

Primed for Growth: A Roadmap for Accelerating Canada's Printable, Flexible, Wearable Electronics Industry

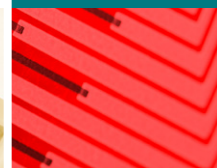
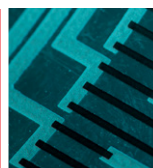
CPEIA Sector Development Leadership Council Report

Strategic Directions

January 16, 2017



The united voice of Canada's
Printable Electronics sector



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Executive Summary

Canada's opportunity

Printable, flexible and wearable electronics (PE) is an emerging market with commercial production already worth tens of billions worldwide. This is a rapidly growing global industry expected to be worth US\$70 billion by 2024, according to market research firm IDTechEx.

PE lies at the convergence of several industries in which Canada has a strong track record – advanced materials, micro-electronics, information and communications technologies, printing and advanced manufacturing.

The Canadian industry sector has the expertise, innovation and opportunity to revolutionize this industry, for substantial socio-economic benefits across Canada and abroad. More than 250 domestic organizations that we know of are active in the space.

The applications for these technologies are diverse and include health care, transportation, environment, resources, energy, defence and consumer electronics. PE has the power to create brand new industries by crossing a traditional sector with electronics, such as textiles to create smart textiles, fashion to create wearable electronics and packaging to create smart packaging. These are industries in which Canada has traditionally been a strong player, but may fall behind without adding electronic functionality.

The state of the domestic PE sector

On Nov. 22, 2016, the Canadian Printable Electronics Industry Association (CPEIA) convened at the Toronto headquarters of Xerox Research Centre of Canada the inaugural Sector Development Leadership Council (“the Council”).

This high-level meeting articulated the commercialization challenges facing the domestic PE sector. Thirty-five senior decision makers from across the CPEIA's diverse membership served as a representative cross-section of the CPEIA's 80 member organizations.

According to CPEIA Members, significant challenges remain in scaling up the sector in Canada. Our startups and young SMEs need assistance to connect and work with the core group of larger Canadian and global companies that can help them overcome R&D and scalability hurdles, connect with end users and get to market. The larger organizations, meanwhile, face their own challenges to compete in the global market, such as making their products intelligent with the advanced features supported by PE.



The challenges facing an emerging technology sector

The Council identified four key challenges for the growth and development of this emerging sector in Canada that impact startups, young SMEs, established mid-sized companies and multinationals with Canadian operations in various ways:

- **The Market Challenge:** Defining applications and products with large and profitable markets in partnership with world-class end users. Critical in this is accessing such end users globally and getting them to work with Canadian companies.
- **The New Product Development Challenge:** Prototype development towards commercialization with lead end users/customers for trials and early adoption. Critical in this is conducting trials of new technologies in sufficient scale to prove the business case for profitable commercial adoption.
- **The Manufacturing Challenge:** Resources for SMEs to invest in their own facilities before the market and business case has been proven for manufacturing scale up. Critical in this is creating and accessing sufficient scale-up manufacturing resources, including equipment, skilled people and production lines.
- **The Financing Challenge for Scale Up:** Access to capital for startups and SMEs at various stages of growth. Critical in this is lack of access to traditional VC funding for materials, electronics or new emerging cross-sector ventures.

We need a sector specific solution for scaling our industry

Council participants agreed that current fragmented government support programs and local community-based economic development agencies do not provide the comprehensive, industry-driven approach that's required to build a healthy ecosystem, scale startups and SMEs, and strengthen the large Canadian players and active multinationals working in Canada.

This sector needs an industry-specific network dedicated to building the entire ecosystem for these emerging technologies coast to coast across Canada. One that creates linkages across the supply chain and begins with end users and customers, followed by the other essentials required to de-risk a product for volume manufacturing.

Council participants agreed a new approach is needed that has government funding support, one that focuses on commercialization, to bridge the gap between the innovators and integrators of new technology and its potential end users.

Industrial companies in an emerging technology sector require funding and program support for the trials and commercialization activities that follow the R&D phase, along with the flexibility to decide where, how and with whom these resources will be allocated. While funding for university-based research is great for emerging areas, the sector must focus on the scale up of R&D that can only be achieved with R&D investments into industrial firms and activities.



Government funding would help de-risk this scale-up process. It would ignite our companies' ability to lever government funding and attract the private sources that are currently lacking, such as VC investment.

How would we use government funding? Our strategic plan

Government funding would be used to:

1. Develop sector plans and assemble leadership councils for major PE technology areas in
 - a. wearables/health,
 - b. connected homes and intelligent buildings and
 - c. smart parts for transport (automotive and aerospace) that directly benefit key Canadian manufacturing sectors, in addition to
 - d. intelliPACK, the current program for intelligent packaging. We would link university and college R&D to these sector plans.
2. Market our sector to dozens of additional global end users like Unilever to help drive development of revenue-generating products.
3. Promote our sector and our industry events to attract a global audience to Canada so our companies can engage with the global supply chain.
4. Open market access in the 4 new verticals identified in point 1 such as automotive and health care beyond smart packaging where we have globally competitive Canadian players.
5. Fund and carry out product development activities, pilots, trials and demonstration projects that lever resources from across the CPEIA Membership, to target and educate end users in key market verticals.
6. Link and develop critical manufacturing capabilities that currently do not exist in Canada such as smart textiles and 3D printable electronics.

As a self-organized, non-profit industry group, the CPEIA cannot achieve all this with its current funding formula. SME membership fees are kept low, in line with their ability pay, but these firms could benefit most from more support from the CPEIA. Because larger companies pay more and must also see an ROI on their membership dollars, most of our resources with our current funding formula must be dedicated to them.

Emerging sectors mature over 15 to 20 years. With the right government funding formula, a sector organization like the CPEIA could provide the support SMEs need, help create, develop university spin-offs startups and SMEs scale faster, put in place programs, and cut this growth curve by at least five years. This will create robust growth and economic benefit for Canada much faster than if industry firms are left to struggle along on their own in a fragmented market.



Introduction: What does this sector mean for Canada?

Printable, flexible and wearable electronics (PE) is an emerging market already worth tens of billions worldwide. PE lies at the convergence of several industries in which Canada has a strong track record – advanced materials, micro-electronics, information and communications technologies, printing and advanced manufacturing.

The Canadian industry sector has the expertise, innovation and opportunity to revolutionize the electronics industry, for substantial socio-economic benefits across Canada and abroad. More than 250 domestic organizations that we know of are active in the space.

Our sector includes startups and young SMEs. We also have a roster of larger companies with the potential to become the next Lululemon Athletica, CCL Industries or Array Marketing - employing thousands of people, with tens or hundreds of millions of dollars in revenues and listed on the Toronto Stock Exchange. In addition, multinationals that employ thousands globally are active in Canada and adding PE capabilities in the manufacturing sector. We have over 30 academic organizations involved in R&D in our space across Canada.

