MANUFACTURERS' OUTLOOK 2017

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Executive Summary

Although economic growth was disappointing this year, Canadian manufacturers have a positive view of their prospects next year when GDP for Canada and the US is forecast to rise a bit above 2%.

The **PLANT** Manufacturers' Outlook 2017 survey shows 36% of senior company executives are optimistic although most (55%) qualify their optimism with caution.

The survey, conducted by Northstar for **PLANT** Magazine in partnership with sponsors Grant Thornton LLP, SYSPRO Canada and Machines Italia with the Italian Trade Commission, is based on 526 replies from senior manufacturing executives (margin of error +/- 4.27%, 19 times out of 20).

Most of their companies (65%) fall into the small business category (under 100 employees); 23% are medium-sized (under 500); and 13% are large firms (500 or more).

More than half of the senior executives are expecting orders and sales to increase (by an average 15% and 16%); but costs will also increase (by 9%). Pricing will stay the same for 55% but 33% expect increases (of 8%). Forty-two per cent see profits rising an average of 13%.

Pricing and costs top the list of challenges for 50% of respondents, followed by increasing sales (48%), economic conditions (45%) and the value of the loonie (42%).

Caution is evident by their intentions to invest. Sixty-six per cent don't know how much they'll invest in machinery, equipment or technology in 2017, and 72% are unsure about investments in their facilities. But 60% expect to invest in training and 55% in machinery, equipment and technology over the next three years.

Only 33% are concerned about entering new markets and 37% don't export at all. Most (86%) are doing the bulk of their business in North America, 62% of it in Canada.

What's holding them back from increasing revenues outside North America? Thirty-two per cent say intense competition, followed by currency fluctuations (26%) and transportation/logistics issues (24%).

Forty per cent will drive growth by focusing on North America, 45% will expand sales and distribution channels and 44% will introduce new products.

Despite the growing risk to government and business networks from cyber attacks, most executives (48%) gauge their level of concern as mid-range and half describe themselves as prepared. The threats manufacturers are most unprepared for are targeted external attacks (26%) and breaches through a third party vendor (24%).

With increasing focus on regulations targeting the reduction of carbon emissions, 77% are very or at least somewhat engaged. But recent government moves to put a price on carbon have not raised the priority level of responses to climate change for 51% of companies and 46% do not include carbon reduction as a part of a formal business strategy.

As in past surveys, companies reveal they've been slow to take advantage of measures and technologies that would improve productivity. Only 30% make use of automatic data access, analysis and review to measure and monitor productivity; 42% do it manually; 28% don't measure; and 61% won't be connecting the shop floor to the top floor over the next 12 months. The top three adopted technologies are CAD/CAE/CAM (46%), data acquisition, information and control technologies (34%) and computerized processing, fabricating and assembly technologies (27%). Thirty-two per cent don't use any of the listed technologies.

Respondents also demonstrated limited engagement with the Industrial Internet of Things (IIoT), which connects and optimizes machines via the internet. Only 6% are applying IIoT capabilities and a major obstacle for 31% is not knowing where to start.

Most respondents (80%) either don't know or aren't sure what their companies will spend on innovation in 2017, but they're almost evenly split on investment increasing (48%) or remaining at the same level (49%) over the next five years. Whatever their spending plans, most (62%) have not – nor do they plan to – take advantage of the SR&ED federal tax credit for investment in research. Only 27% plan to do so in 2017.

Canadian Manufacturers & Exporters recently unveiled its Industrie 2030 initiative: to double output and exports by 2030. This year's Outlook study shows manufacturers are keen to grow but have some work to do if they are to meet these ambitious objectives. It will mean embracing productivity-enhancing technologies such as the Industrial Internet of Things and for some actually venturing outside Canada, while others will focus on diversifying their exports beyond North America.

Joe Terrett
Editor
PLANT

Message from Grant Thornton

We are very grateful to have been given the opportunity once again to partner with **PLANT** Magazine in the Manufacturers' Outlook survey and roundtable – a survey in which many companies from across the country participated, sharing their opinions on Canadian manufacturing and on the opportunities and challenges that lie ahead.

As has been the case for a number of years, Canadian manufacturers continue to express a generally optimistic view of the industry and its prospects. With an overall focus on innovation and growth, they believe manufacturing will continue to make a favourable imprint on the economy as a whole.

By making significant investments in training, technology and new equipment while also focusing on expanding sales and distribution channels, both domestically and internationally, manufacturers believe there is no lack of opportunity before them. Many manufacturers have continued to take advantage of the improved economy south of the border, despite the uncertainty accompanying the US election. Others are more seriously considering new or further expansion into the global marketplace, a marketplace that Canadian manufacturers currently under-serve in the minds of many.

