in general?

Dr. Robert Walker: There are two sides to that. Again, I come back to a comment made by one of my colleagues here that we have many start-ups in Canada. The challenge we have is turning companies into sizable companies. It's getting over that threshold of size and market access.

I also think at times we struggle with not having science capacity that's sufficiently robust. The idea of the national laboratory, which is being created at Chalk River, is one such entity. It has critical mass, large infrastructure, and opportunities of easy access by academics and innovators and entrepreneurs to come in and test ideas to prove their viability commercially, to answer questions of regulators, to couple with international capitalists, to be able to prove the concept, to get over prototyping stages, and oftentimes to introduce to larger companies around the world that are interested in accessing or acquiring that company and giving it the critical mass.

The idea of a national lab is something new to Canada, something of the scale of national labs that we see in other jurisdictions such as the U.S. It's going to be enormously interesting to watch how that dynamic plays out in Canada over the next decade.

I'd also highlight that, going forward, solving the problem of decarbonizing the global economy is something I think Canada is uniquely positioned for, given the strength we have, not only in nuclear technology but renewable energy. I believe we need every arrow in the quiver to solve these problems, and a combination of nuclear energy and renewables that build on their complementary strengths can be the answer. I believe CNL's well positioned to help move that forward.

● (1205)

The Chair: Thank you very much, Dr. Walker and Madam Gallant.

Now we move on to Ms. Sgro for nine minutes.

Hon. Judy Sgro (York West, Lib.): Thank you very much, Mr. Chair.

My apologies to the chair and committee, but it was unavoidable. I'm sure my colleagues all understand how that happens, but I am glad to be here, and I offer my apologies to our witnesses. I knew you were in great hands with the rest of this committee and they ask all kinds of interesting questions.

Dr. Walker, can you elaborate a bit more on decarbonizing, because it's certainly an issue that we're all very concerned about?

Dr. Robert Walker: Thank you for that.

One of the attributes we often associate with disruptive technology is that it occurs quickly. All of a sudden it's there, it's visible, and we're now aware of it. Some of my remarks were to suggest that there's often a very long gestation for it. Our G-7 leaders have said we need to decarbonize global economies by 2100. That sounds like a long time away, but I would suggest that it's a very pragmatic and practical outlook for the time required to do this because there are so many profound changes to occur in infrastructure, in outlook, and in technologies before this can occur.

I again come back and believe that the solution to this requires using the phrase “many arrows in the quiver”. We need energy sources that are clean, safe, reliable, and affordable. A multitude of energy sources have strengths along those four attributes and some challenges. How do you find the pairing up of those sources to have that magic to make it viable at scale?

I, for one, believe that renewables and nuclear energy combined will be a big part of that answer, along with dramatic changes to grid technology. These require massive investments. They require big science and many companies aligned to make it happen. Canada is a relatively small country and is uniquely positioned with strengths in renewables and nuclear technology, and has the potential to be a world leader in this area.

Hon. Judy Sgro: That's very encouraging. I hope everybody was listening as we go forward.

So 2100 is an awfully long time away, and what's interesting here is that you say it's a reasonable date to have. I guess it seems a very long time to those of us who are impatient, but hopefully progress will be made.

To our other witnesses, we've had a variety of people come before us from various universities and so on. What do we need to do as a country to ensure that our young people who have creative skills and want to be innovators.... Where do we need to be investing more? What roadblocks are in their way? I'd like to open it up for all the panellists to give us some idea of what else we need to be doing to provide opportunities for Canada to position our country better.

Mr. Karna Gupta: Thank you for the question.

I'll kick it off this way. I think it really needs to start at a very early stage at the school level. I recognize the difference in terms of the provincial versus federal jurisdiction issue on education. But that aside, I think a national strategy is needed in terms of making sure our kids are exposed to the right programs at an early stage so their learning capacities are for what's needed for tomorrow and so they are not faced with choices in grade 8 or 9 such that when they come out on the other end their options are working either at Walmart or at Tim Hortons.

If we're going to build a knowledge economy, the most critical ingredient is knowledge. We need to start building for it, and it needs to start before we get to the high school level. Universities play a huge role, but I think we need to start at a high school or junior school level and make sure that the programs are there and the leadership is there to drive kids into the programs we need, which are mostly around STEM, around science. That keeps the doors open. Kids can do other things if they want to later on, but at least the doors are open for them to where they need to go.

Having been a parent of two children who are grown up now, I'd say that the biggest issue for a lot of kids is what program you go into during your early days in order to have the maximum number of opportunities and options available in front of you. Don't shut your doors until you know what you want to do. Way too many kids shut their doors too early, and then opportunities are very limited downstream as they come out of high school on the other end. This needs some national discussion and leadership in terms of programming and how we do that.

● (1210)

Mr. Robert Annan: Thanks for the question.

It's a big question. Recognizing, of course, the challenges around federal-provincial jurisdiction when it comes to education, I think there's still a lot the federal government can do and is doing.

I think working with young people is important. For instance, I know that one organization, Let's Talk Science, does a lot of great work with young people in encouraging K-to-12 students to engage in science, whether it's through science fairs or scientists in the schools and that sort of thing. Support for those kinds of organizations I think is really great.