With PE, we no longer have to rely on bulky and rigid silicon components produced through capital intensive manufacturing. We can replace electronic circuit boards manufactured with wasteful and environmentally harmful processes. We can embed electronics in printed 3D devices and components. We can enable a new generation of wearable healthcare technologies, smart fabrics, connected homes that conserve energy, and even smart packaging that can reduce food and packaging waste. All this can be done with additive manufacturing processes that do not use harmful chemicals.

All this can be done while generating new wealth and new jobs for Canada.

And yet, significant challenges remain. Our startups and young SMEs need assistance to connect with and work with the core group of larger Canadian and global PE companies that can help them overcome R&D and scalability hurdles, connect with end users and get to market. The larger organizations, meanwhile, face their own challenges to compete in the global market, such as making their products intelligent with the advanced features supported by PE.

On November 22, 2016, the Canadian Printable Electronics Industry Association (CPEIA) convened at the Toronto headquarters of Xerox Research Centre of Canada for the inaugural Sector Development Leadership Council (“the Council”).

This high-level meeting had one goal – to chart a roadmap for the future. This roadmap is meant to articulate the commercialization challenges facing the domestic PE sector, determine how industry and academia must work together for mutual gain, and decide what role government policy must play to provide an appropriate supportive framework.



The Council attracted 35 senior decision makers from across the CPEIA's diverse membership – entrepreneurs, corporate executives, academics and representatives of provincial and federal programs that support R&D and commercialization activities. On-site polling of the participants confirmed this group served as a representative cross-section of the CPEIA's 80 member organizations.

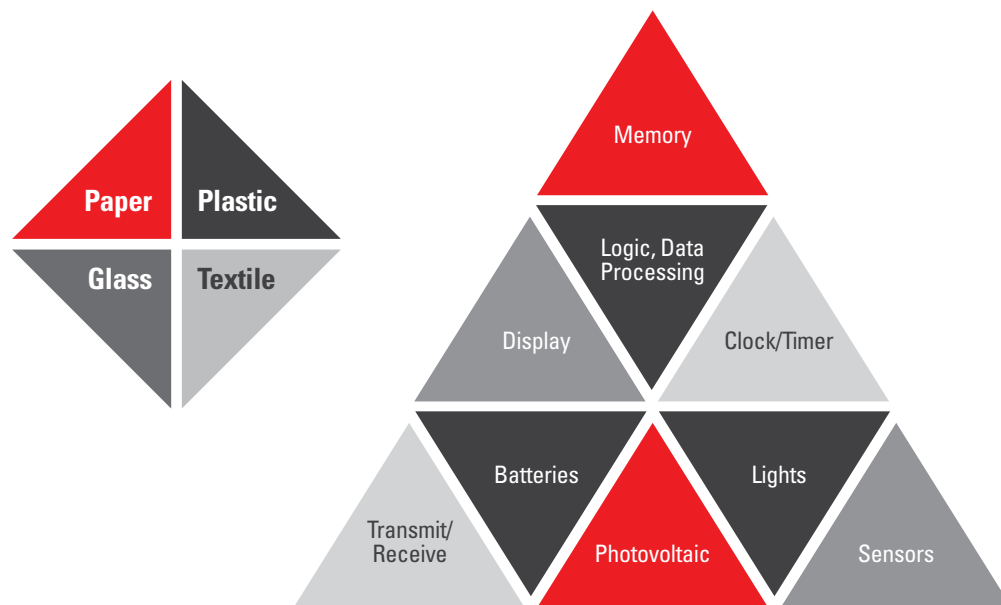
This report summarizes the outcome of the Council's high-value consultation and discussion. The Council was facilitated by CPEIA President and CEO Peter Kallai and included electronic audience polling. Select polling results are included in this report.



Part 1: Canada's PE sector profile

What is printable and flexible electronics?

With PE, inks that can conduct electricity – made from materials such as graphite, silver, and copper – are printed on a substrate at high enough density to form a complete electronic circuit, but thin enough to have negligible impact on the substrate thickness. The substrate can be rigid, flexible or even stretchable, such as paper, plastic, fabric or glass. These inks can be applied through traditional printing processes such as flexo, screen, inkjet, gravure, and offset, as well as through coatings. This can be done through fast and inexpensive automated processes, such as those used in the commercial printing industry for newspapers and magazines. These electronic components can also be embedded through additive manufacturing processes, such as 3D printing or in-mold electronics.



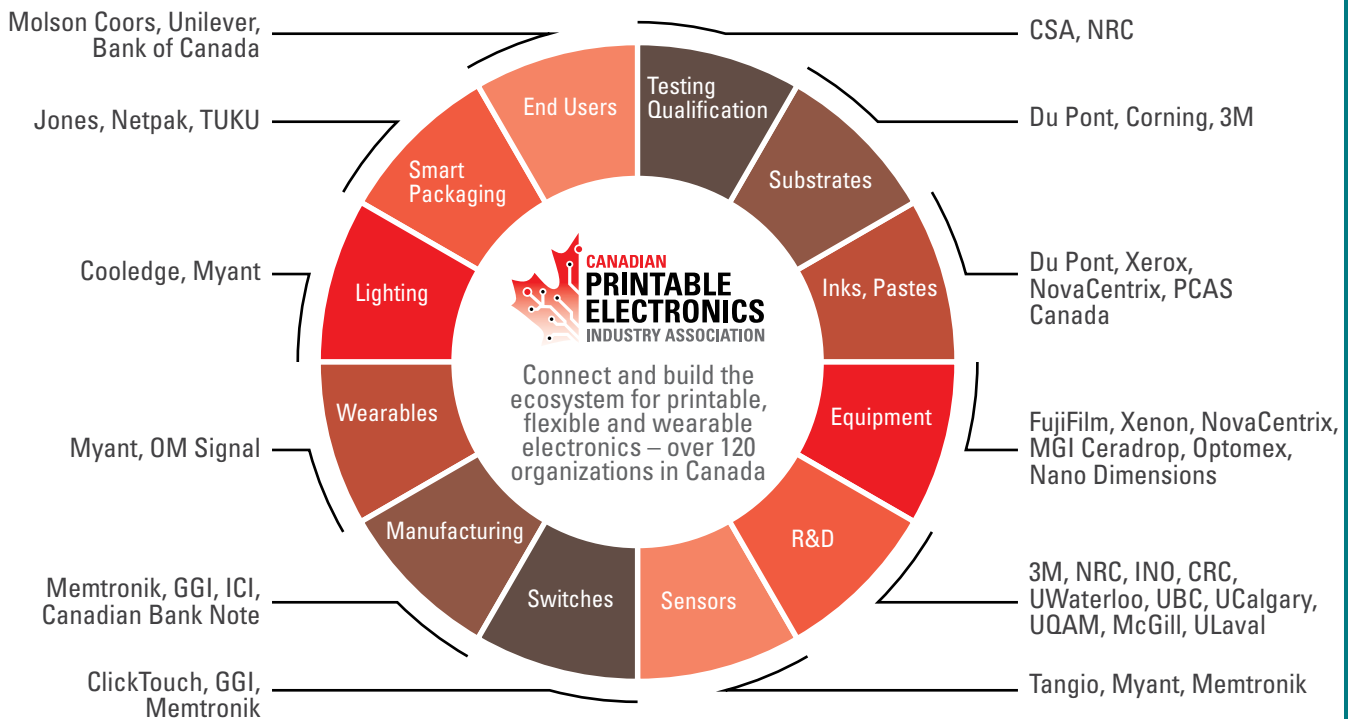
PE can be used to create discreet components such as displays, conductors, transistors, sensors, light emitting diodes, photovoltaic energy capture cells, memory, logic processing, system clocks, antennas, batteries, and low-voltage electronic interconnects. These can be integrated into simple systems that, for example, can record, store, and then transmit temperature information. Fully functional electronic systems can be created in this way, or discreet components and sub-systems can be produced to function as part of a hybrid solution with conventional silicon-based integrated circuits or components.