I will make one statement, though. I think there is a risk in focusing too much on STEM to the neglect of broader skills. At Mitacs, of course, we work a lot with STEM students, but roughly 15% of our interns who go through now are actually from the social sciences and the humanities. Those creative disciplines have a lot to contribute to innovation, particularly once you start bringing multidisciplinary teams together, where you have engineers working with psychologists and with design people. This kind of mix of skills is important. While of course STEM is important in terms of creating people who have the tools to build disruptive technologies and so on, I think the creative disciplines are still really important. We don't want to neglect them.

I'll also say that, generally speaking, while we are doing a good job as a country with post-secondary attainment—we have one of the highest rates in the world of post-secondary graduation per capita—we do have blind spots, particularly at the higher levels. In terms of Ph.D. production, for instance, we're 20th in the OECD per capita. We just don't produce people at the highest levels of education, and I think we can do better on that.

Right through the post-secondary system, I think it's important to build in diversity so that all of our bachelor's graduates aren't going through exactly the same kind of training—and the same with master's graduates and Ph.D.s—but rather that we provide a diversity of opportunity, which you can do through co-op, internships, and other sorts of experiential learning.

To my mind, diversity, both in terms of disciplines and in terms of experience, is really important to creating a generation that has the necessary skills.

Mr. Walter Di Bartolomeo: Beyond that, I'll add two things.

There was a mention of women in science and promoting women in science. I think there's an opportunity to tap into the knowledge capability of women. Many of the provinces do have women in science chairs and the like, and I think that's one opportunity to continue to promote, through the STEM programs, early recognition for young girls of the importance and the value that they can bring and that industries can bring to them.

Perhaps a second thing is to move away at the university level from tenure track, which is very traditional—publish or perish—and move more to what is of value to the country, in terms of the technology that's being developed and the research being done, as a means to promote who becomes a tenured professor. That will necessarily pull in different types of students and different types of collaborations with the various industries across the country.

I think those are two things where perhaps we have to move away from more traditional means and ask what the future really needs from us there.

The Chair: Mr. De Koninck.

Dr. Jean-Marie De Koninck: If I may add something, I just want to say that we often underestimate the potential for innovation amongst our kids, particularly at the K-to-12 level.

I want to talk about an experience in France. It's called MATh.en. JEANS—math in jeans—and about 100 professors, researchers from the CNRS, the Centre national de la recherche scientifique, go to primary schools to talk about research and mathematics. You would think that you'd need the basics. No, you don't need the basics. There are geometry concepts. There are a lot of concepts that don't need any background. They stimulate the kids. They build their confidence and so forth.

Normally, you wouldn't do that. By the book, you don't do that. But they do that and it works. Maybe that's why they have some of the greatest mathematicians in the world.

● (1215)

The Chair: Thank you very much, Mr. De Koninck and Madam Sgro.

Now we'll go to Mr. Carmichael for nine minutes.

Mr. John Carmichael (Don Valley West, CPC): Thank you, Chair.

Thank you to our witnesses for appearing today. It's a fascinating discussion. Primary school...?

Dr. Jean-Marie De Koninck: Yes.

Mr. John Carmichael: It's amazing.

I'd like to start with Pratt & Whitney and Mr. Di Bartolomeo. I wonder if you could just give us a quick look at CARIC, the consortium for aerospace research. It's a year since the funding began. We are in the first year. Are we seeing anything on the horizon that's going to assist us on some of today's discussion?

Mr. Walter Di Bartolomeo: Yes. April 2014 was the inauguration. Had you asked me at that point if we would be this far advanced, I would have not believed it. We have subscribed all the projects we expected to do in its first year of operation. It's pan-Canadian in terms of the pull. There was some concern that it would Quebec-centric. That is not the case. For the level of projects, I would say that the demonstrator programs being proposed at the level supported by CARIC are really leveraging, and one of the concepts is to build on small and medium-sized enterprises.

I would say certainly that success from a project perspective really was there as part of the Emerson report: go out and create a collaboration framework across Canada. The basis of that is education. It's using the universities to go and do work, but for the value of Canada. In other words, it's for something that at a point in time may succeed, and if it succeeds, it will be commercialized, recognizing that often success is surrounded by failure and that some of the best learning we have is actually embedded in failure.

Finally, I would say that it's been one year beyond our expectations in terms of what we've been able to accomplish, certainly in terms of pulling on small and medium-sized enterprises with the support of the larger OEMs. Also, the talent that's being pulled and supported is very strong, with some things that probably in five to seven years, I would say, will see the light of day in terms of market potential.

Mr. John Carmichael: That's excellent. That's good news.

You spoke briefly about the new turboprop engine. Clearly, when you start talking about a 35% improved fuel consumption or a reduction, I have to think that's disruptive to an industry.

Can you speak to some of what is happening at Pratt & Whitney and in the industry that would take us to that level? Also, are there parts of the development of an engine of that nature that would be subject to new technology—you mentioned some of the components—such as 3-D printing and some different elements that might help you achieve your goals to create such an impact?

Mr. Walter Di Bartolomeo: I would say that on the basic physics, we haven't developed new physics. I would say that the capability to manufacture components using some of the newer technologies allows us to actually put into practice some of the things I've been dreaming about for the last 10 or 15 years. If at a point in time when this 35% better engine is on the table and you were to go and look at it, you would be surprised at how non-spectacular some of these things are.

But that ability to go and manufacture it, the ability to build it as an overall system in a different means and to take the technology we've developed over the last 10 or 15 years from a combustion perspective and from an aerodynamics perspective, that starts to materialize into a product that will be very disruptive for us. As you know, 35% is not a small number, but by the same token I would say that it's the continued and continuous development and the willingness to fail, supported in partnership with the Canadian government, the Quebec government, and the Ontario government, that allow us to go and do that.

Fundamentally, manufacturing technologies like 3-D printing are allowing us to develop some of these things, as are the new materials, lightweight materials, and just the computing power that allows us to go and analyze things to a level that we couldn't have done 15 or 20 years ago. I think there's a convergence that allows us to leverage that.

Mr. John Carmichael: If you've been reading some of the minutes of these meetings, some of our witnesses and guests have taken exception to the constant reference to "disruptive technology". They've used the term "transformative technology" or "transformative changes" to industry. Clearly that is one; it's very impressive.

Mr. Gupta and Ms. Hutchinson, maybe I could swing over to you for a minute. I'd like to ask you about online commerce presenting complexities for securing customers, enterprise, and government communication, all of which call for security techniques. Obviously that's your background, so that's an area I'd be curious to hear your opinion on.

What can government do to foster and capitalize on the opportunities related to the adoption of e-commerce, and how can industry associations like ITAC—I know we've talked about this at previous committee appearances—support these investments so that they're done in a safe way for both business and consumer?

● (1220)

Mr. Karna Gupta: I think first we need to understand what the situation is today in the Canadian market. In the Canadian market, most of the time you see that small and medium-sized businesses are not using online tools as much as they should in order to grow. That is a statement of fact. If you go look at eBay or others, from their statistical point of view, they will say they're not using it.

Why are they not using it? The underlying economics are not supportive of it. To give you an example, if I'm south of the border and I order some goods from any store, the goods will show up the next day at the price I clicked on my screen. At that price, at my door, they will appear. If I do that sitting in my home today, they will be double the cost with shipping and everything else.

The economics do not support it. Fundamentally, the business model for online trade in Canada is not exactly where it needs to be. That needs a little bit of work.

The second part is privacy and security. That needs a much deeper discussion in terms of what gets disclosed. This is really a policy instrument that government, with industry, needs to develop in terms of what is getting disclosed from consumers and users on the platform. When we talk about data on a platform, it's not necessarily residing here. The moment your computer is connected to a wire, it is reachable from anywhere in the world. We live in a day of false security that everything is resident here. It isn't.

I think the policy instruments need a lot more work. I don't think any study has been done, or government has any work getting done, on what type of data people should put up in online trade. There is a lot of trepidation on the part of users to use the e-commerce platform. Economics aside, they don't want to put data up online. That's holding a lot of the consumption back. People do shopping online but they don't buy because they have to put in some data and information.

This is where some of the policy discussions become very important—what we expect our citizens to put in, how we manage it, and where it resides. On that part, I don't think we have a good answer yet.

Mr. John Carmichael: Thank you.

Briefly, on your IoT white paper, I may have missed it in your presentation, but what's the timing on that? When can we expect it?

Mr. Karna Gupta: It will be a living document. You'll see the first one probably within the next couple of weeks. It will be mostly around a call to action on what the issues are and what needs to happen. Then we'll probably convene some of the experts to put together some of the major issues we need to address.

The first one will probably come out more as a call to action around IoT: what it means, what the implications are, what some of the potential business models are, and what the issues are and how to address them. It will be more of a call to action.

Mr. John Carmichael: I'm running out of time now, and I had another question for Mitacs.

Mr. Annan, talk to me briefly about the silos again, the funding silos that you talked about. We have a few seconds left.

Mr. Robert Annan: Coming out of World War II, there was a sense that science and research had the potential to transform society in positive ways. There was the creation of a lot of funding agencies here, and in the States and Europe, that were designed to promote basic research or applied research and to have these things exist effectively independently. We're still living with the aftershocks of that.

I think there's a recognition of that within the community. Last week actually, we signed a sort of memorandum of understanding with NSERC, to make sure we're coordinating and collaborating, because we all have the same essential participation base: Canadian researchers at universities, Canadian companies engaged in research. We're all geared toward the same sorts of outcomes, which are innovation and research, and so on.

I think that collectively the community is trying to find ways to work together. I think the government can maybe accelerate that process by encouraging cross-sector collaboration, but looking at mechanisms in order to do a better job of coordinating the pieces or prevent duplication and overlap.

I know those are areas that have been a focus for the government for some time. They were areas that have been identified, for instance, in the Jenkins report on industrial R and D, which came out a couple of years ago. Anything in that regard is likely going to yield positive effects.