The CPEIA has the critical mass

Over the past two years, the CPEIA has become the magnet that draws the ecosystem of Canada's emerging PE sector together. We work with our membership to accelerate innovation, drive end user adoption and establish Canada on the global stage. The following chart shows the eco-system and shows selected members and how it all fits together.

Two-thirds of our membership is comprised of industrial companies. The other third includes academics, government labs, consultants and finance organizations that support R&D and commercialization activities, such as the National Research Council of Canada and the Business Development Bank of Canada.



The CPEIA works with its Members on critical development strategies to facilitate growth through networking, stimulate R&D and investment, build a strong supply chain and drive the broad adoption of PE by end customers in a range of Canadian industries. Our membership focuses on applications in Intelligent Packaging, Intelligent Buildings, Aerospace and Defence, Automotive and Industrial Applications, Health and Wellness, Intelligent Documents, and Consumer Electronics and Wearables.



Secure Documents



Intelligent Labels



Smart Parts



Intelligent Buildings



Smart Sensors

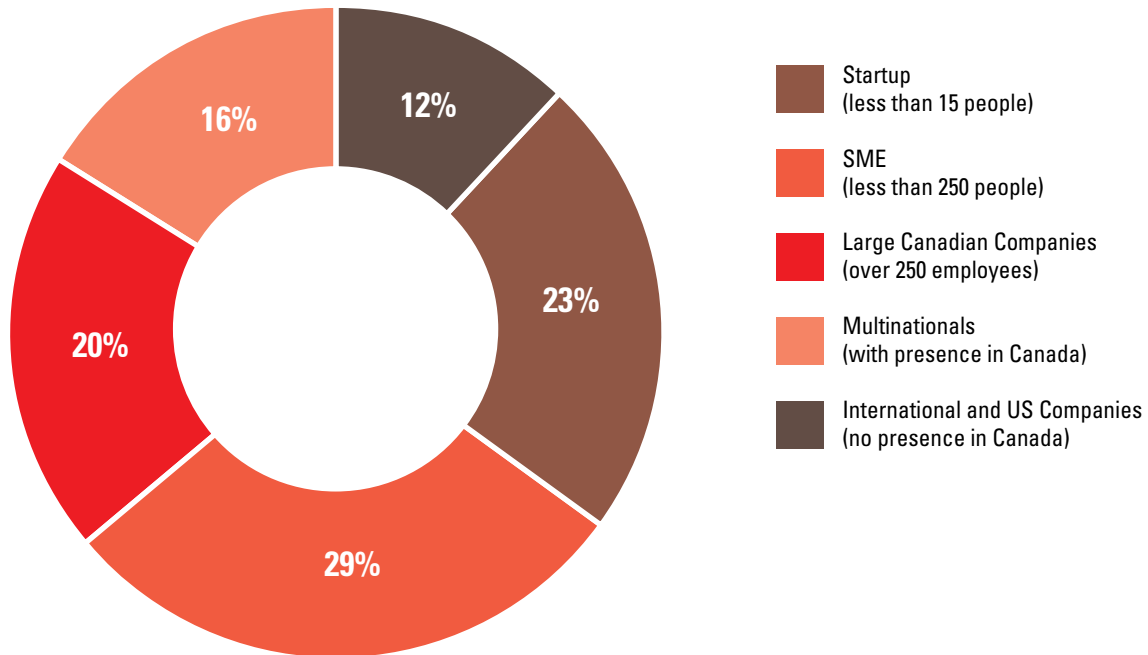


Wearables



Industry break down and red flags for sustainable growth

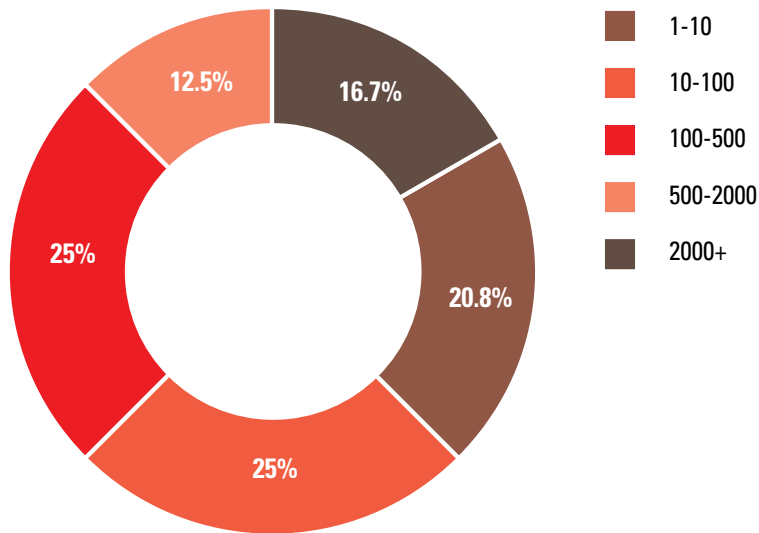
In terms of organization type and size, the nascent state of Canada's PE sector is demonstrated in the following graph by the number of CPEIA Members that are startups and SMEs.



During the Council, we also polled participants to dig deeper. What follows are the response to several questions.

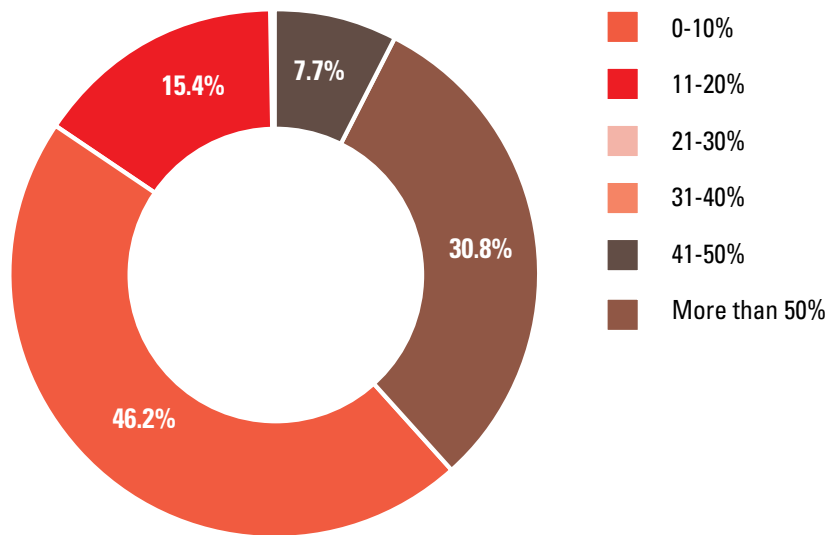


Question: How many employees do you have globally?



This question again demonstrated the nascent state of our industry, with about 45 per cent of respondents reporting fewer than 100 employees globally and an additional 25 per cent still in the SME weight class with no more than 500.

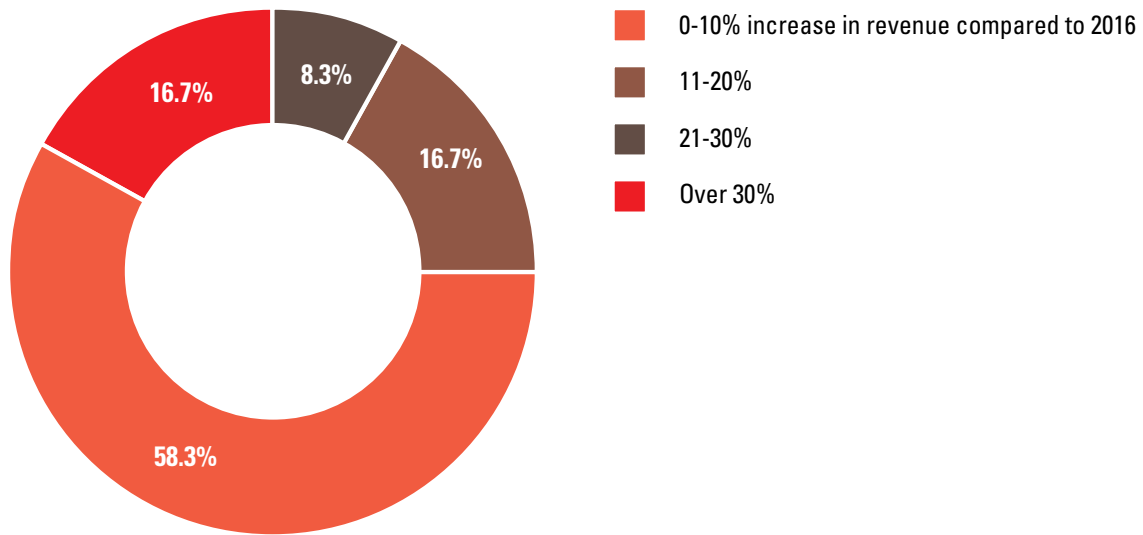
Question: For industrial firms, what percentage of your employees are involved in R&D at this time?



The early stage of our domestic industry again revealed itself here, with more than half of respondents reporting that 41 per cent or more of their staff are involved in R&D. A large percentage of our ecosystem is young companies trying to bring new technologies and applications to market.



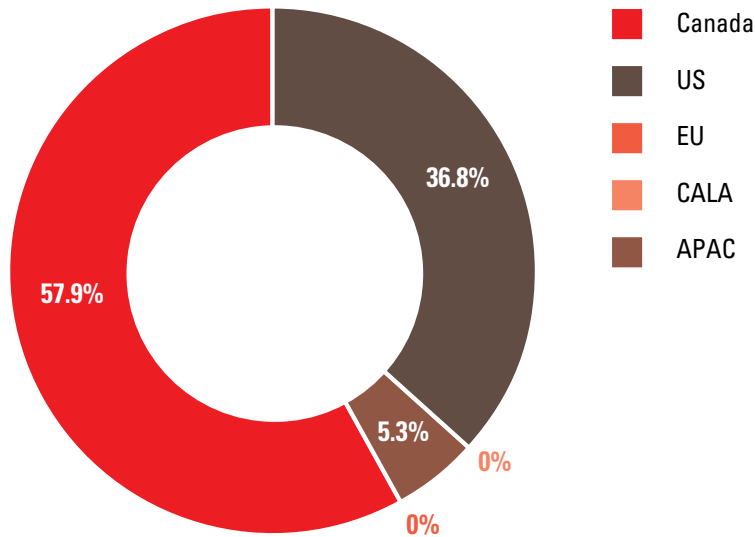
Question: For industrial firms, what is your expectation for revenue growth in 2017?



Expectations for revenue growth are generally modest, with 58 per cent expecting only single-digit growth. This represents a huge opportunity to scale up and expedite growth.



Question: What is the main market from which you derive most of your revenue?



The majority of industrial companies (almost 58 per cent) remain reliant on the domestic market when what they need to truly flourish is access to global markets.

Most PE industrial companies expect only single-digit revenue growth in the coming year. Almost the same number derive most of their revenue from the relatively small market that is Canada. This is an obvious point of concern considering this is a *global* growth industry. It speaks to how much of the Canadian PE industry is made up of earlier stage companies still trying to find their footing in a global marketplace.

These numbers are also interesting when framed by the concerns raised in the Business Development Bank of Canada's September 2016 report, *The Scale Up Challenge: How are Canadian Companies Performing?* That report documented the challenges Canadian companies in general face to break out of their regional boundaries to achieve healthy growth and long-term sustainability.



Part 2: PE is a global opportunity for Canada

The global outlook is strong

Global revenues for products using PE in 2016 is estimated at US\$26.9 billion, an annual increase of 31.8 per cent since 2010. Consulting firm Smithers Apex expects the market to grow to an estimated US\$43 billion by 2020.

A separate forecast from market research firm IDTechEx predicts a US\$70-billion market by 2024, for applications ranging from organic LEDs (OLEDs) to conductive inks for a variety of applications.

As this new manufacturing sector progresses from R&D into large-scale production, Canada is poised to take advantage of a rapidly growing global market. When we look at how much this industry has progressed with government support in overseas markets like the EU, it's clear we have a lot of catching up to do. But this gives us the opportunity to learn from, capitalize on or avoid the growing pains of others. We can leapfrog the EU and U.S. industries.

This will require a team approach, to connect our PE companies with global end users in Canada and abroad.

The U.S. is already investing heavily in this area

Our peers south of the border have received hundreds of millions of dollars recently from the U.S. government for printable and flexible electronics and smart textiles. U.S. policy makers recognize the importance of our sector to the long-term strength of American manufacturing.