● (1225)

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

Now on to Madam Papillon for nine minutes.

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

[*Translation*]

My thanks to the witnesses for joining us today. It's really nice to hear from you.

I have several questions to ask, so I will try to be brief, while touching on all the topics I want to discuss.

There is a lot of talk about the perennial issue of balance between basic research and applied research. As we know, we need applied research because it is a key component of science.

I would like to take the time to quote David Robinson, executive director of the Canadian Association of University Teachers. He said the following:

> When it comes to supporting university-based research, the federal government has an unbalanced approach. [...] The government continues to miss the fact that real innovation and scientific advancements are driven by long-term basic research, not short-term market demands.

Do you think more investments are needed in basic research? If so, how should those investments be made? I would also like you to talk about the role of education and basic research in stimulating innovation.

I saw our guests smiling.

Dr. Jean-Marie De Koninck: I will start.

The federal government supports both avenues—basic research and applied research. I personally do basic research, and I receive assistance from NSERC for my research in mathematics.

I think the message we need to send, as Rob said a little earlier, is that the two should not be put at odds. Basic research fuels applied research, which challenges the people doing basic research to identify new results that can then be applied. Those two worlds can coexist.

However, it is true that, in an economically focused society like ours, quick and immediate economic impacts are sought. So there is a tendency to provide more support for applied research. We need to be conscious of that and constantly bring research managers into line. We need to support both types of research and not put them at odds.

Mr. Robert Annan: Sorry, but I will answer in English, as I am a bit nervous.

[*English*]

I'm not comfortable necessarily commenting on how this specific government is achieving that balance. I will say, though, generally speaking, that this is a difficulty around the world—and it's true in the United States and in Europe—regarding how you balance the support for basic research with the view towards kind of planting seeds for long-term harvesting, and how you reap the rewards of those investments from the past.

Achieving that balance is difficult. There isn't good research. There isn't good evidence as to what kind of balance is maybe the most productive, either from a research output perspective, social output perspective, or an economic output perspective. It is an ongoing challenge.

I think it's one whereby it may be possible to have a rethink more generally about this idea that I mentioned before about silos. If we think about either making an investment in basic research or making an investment in applied research, you necessarily set up a competition. What I think we want to be doing is funding good ideas that span the spectrum. Then, at some point you get into the areas around commercialization and so on, which to my mind moves past where you're looking at R and D, in the university ecosystem anyway. Those are different sorts of discussions.

When it comes to applied and basic research, fighting one against the other isn't the most productive mechanism. If we can find new ways of funding good ideas, then I think we'll be making good steps forward.

● (1230)

[*Translation*]

Ms. Annick Papillon: Could you tell us about some worthwhile models?

I have here the Mitacs record for 2013. According to what you told us earlier, you are now working in collaboration with 60 universities. But those 60 universities probably all have their own way of doing things. I see that, in 2013, the Université Laval was not one of your partners. However, the INRS was. That is a good model, especially when it comes to basic and applied research.

I was wondering whether the Université Laval is one of your partners now and, if not, why.

At the INRS, professors and researchers are often veritable jacks of all trades, as are the institute's students I know. You used the expression “back and forth” earlier. That aspect could be inspirational and useful.

Dr. Jean-Marie De Koninck: Concerning the Université Laval, the question should be put to the rector. Be that as it may, the Université Laval is a Mitacs partner, but not financially. The provincial government cuts are not conducive to financial participation in that regard. We still benefit from all Mitacs programs. In that sense, we can say that the Université Laval is a Mitacs partner.

[*English*]

Mr. Robert Annan: Certainly, as you mentioned, we work with 60 universities; a lot of different models are happening. Our model is more or less standard in how we work with students. They spend half their time with companies, half their time with the university. While in some cases, like INRS, a lot of this hands-on work is already happening, we're also working with theoretical departments at the University of Toronto, where there isn't that hands-on work but the students are still working with companies. This model is being imported into different places.

Furthermore, we're working with universities a lot in development of new curriculum, and Walter was talking about the idea of engagement of industry in curriculum building. Obviously, some universities chafe at this idea that they'll have curriculum dictated to them. That's such an old and outdated model. Now companies like Pratt & Whitney Canada and others are looking to build collaborative relationships when it comes to curriculum building. We've worked now with 10 different universities on building new applied master's programs where students do internships as part of the degree program, as part of their requirements. The university retains the overall management of curriculum but now companies are taking the students as interns and are participating directly, including financially, in support of these students.

It's a very healthy relationship that is much more of a partnership than a contractual relationship.

[*Translation*]

Mr. Walter Di Bartolomeo: I would like to add something.

As a result of the Emerson Report, the federal government established steps. It also talked about CARIC, which supports basic technology and research. The technology demonstrators program supports medium development technologies. On the other hand, the Strategic Aerospace and Defence Initiative is really focused on commercialization and development.

Ultimately, industry tries to resolve problems. We may be talking about an extension of existing knowledge, but in many cases, that knowledge does not exist. As a result, we have to develop basic research. For the industry, the goal of that research is to resolve applied problems. It's not really very esoteric.