For example:

The Flexible Hybrid Electronics Manufacturing Institute, announced in August 2015, will receive US\$75 million in Department of Defense funding over five years. This will be supplemented with more than \$90 million from industry, academia and local governments.

In April 2016, the White House announced *The Revolutionary Fibers and Textiles Manufacturing Innovation Institute*, which will receive US\$75 million in federal funding and almost \$250 million in non-federal funding. This is a partnership between MIT and the Department of Defense.

This was followed by the creation of the *Smart Manufacturing Innovation Institute* in Los Angeles, which brings over US\$140 million in public-private investment from leading universities and manufacturers to develop smart sensors for use in advanced manufacturing.

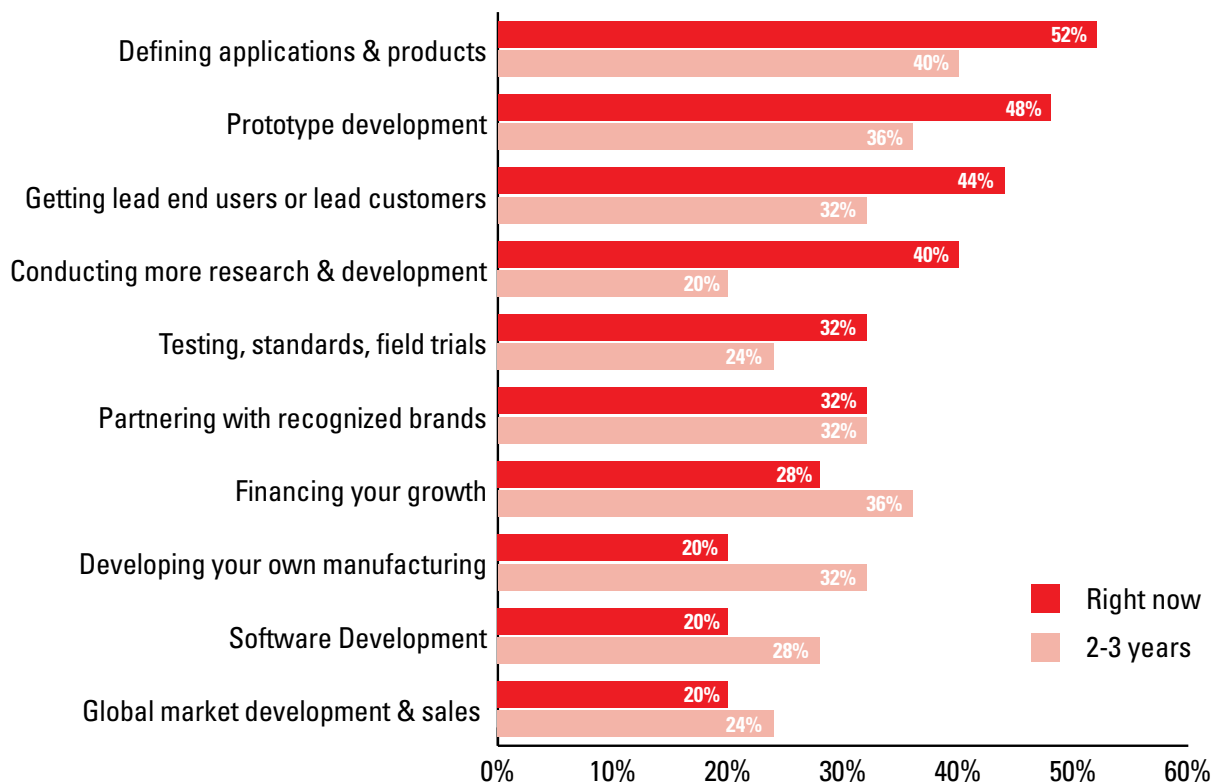
Because Canada's PE sector is dominated by smaller and earlier stage industrial companies, this kind of public-private approach is crucial to capture global market opportunities. SMEs lack the scale and the resources to do it on their own, but through the CPEIA, we can pool the resources and perhaps invite co-investment by the Canadian government.



Part 3: What are the challenges for Canada's PE sector?

Consider the response to the following question:

Question: What are your organization's major challenges right now? What about in two or three years? (click all that apply)



Four key challenges emerge:

- **The Market Challenge:** Defining applications and products with large and profitable markets in partnership with world-class end users. Critical in this is accessing such end users globally and getting them to work with Canadian companies.
- **The New Product Development Challenge:** Prototype development towards commercialization with lead end users/customers for trials and early adoption. Critical in this is conducting trials of new technologies in sufficient scale to prove profitable commercial adoption.
- **The Manufacturing Challenge:** Resources for SMEs to invest in their own facilities before the market and business case has been proven for manufacturing scale up. Critical in this is creating and accessing sufficient scale-up manufacturing resources, including equipment, skilled people and production lines.
- **The Financing Challenge for Scale Up:** Access to capital for startups and SMEs at various stages of growth. Critical in this is lack of access to traditional VC funding for materials, electronics or new emerging cross-sector ventures.

Few people versed with commercialization activities will find these results surprising.



Defining applications for a new technology, developing a prototype, securing lead end users/customers for trials and obtaining financing are typical challenges of the new product development process for any emerging market.

Challenges by company size

Based on group discussions among participants, needs and challenges can be broken down between the four levels of industrial companies found in the CPEIA membership:

Startups

Startups need to get their feet wet in the marketplace early on. They must engage with potential customers, sources of funding, and partners to scale up manufacturing. This is crucial for them to progress up the supply chain and evolve from being only a supplier of components to a supplier of integrated solutions or applications of higher value. Add to this the typical startup needs for mentorship and experienced talent for key positions. While local incubators can provide generic support, industry organizations like the CPEIA can provide highly valuable industry-specific connections and support.

Small- and Medium-Sized Enterprises (SMEs)

SMEs may already have one or two mature business lines, but they are often sticking to nearby markets such as Canada or the U.S. Their challenge is to break into fresh market verticals where their intellectual property and expertise can be parlayed into new products or applications to create new business lines. For example, perhaps a company active in consumer electronics can find new opportunities in remote healthcare or the connected home. Another challenge is to diversify the customer base geographically to EU and Asia to increase sales volumes of the same product or service.

Their challenge for growth is finding the right partners for new business and product development, and to scale manufacturing.

Large domestic companies

While Canada's domestic PE industry is dominated by startups and young SMEs, there is a core group of larger enterprises with well-established business lines and access to a global customer base.

To grow and remain competitive, these companies must deliver fresh innovation to their current customers and add compelling new features to existing products and services. The challenge is to educate existing end users on the benefits of new products and product features and incent them to adopt these new offerings.

This requires early adopters – prospecting and engaging with lead customers that are willing to take a calculated risk on something new and different because they believe it will afford them a new competitive advantage. Their success will entice others to follow. This requires the resources to stage regional and local trials to prove the new technology and drive initial adoption. This must be followed by a strategy to scale, which may require additional partnerships with manufacturers and other companies in the supply chain.



Global multinationals

These companies have multiple established business lines, robust supply chains and often substantial internal resources for R&D and business development. But they are always on the lookout for new partners and new innovations to complement their own to open new markets and new revenue streams. For many multinationals, Canada is a desired location from which to operate due to our disciplined, creative and multicultural workforce. The cost of doing business in Canada is also relatively low compared to Europe or Silicon Valley.

The challenge for these companies is that they are often too internally focused within their own silos and only pursue what are easily identified as large market opportunities. They need to engage with the up-and-comers, the innovative startups that are breaking new ground and challenging the status quo. These startups are potential partners and/or acquisition targets.

And just like any other company, multinationals are also eagerly trying to understand the needs and wants of new end user groups and find the right partners for product trials.

Why current support programs and resources are not enough

Various programs and services do exist to help companies overcome these hurdles ... to a degree.

Startups can turn to regional economic development agencies and incubators like Invest Ottawa, Communtech in Kitchener-Waterloo or the MaRS District in Toronto. There are also government resources such as those offered by BDC, Ontario Centres of Excellence, NRC-IRAP, SR&ED and NSERC.

While these various resources are valuable and useful at various stages of an industrial company's lifecycle, they do not collectively form the coordinated and focused strategy required for an emerging technology sector. Participants at the Council agreed a different approach is required to create the collaborative ecosystem that will develop an emerging technology sector into a robust and sustainable one.



The challenges and shortcomings of the status quo


Participants identified the following challenges with current government programs and other aspects of the commercialization eco-system:

- Government programs that offer financing and tax credits slant too much in favour of early stage R&D. There is insufficient support for later-stage commercialization and scale up.
- Some government programs focus heavily on university R&D and making funds accessible to industrial companies only if they are working with a university partner. As one participant observed, 90 per cent of what a company needs for commercialization happens outside of academia. There is no suggestion that university R&D no longer be supported in this fashion, but more flexibility is needed for government programs to also support company-to-company collaboration.
- Venture capitalists are currently averse to funding electronics and hardware – technology areas that are core to the activities of many PE companies. There is only one VC that funds emerging new materials in Canada. Available investment dollars are very limited.
- Regional incubators and economic development agencies often lack the inspirational, hands-on and responsive support that comes of connecting entrepreneurs and startups with seasoned executives and established enterprises within their industry sector, for mentoring and partnership.
- There is no framework to govern industry partnerships and to protect competitive differentiators, such as intellectual property.
- There is a lack of coordinated brokerage, to connect people, resources and companies across industry, for trials, pilots, manufacturing scale up and general collaboration.
- There is no strategy to assist with market adoption, to educate end users so they understand the benefits (ROI versus cost) of applying an emerging technology. For example, adapting PE in a traditionally low-tech industry such as packaging.
- The costs of market entry are unique to each vertical and are not addressed, such as the regulatory costs involved with commercializing healthcare-related products and services.

Canada's PE startups and SMEs require resources, support and coaching to help them mature and commercialize compelling products and applications driven by market need.

This demands an industry-specific network dedicated to building the entire ecosystem for an emerging technology. One that creates linkages across the supply chain. This begins with end users and customers, followed by the other essentials required to de-risk a product for volume manufacturing.





Achieving critical scale in a new area like smart packaging creates the competitive cluster resources and volume of companies that are needed to capture markets. If only one company does it, limited attention is given to the innovation.

The CPEIA and its Members can help create such clusters at the intersection of traditional industries and new technologies such as in smart packaging, wearables, smart parts and other verticals if given the resources and the investment.

Can we afford to let history repeat itself?

We must provide the framework that will equip SMEs to successfully scale R&D, from prototyping to volume manufacturing, and connect them with alliance partners and end users to bring their products to market. This includes sources of capital and the proven experience to scale a technology company.

We can't afford to allow history to repeat itself, where world-leading Canadian innovation has been left to wither on the vine for lack of the commercialization and export support it required to become globally competitive.

This has happened too often in the past with other industries, where Canada's global market share has eroded over time. We've seen it in space, remote sensing, robotics and biotechnology, just to name a few.



Part 4: Our strategic plan for the future

We are much more than a traditional association that lobbies government for regulatory change or funding. We insert our Members into the supply chain, to provide them with access to the partners, suppliers and end-users that will help them develop compelling products and grab market share.

The Beacon: The intelliPACK Leadership Council and Program

For example, we engage with major brands like Unilever and Molson Coors. These household names hunger for new technologies that can enable intelligent packaging and digital engagement with the consumer at the point of sale. They want to reduce packaging and food waste and protect consumers from product tampering and counterfeiting. We work with the PE innovators, integrators and manufacturers across the supply chain that can deliver on these needs.

Without our organization, these big brands wouldn't seek out Canadian SMEs. Instead, they are more likely to partner with organizations in the U.S. or the U.K. But thanks to our efforts, these brands have now invited half a dozen Canadian SMEs to review and evaluate their offerings and possibly work on field trials. These individual SMEs were not able to connect with these brands on their own.

In fact, we have created a permanent Leadership Council for intelligent packaging for Canada – *intelliPACK*, co-chaired by Unilever – to drive these connections on behalf of Canadian industry. This council is lead by 16 industrial organizations and looking to deliver industry development activities to a targeted 120 industry firms.

This is just one example of how the CPEIA is proactively creating new supply chains that will generate new wealth and new jobs in Canadian manufacturing. We are doing what we can to overcome the challenges faced by our sector, but as a small non-profit association, the CPEIA can only do so much.

Our sector has opportunities in six other industry verticals where our technologies are applied – defence, aerospace, healthcare, wearables, connected homes and intelligent buildings. CPEIA members confirmed that this is the approach that they wish to use for all other verticals that the CPEIA should attack.