We cannot always expand on something that already exists. We need basic research. We believe that, in the aerospace industry, methodologies and programs supported by the government already exist, and we want that to continue.

Ms. Annick Papillon: Okay.

[*English*]

The Chair: Thank you, Ms. Papillon.

Now we'll move on to Mr. Daniel for nine minutes.

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

It's certainly been a very interesting discussion.

I'd like to pick up on one of the points that I think some of you have already raised. It's to do with small businesses and IP. I think we've invested a lot of money into research and a number of good ideas are sitting on the shelf without being promoted, etc. Some very intelligent Ph.D.s having raised that.

How can this government do something to assist small and medium-sized business in protecting their IP and making sure that their IP is protected, because that's a fundamental step in their progressing to getting into bigger companies and bigger organizations, etc. How can industries like Bombardier and some of the bigger companies assist some small companies in going through this process of getting the IP established so they can move forward?

Maybe we can start with Madam Hutchinson, since you're government relations.

● (1235)

Ms. Kelly Hutchinson (Vice-President, Government Relations and Policy, Information Technology Association of Canada): From an IP perspective, you're right in speaking to the collaboration between industries. If you're working, uniting large and small companies is really the first step in being able to help them bridge that gap and get over that hurdle when it comes to challenges.

When it comes to this particular subject matter of IP and small businesses, I would have to hand this over to Mr. Gupta for a response. But thank you very much for asking me a question on my first attendance at one of these meetings and on my birthday.

Mr. Karna Gupta: Intellectual property is the most valuable asset the company would have. We need to have an IP regime that is not only on par with the global scale but in fact better. You can look at any small Canadian company, and I'll use myself as an example. I used to be CEO of Certicom. I had 500 intellectual properties filed globally. My last filing used to be Canada just because the regime here took much longer to get it processed and IP-protected.

Enforcing is also very critical. If you cannot enforce IP, it is absolutely useless. The courts and the practices need to be up to snuff at a global standard to make sure that our companies can in fact enforce the intellectual property they have. I would submit to you that most Canadian small companies, when they take a larger company to court on IP infringement, actually do so in the United States because often the courts move a lot faster there.

Things are changing. I think we have had this discussion before in a different panel. I think things are improving and the government is paying a lot more attention, but intellectual property is the most critical asset for our companies.

Mr. Joe Daniel: I agree fully with that, but the question is how this government can help small businesses make sure they secure the IP that will allow them to actually get to the next level of growing their businesses, getting more jobs, doing all the things that would make that possible.

Mr. Karna Gupta: I'll give you two specific examples. One is that I think our intellectual property regime needs to be a lot more nimble and faster for the Canadian companies to process. Second, one of the comments we put forward in our budget submission was that if I was a small business and I generated $2 of revenue—$1 from regular business and $1 from selling intellectual property—that revenue should be taxed at a lower rate to create incentives for our companies to promote and commercialize the intellectual property they have, not only locally but globally. That is a policy instrument we could use to promote greater use of our intellectual property.

That's very simple. The U.K. is already going down this path on intellectual property. They're seeing a lot more SMEs using intellectual property for commercial purposes, so all of the development now is not going to esoteric IP protection of all kinds. They're creating IP that is more relevant to the business use.

I'll use the example of mathematics. Certicom's IP was all in encryption. Your BlackBerry used to be encrypted by us and NSA's encryption was done by us. Mathematics is not protectable. Mathematics is public property. The IP is done by protecting how you implement process and all of that, so you create a fence around how it is used. If that is done right and I generate revenue from it, I should be incented. I'm creating jobs. I'm giving more work to the local graduates. I'm hiring more locally from local universities. There is a very direct linkage between how we treat IP and business outcomes.

Mr. Walter Di Bartolomeo: I'll add a couple of things. We had a quick discussion around CARIC. The IP framework around that collaborative network is really links to domains of expertise. If we do a collaborative project with a university and a small or medium enterprise, then for the use in gas turbine engines really Pratt & Whitney Canada would look to retain that IP. But for non-competitive areas, really the subject matter expert, the small or medium enterprise, could exploit that. In order for that to be done, the level of investment and the repartition of risk should be commensurate with what an OEM would put in. If Bombardier is going to put in a fair number of dollars, we would expect the small or medium enterprise to do the same.

What the government could do is to support small and medium enterprises to a level that's commensurate in that respect. That allows a sharing of that IP that's in line with the risk being taken. Then they could exploit it beyond the specific domains of interest of that OEM. For Bombardier, that would be aircraft. For Bell Helicopter, it would be helicopters. For Pratt & Whitney, it would be gas turbine engines. It could be used in other parallel industries. It could then go ahead and do that. I think that's a framework that has worked well.

● (1240)

Mr. Joe Daniel: Let me phrase my question slightly differently. Should the government provide funding for small businesses to secure their IP with the hope of actually getting that money back once they've taken that IP and developed their business?

Mr. Walter Di Bartolomeo: I would say it's more to develop the IP. The securing of IP through the IP protection capabilities is probably sufficient. It's really to develop the IP. You have to develop that IP.

Mr. Joe Daniel: To develop the IP, if you have to patent it, it's tens of thousands of dollars. For a small business that could be quite difficult.

Mr. Walter Di Bartolomeo: The short answer is yes.

Mr. Joe Daniel: Okay.

Let's go to the nuclear side of things. There are disruptive technologies coming along, such as thorium salt reactors. What are your comments about that in terms of the nuclear industry and power generation?

Dr. Robert Walker: Thank you for the question.

The nuclear industry is an industry that is highly innovative. Many of the reactors in operation around the world today are first- and second-generation technologies. The ones on the drawing board are fourth-generation technologies that deal with fundamental issues of waste and safety and assured shutdown in the event of accidents. These are the ones that will be the game-changers as we move forward to decarbonize global economies over the next many years.

One of the unique realities of nuclear technologies is that an investment in a nuclear power plant is actually a 60- to 90-year investment. Thinking in the long term and how one upgrades the capabilities of reactors on that scale of timeframe is among the issues, but frankly emerging solutions, to address. A myriad of technologies are being examined around the world and here in Canada, ones that build on our pedigree in CANDU and its strategic advantage in the flexibilities of fuel cycles. As well, there's a potential game-breaker in what are called small modular reactors that introduce a variety of technologies for safe, affordable operation, including off-grid applications in the north of Canada, for example, that can dramatically address some of the issues we have with cost, affordability, capital investments.

These are frankly game-changing technologies. The international panel on climate change says it needs to be part of the answer. I think the technologies are emerging to make it part of the answer. It does come back to a point I made in my remarks about the risk factor and how the public perceives risk.

The Chair: Thank you very much, Dr. Walker.

Mr. Masse, you have nine minutes.

Mr. Brian Masse (Windsor West, NDP): Thank you, Mr. Chair.

Thank you to the witnesses for being here.

I'd like to continue with the nuclear issue. One of the things I've taken an interest in is the deep geological repositories for radioactive material. I'm wondering how far off we are with new technology to deal with what's taking place. In Germany, the Morsleben and the Schacht DGRs have been decommissioned because they've been deemed unsafe. The Waste Isolation Pilot Plant, or WIPP, in New Mexico recently had a breach contaminating over 20 people. Thank goodness it was an isolated location.

OPG right now is considering Kincardine as a DGR. It's never been done before. It's within about a mile and a half of the Great Lakes. It's created quite a problem. There are about 153 resolutions representing 20 million people who are opposed to this, including the U.S. Congress and Senate, which has two distinctive bills about this. Canada once promised, under the Joe Clark regime, that they would never do this type of activity within 10 miles, I believe, of the Great Lakes. We seem to be breaching that agreement.

I would ask whether or not there has been any type of breakthrough. What we're doing now is that basically a shaft about the length of the CN Tower goes down into limestone. It doesn't seem like a very high-tech solution to take the secondary nuclear waste, bury it as deep as we possibly can, and hope that nothing happens for 100 million years. How far away are we from maybe some new technology that could actually deal with this waste in I think a little bit more of a sophisticated way? The minister now has our report on her table. She's put it off until after the next election and is actually calling for more hearings because of the complexity of this.

I'm just eager to hear whether there's any new technology on the forefront out there that could help deal with this problem, because I think it's a very crude way to deal with nuclear waste.

● (1245)

Dr. Robert Walker: That might be a question that's directed at me.

Mr. Brian Masse: It's for Mr. Di Bartolomeo.

Mr. Walter Di Bartolomeo: I don't deal with nuclear waste.

Mr. Brian Masse: You mentioned risk in your report here.

Dr. Robert Walker: Perhaps that was my remark.

Mr. Brian Masse: Maybe it was. I'm sorry; I could be corrected.

Dr. Robert Walker: Thank you for the question. I put this in the category of some of those grand challenges that industries are facing with technologies that address big social issues. The social issue here is not the DGR; it's how to provide clean, safe, reliable energy at scale. Nuclear technology is one of the answers to that. It, unlike, for example, the fossil fuel energy source, has no externalities. One sees the waste at the end of the equation and says, here it is. It's not in the air. It's not in the oceans. The question is how best to deal with it.

The issue of DGR technologies has been examined over many years, previously by AECL and now by CNL, to understand the science around keeping this material isolated for long periods of time, understanding how radiological materials migrate in the environment. These have been put forward as solutions that are believed to be safe. Those go through regulatory reviews to gain an opinion on whether that's considered acceptable for moving forward.

To the point I made in my remarks, oftentimes, and not just in this case but also I would say in the case of child vaccinations or genetically modified foods, we end up with case studies that are indicative of how a risk is perceived by the public. On the one hand, science comes forward to try to explain that risk and the risk versus the benefits and it looks at how society accepts that. I've seen times where society's response to that is that no risk is acceptable. How do you find the right answer to move forward on these issues?

I don't have the answer to this but I suggest that among the policy and legislative and regulatory issues that governments will struggle with as we move forward to find technology answers to some of these big challenges with public health, energy, and climate change, we are going to struggle to find answers to the question of whether society will accept the risk-benefit equation in moving this forward.