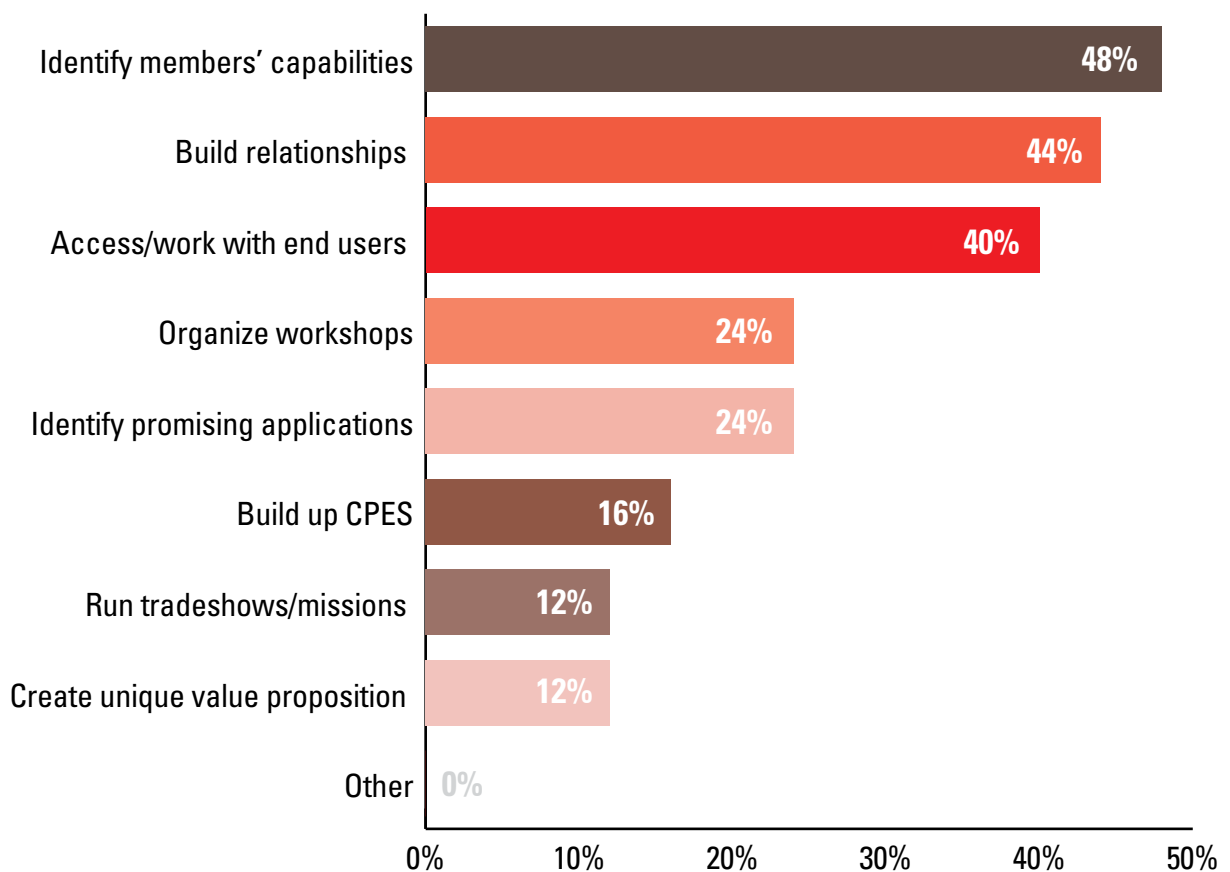


Strategic focus for the next 3-4 years

Where do our Members see the greatest opportunities in PE? Their chief growth markets for PE technologies and applications are:

- **intelliPACK:** Intelligent Packaging and Retail
- **intelliWEAR:** Health and Wellness Wearables
- **intelliBUILD:** Connected Homes/Intelligent Buildings
- **intelliPART:** Aerospace and/or Automotive

Our Members see the CPEIA's role to tackle these markets as follows:



The responses to this question show that collaboration is key. The top priorities for Council participants is for the CPEIA to facilitate partnerships to develop promising new applications, organize workshops that provide a venue for networking and knowledge sharing, and build relationships with associations that represent potential end users. All this begins with identifying the capabilities (and needs) of CPEIA Members.



CPEIA members are willing to invest

All participants expressed a willingness to take part in these types of activities and programs for mutual benefit. The intelliPACK Leadership Council was lauded as a successful example of how CPEIA members and other industry partners can and should work together. Almost all participants said they would provide a delegate for a Leadership Council for the three additional market verticals listed above.

But such programs require resources, both financial and in terms of human capital. The CPEIA cannot on its own undertake new programs like intelliPACK without member organizations contributing resources.

About 71 per cent of participants said they would contribute an annual fee of around \$500, in addition to their CPEIA membership fee, to support such a program. But of course, such resources must be levered through other funding partners and sources to create much-needed programs.


What is needed to address our industry's core challenges

But regardless of the market verticals CPEIA Members wish to pursue and the extent to which the CPEIA can assist, the same four challenges outlined above will remain and must be addressed:

- **The Market Challenge:** Defining applications and products with large and profitable markets in partnership with world-class end users. Critical in this is accessing such end users globally and getting them to work with Canadian companies.
- **The New Product Development Challenge:** Prototype development towards commercialization with lead end users/customers for trials and early adoption. Critical in this is conducting trials of new technologies in sufficient scale to justify commercial adoption.
- **The Manufacturing Challenge:** Resources for SMEs to invest in their own facilities before the market and business case has been proven for manufacturing scale up. Critical in this is creating and accessing sufficient scale-up manufacturing resources, including equipment, skilled people and production lines.
- **The Financing Challenge for Scale Up:** Access to capital for startups and SMEs at various stages of growth. Critical in this is lack of access to traditional VC funding for materials, electronics or new emerging cross-sector ventures.

The CPEIA alone cannot address these needs.





While there must continue to be a long-term strategy around basic and applied R&D, Canada's PE industrial companies need help where it matters now to secure new markets and new streams of revenue.

Industrial companies in an emerging technology sector require short-term funding and program support for the trials and commercialization activities that follow the R&D phase, along with the flexibility to decide where, how and with whom these resources will be allocated.

Government partnership with industry is crucial

About 76 per cent of participants confirmed they would be willing to invest in a joint industry-funded program to overcome these common challenges.

This response rate rose to more than 82 per cent when participants were asked if they would be willing to invest in a joint *industry-government funded* program. About 92 per cent agreed it would assist their organization if their commercialization projects could be co-funded from such a program.

Lastly, half of participants reported that, on average, such a co-funded program would allow them to create up to 10 new jobs over the next three years. About 35 per cent put the number at 11-20. The remainder, obviously larger organizations, cited up to 50 new jobs.