To your point about ongoing research on ways to recycle fuel, I made reference to reactor technology going forward. Much of that research is built around what is called the closed fuel cycle. In other words, you burn the fuel, you take it out, you do some work on it, you put it back in the reactor, and you burn it again. You actually diminish the volume of waste. You dramatically extend the lifetime before you're into a DGR kind of problem. Ultimately the view is still that you'll need deep geological repositories but perhaps with less footprint, less radioactivity, etc., and perhaps with greater public acceptance.

I think the profound question here is whether this is a discussion around DGRs or a discussion on finding solutions to decarbonize economies. We tend to be having only the first discussion and not linking it to the second discussion.

Mr. Brian Masse: Mr. Gupta, it was interesting to hear your testimony with regard to interaction with kids and students who are younger. How, though, do we go about getting more fairness? Say, for example, my kids go to what's called a comp ed school. A comp ed is an inner-city school that doesn't have a lot of money. They have two smart boards, for example, or three smart boards compared to other schools that will have iPads and smart boards and all kinds of different things.

What do you suggest? Is part of it a question of resources or is part of it getting them to students and getting them early access to technology and things that can actually grow them? Is that something you think there should perhaps be national involvement in, to level the playing field? The way things currently stand, in the Ontario education system, often these are things fundraised for by families. If you're a family in a newcomer area, often there are not as many supports there or they are still getting going in life, so the school doesn't benefit from some of the fundraising. The schools simply don't have enough money right now. Is that really a barrier to kids getting a jump on technology and robotics and so forth?

● (1250)

Mr. Karna Gupta: It's a very good question. A lot of work is actually going on in this area. I was fortunate enough to come across, as part of the millennium goals, a program called Millennium@EDU. If you look into that, you'll find even within the developed countries like Spain and Portugal, they have immensely developed by having a national strategy around deploying Millennium@EDU.

What that means is that you get industry collaborating with the government, co-funding, and delivering a curriculum of prepackaged tools to schools that otherwise don't have sufficient funding. That could go to the north. That could go to inner-city schools. Now you have the full material developed, delivered, and available to students in terms of their curriculum. It's not only the private schools that have access to it. You basically equalize and democratize the process of delivering the education.

It is a program that we as an organization are trying to look at. How do we shop this around various governments? Should we do this in Canada because it has been happening in several countries in Europe? It has happened in Africa and some of the states in the U.S.

Unfortunately, we run into the barrier of the federal-provincial jurisdictional issue, but this does need a national discussion. Should we do this to democratize and equalize the delivery of programs? Big corporations like Microsoft, Intel, and Symantec, they are sponsoring this program globally through Millennium@EDU. We as a nation are not taking advantage of it. We have private sector partners at the table. We just need the government side, whether it be federal or provincial, to step up and say they will participate, engage, and roll it out to various schools.

I think part of it is that our structural issues get in the way. You not only have the federal-provincial; you also have the multiple school boards. It's just getting more complex from an administrative point of view to deliver the program, but there are programs that we can look at. It's not a new invention. Other countries have done it with results that can be looked at.

The Chair: Thank you, Mr. Masse.

Our last questioner is Mr. Maguire.

Mr. Larry Maguire (Brandon—Souris, CPC): Thank you, Mr. Chairman.

Thank you to the panellists for being here today as well. I certainly appreciate all of your presentations. It was very informative for a person who hasn't had the experience of being on the committee that much.

I certainly wanted to ask you, Mr. Gupta, about one of the comments that you made. It was that obviously these types of technological advancements take place because of, in your comments, three areas: capital, markets, and talent. Rural and remote broadband was one of the things that you pointed out there as well.

Can you just expand on that a little bit more and what's needed in that area? We have programs that are out there now developing some of that and trying to get higher speeds into some of those rural areas. Certainly, in the northern areas, as my colleague across the way has indicated and she represents those areas as well, we need advancements in that.

At the same time, here's a question to everyone. In regard to your experiences and in regard to, maybe we'll call it disruptive technologies, but leaps into the future, could you describe to us where we're going and what you see on the horizon in some of your industries? You touched on a few, but can you expand on some of that as well?

Mr. Karna Gupta: On rural and remote, I think it does need a national investment strategy. I think if you look at most of our large infrastructure carriers in the country, whether it be cable, satellite, or telephony, these companies do spend several billions of dollars a year to upgrade their technology and they continue to do so.

Given our geographic footprint, the way the country is, there is an economics question that comes to the table. How do you make it more viable and economically attractive for various companies to invest? This is where it needs to be addressed from a policy point of view and from a government point of view. How do you look at this as a national infrastructure project and collaborate with the companies to roll it out? You can't just tell the companies, “Thou shalt take infrastructure everywhere and up into the remote areas”, if the economics don't work.

If you look at most of the companies, I would submit to you that their total investments on an annual basis probably run in excess of $10 billion, when you combine them all. We still haven't reached the remote areas. It does require a support between public and private to look at this, just like roads and sewer systems. We need to build this infrastructure collectively between the private and public sector.

● (1255)

Mr. Larry Maguire: Thank you.

Mr. Robert Annan: I'll jump in on this question about leaping into the future. We work with hundreds and thousands of students each year who are coming out of the universities. I feel that I am now definitely old enough to say that young people today are not like me or, with respect, many members of this committee.

People such as my kids, people coming out of universities now, just take it for granted that they have in their pockets a means to access the entirety of human knowledge and to connect with anybody on the planet immediately, including, with social media, people they don't even know. They can just make these connections. In a way, they're coming out ready and primed to change the world. They have a lot of tools at their disposal, but many of the mechanisms we use to educate, to train, and to support were built for a different time. I think one of the challenges we have is, how do we evolve?

Institutions are not easy to change. You don't change overnight. Technology changes a lot faster than universities. Universities change very slowly—very slowly—but that doesn't mean we can't find mechanisms to adapt and to support. The students, the young people today, are going to run further than we can keep up with, so how do we try to evolve the infrastructure we have, the support mechanisms we have, in order to support entrepreneurship among young people, to make transitions easier from university into the private sector or the not-for-profit sector, and to take their ideas and make them reality?

Whether it's through protecting the IP or through tools for development, and whether it's broadband in rural and remote communities or aboriginal communities, for all these sorts of pieces what we can do to connect them to the opportunities available I think is really essential, because the young people today are going to push into the future whether we adapt or not.

Dr. Jean-Marie De Koninck: If I might add to that, in 30 seconds I want to make a general statement that is essentially related to your question on the future. There is a lot of potential in our young Canadians, and I know it as a professor. I see it on a daily basis. They're the ones who are going to solve today's problems in the environment, energy, health, and so forth, but they are also the ones who will boost the economy of tomorrow. Whatever support—any kind of support—we can bring to help these kids fully develop is the best investment Canada can make, in my opinion.

Mr. Walter Di Bartolomeo: In the aerospace industry, I'll say that if you look at the first 100 years of aerospace, you'll see that an aircraft was a tube with wings on it. Perhaps not in my lifetime but in my children's lifetime, I think an aircraft will look different. It will look more like a boomerang. We won't have window seats. People will be inside this boomerang and will use cameras and whatnot to see what's going on outside.

That will drive a whole level of fundamental technology that will be different: the aerodynamics, the materials, the structures, the electrical power, the distributed power, and the alternate fuel sources for that. I don't think it will be in my lifetime, but an aircraft will look completely different in the lifetime of our kids.

Ms. Kelly Hutchinson: Probably what we can do to keep pace is to have studies like this that look forward and assess the security and the implications when it comes to privacy and all of the various aspects of even this thing that we've called the Internet of things that is growing today.

We're kind of building a plane while we're flying it. If we have this future of youth and adults who are moving forward in this great new capacity, we as leaders need to look forward to that and help build that framework to ensure that it's safe for Canadians and supports job and workforce implications and security and privacy for all of us. That's the one thing we can really do and I commend you for doing this study today.

● (1300)

The Chair: Dr. Walker.

Dr. Robert Walker: I would build on the comment here that the leap into the future says the world will speed up. The policies and the safety, security, ethical, and regulatory challenges that will face government are already speeding up. They're going to speed up. They're going to get more complex. Government's relationship with science needs to adapt to that new reality.

Mr. Larry Maguire: I think that's partly why I would agree that this whole thing is going to roll a lot faster than it did in the 1970s, 1980s, and early 1990s, say, because it already has. That's why we've brought in some of the bills that we have, and the changes to adapt.

Do you see any other ways of being able to do that and still preserve the IP? It's a preservation that needs to be done so these companies will flourish and will want to continue to expand. Are there ways other than just research and development taxes and those sorts of things?

The Chair: You have the last word, Dr. Walker.

Dr. Robert Walker: I come back to say, how is it that government gets better at anticipating the policy and regulatory challenges we're going to experience? I believe the dialogue that you've been having here has given you an insight as to what's coming. Government's approach has typically been naturally reactive in dealing with policy and regulatory matters. When you see the problem, we adapt to it. We need to get better at anticipating and getting ahead of those challenges. For example, the position paper on the Internet of things gives a platform for saying it's coming, how do we get ahead? By focusing on trying to be proactive and in front of it, we'll be more adaptive. Now the answer to that: more dialogue such as this.

The Chair: Thank you very much, Dr. Walker.

Because of the agreement on this committee, the 52nd meeting of the Standing Committee on Industry, Science and Technology will be the last meeting on this study in this session of Parliament.

Elections are disruptive as well, ladies and gentlemen, and I think everybody here who is on this present committee is dedicated to making sure that we continue this study in the next Parliament, but we don't have that capability of making that a definitive position.

With that said, we want to thank our witnesses very much for their contribution. I know that future committees will use the testimony in many different ways. Not only your testimony, but the previous witnesses have been extraordinary as well in the sense of what you've said with regard to helping us predetermine where we're going to go to have a broader vision and try to anticipate rather than react.

Colleagues, thank you very much for your cooperation as well.

We're adjourned.