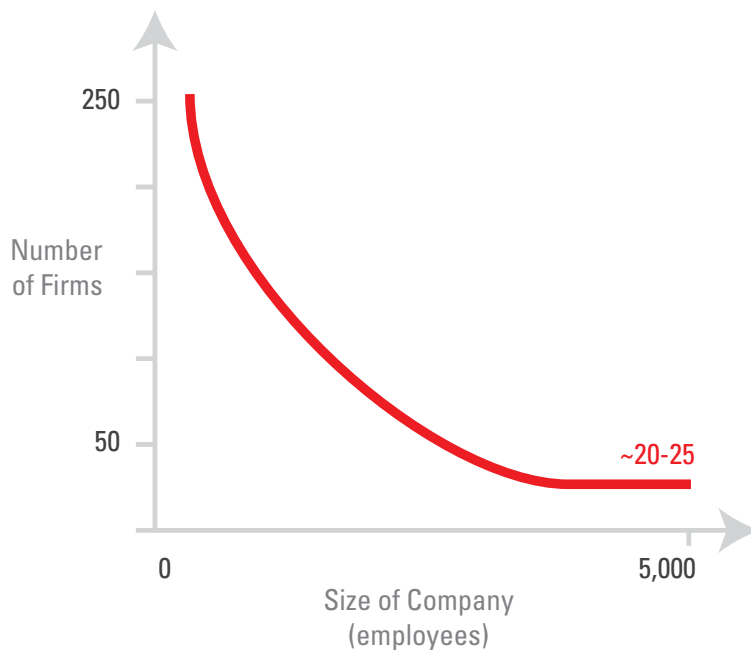
How much co-investment can Canada's PE industry make into a joint industry-government funded program for trials and commercialization projects? Assuming they would need to cover 33 per cent of the cost in cash and 33 per cent in-kind, about 90 per cent of participants said up to \$100,000 per year. The remainder chose up to \$200,000. Such funding levels would be sufficient to run field trials in the neighbourhood of \$300,000 to \$600,000 in total costs, or to develop new prototypes. A dozen of our members can also use VC style equity funding to scale their businesses.



Why are we asking government to support us?

As a self-organized, non-profit industry group, the CPEIA cannot achieve all this with its current funding formula. SME membership fees are kept low, in line with their ability pay, but these firms could benefit most from more support from the CPEIA. Because larger companies pay more and must see an ROI on their membership dollars, most of our resources with our current funding formula must be dedicated to them.

Our sustaining members – mid-sized and multinational organizations that pay membership fees of \$2,500 and \$5,000 – do not represent a large enough group to provide enough revenue for our operations. This is, after all, an *emerging* market space in which Canada has yet to grow a substantial number of mid-sized and multinational companies, compared to more established industry sectors.



When we look at how much this industry has progressed with government support in overseas markets like the EU and the US, it's clear we have a lot of catching up to do. But this gives us the opportunity to learn from, capitalize on or avoid the growing pains of others.

Startup growth is often illustrated with a hockey stick to represent slower growth as the early stage and fast-paced growth as the next stage. At present, the Canadian industry is growing on the lower section of a hockey stick, but with the right kind of support we could move up to fast growth. While support for regional clusters has traditionally been strong from government, we are hoping that government can see the value in a more sector-focused and national approach to cluster development.

Government must play a different role and develop a new set of tools with the input of industry to help drive commercialization for PE and any other emerging high technology sector. The traditional R&D focus can get companies into the race, but it's not enough to help them to win it.



How would we use government funding? Our strategic plan

We require funding from government sources that recognize an emerging industry sector such as ours must be supported and encouraged in ways that fall outside the constraints of traditional government program models.

What form would a government-funded program take? Council participants advocated a facility, or group of facilities working in collaboration. The focus would be to combine resources from participating organizations to de-risk the process of new product development, prove product viability to potential customers and investors and lay the groundwork to scale up manufacturing for full commercial production.

Specifically, such a program would:

1. Develop sector plans and assemble leadership councils for major PE technology areas in
 - a. wearables/health,
 - b. connected homes and intelligent buildings and
 - c. smart parts for transport (automotive and aerospace) that directly benefit key Canadian manufacturing sectors, in addition to
 - d. intelliPACK, the current program for intelligent packaging. We would link university and college R&D to these sector plans.
2. Market our sector to dozens of additional global end users like Unilever to help drive development of revenue-generating products.
3. Promote our sector and our industry events to attract a global audience to Canada so our companies can engage with the global supply chain.
4. Open new verticals such automotive and health care beyond smart packaging where we have globally competitive Canadian players.
5. Fund and carry out product development activities, pilots, trials and demonstration projects that lever resources from across the CPEIA Membership, to target and educate end users in key market verticals.
6. Link and develop critical manufacturing capabilities that currently do not exist in Canada such as smart textiles and 3D printable electronics.



Conclusions and next steps

Canada needs to build sector specific eco-systems like ours that drive collaboration between end users and suppliers at all levels, to create world-class and market-ready technology right here at home. This is how the auto, space and aerospace sectors operate.

We must remember that the startups and small SMEs that represent the fragile backbone of an emerging sector need help to secure the large end users and industry partners to make their products market ready, and manufacturing ready. They need an industry cluster organization such as the CPEIA that can bring these end users and partners to their door and de-risk the process of commercialization.

A new approach, focused on giving an emerging tech sector like ours the sector-specific support it truly needs, is crucial to our nation's Innovation Agenda.

The CPEIA is already blazing the trail, creating linkages across the supply chain through workshops, multidisciplinary leadership councils for our target industry verticals, conferences and events, and through strategic partnerships with key industry associations. But CPEIA must put in place new programs, that is currently beyond its resources that requires government co-funding.

Those partnerships already include organizations like PAC, Packaging Consortium, the Continental Automated Buildings Association and IEEE.

With support from government, we will accelerate and expand these activities.

Emerging sectors mature over 15 to 20 years. With the right government funding formula, a sector organization like the CPEIA could provide the support SMEs need, help startups and SMEs scale faster, and cut this growth curve by at least five years. This will create robust growth and economic benefit for Canada much faster than if industry firms are left to struggle along on their own in a fragmented market.

The November 22 Sector Leadership Development Council served as an excellent first step to identify the common challenges faced by Canada's PE industry, to begin a frank and necessary dialogue between private and public sector organizations at all levels, and to develop a roadmap for the future. As summarized in this report, the Council identified how CPEIA members believe their association can best serve their interests, how industrial companies must work together and how government policy can best support their industry.

The November 22 meeting will be the first of many as we further develop this strategic plan and define a roadmap for its implementation.



Appendix A:

List of Organizations at the November 22, 2016 Sector Development Leadership Council Meeting

1. 3M Canada Company
2. Array Marketing
3. Atlantic Packaging
4. BioApplied
5. Business Development Bank of Canada
6. Centennial College
7. CPEIA
8. CSA Group
9. EMD Performance Materials Corp.
10. Formi 3DP
11. GO 2 SCOUT 4 R&T
12. ICI
13. Innovation Science and Economic Development Canada
14. INO - Institut National d'Optique
15. Jones Packaging Inc.
16. Memtronik Innovations
17. MW Canada
18. Myant Inc.
19. National Research Council of Canada
20. NGTronix Industries Corp.
21. Ontario Centres of Excellence
22. OTI Lumionics Inc.
23. PCAS Canada
24. Red River College
25. Tech-Access Canada
26. Unilever
27. University of Western Ontario
28. XRCC





CPEIA

Established in 2014, the Canadian Printable Electronics Industry Association (CPEIA) brings together key Canadian and international players in industry, academia and government to build a strong Canadian PE sector. The Association is the united voice for the sector and implements critical development strategies to facilitate growth through networking, stimulate R&D and investment, build a strong PE supply chain and drive the broad adoption of PE by end customers.

Learn more at: cpeia-acei.ca



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