Yet, with these investment and expansion opportunities come a host of challenges. Manufacturers continue to face a shortage of skilled labour. Many also struggle with how to best create attractive and lasting opportunities for the evolving millennial workforce. Manufacturers' success today hinges on moulding a company culture that positively influences its workforce and its resulting products and profits. Pressure on pricing, cost containment and the enhanced risk of cybersecurity pose significant challenges for many manufacturers as well.

Here at Grant Thornton, we have the privilege of serving manufacturers across the country and around the world. Our experience has taught us that those in the manufacturing industry are adaptable to change and are continuously able to turn challenges into opportunities. We have no doubt that this trend will continue. As a firm, we take a lot of pride in our association with such a progressive and important sector of our economy and very much look forward to helping manufacturers succeed for years to come.

Jim Menzies
National Leader – Manufacturing Industry
Grant Thornton LLP

Message from SYSPRO Canada

Canadian manufacturers continue to be cautiously optimistic about their business prospects in 2017, as reflected in **PLANT** Magazine's annual Manufacturers' Outlook report. SYSPRO Canada is once again proud to co-sponsor, along with Grant Thornton, this insightful report, which surveys leading Canadian manufacturing executives about their business intentions for the coming year, including outcomes and impacts. The report also expresses their opinions and insights into the future of Canadian manufacturing.

This year's study provides telling insights into the changing world of Canadian manufacturing. In addition to on-going concerns about growth, productivity and risk, companies are facing new challenges such as the Industrial Internet of Things (IIoT) and increasing cybersecurity threats.

The IIoT continues to advance in the depth and breadth of internet-enabled technologies, critical production, inventory, purchasing and order processing data, that can now be passed automatically between manufacturing devices and systems. Most of the respondents don't know anything about IIoT capabilities and are not applying them. Their biggest obstacle? Not understanding how to get started.

Manufacturing is one of the industry sectors most vulnerable to cybersecurity threats that involve asset misappropriation and fraud. It presents unique opportunities for employees, contractors, vendors and cyber hackers alike to take advantage of unsuspecting companies – which exposes companies to significant financial loss and the potential for damaged reputations. The study indicates that their level of preparedness is relatively high, but they aren't fully prepared to mitigate all risks.

Growth continues to be key and includes expansion into new geographic locations, emerging markets and new lines of business; and developing top talent. More than half of the businesses expect to increase orders and sales in the coming year, and executives will continue to invest in infrastructure (including training, machinery equipment and technology) over the next three years.

As a global organization that serves leading manufacturing and distribution organizations by streamlining operational efficiency with enterprise resource planning (ERP) solutions, we feel strongly that Canadian manufacturers have limitless opportunity to establish themselves as sustainable global market leaders.

SYSPRO Canada is dedicated to helping Canadian companies grow and prosper. We anticipate manufacturers will experience great success in the coming year, and we're excited to participate with them in the opportunities that lie ahead.

James Weir
Vice-President of Sales, SYSPRO Canada

Manufacturers' Outlook **2017**

BUSINESS **Growt**

Challenges ahead, but optimism prevails

By Joe Terrett, Editor

Well, what a whacky year it has been so far, and a tough one for nations like Canada that support global and freer trade. Britain votes to leave the European Union, jeopardizing its trade flows with the continent; the Canada-European Union Comprehensive Economic and Trade Agreement (CETA) almost blows up when a tiny region in Belgium refuses to ratify it; US reality show actor and billionaire Donald Trump succeeds in an unlikely quest for the White House and is now president-in-waiting, thereby jeopardizing NAFTA, US participation in the Trans-Pacific Partnership, and climate change measures brought in by the Obama administration. These and any number of "unknown" factors will directly or indirectly affect Canadian manufacturers. And all of these eruptions occurred after **PLANT's** annual Manufacturers' Outlook survey went into the field from June to September.

Turns out the customary cautionary view of the year ahead expressed by manufacturers is prescient.

The 526 responses to the 2017 edition show owners and senior executives of companies across Canada, most of them with less than 100 employees, are nonetheless looking at the year ahead with confidence. Economic growth has been disappointing this year – under 2% following downward revisions – and the forecast for next year in Canada and the US is growth of a bit over 2%. More than a third (36%) of senior executives are optimistic about their prospects next year, but 55% express caution. This caution is evident in their uncertainty about investments in assets and innovation.

Twelve panellists representing manufacturers, industry analysts and providers of services, gathered at **PLANT's** offices in Toronto as participants in the 2017 Outlook roundtable where they shared views on the survey results and challenges they face. Incidentally, the event was held a little more than a week before the US election, but a Trump presidency wasn't a topic of great concern.

Northstar conducted the survey for **PLANT**, in partnership with sponsors Grant Thornton LLP, an accounting, tax and advisory firm; SYSPRO Canada, a provider of ERP software and services; and Machines Italia with the Italian Trade Commission. The margin of error is +/- 4.7%, 19 times out of 20.

First, let's take a look at the entrepreneurs who participated in this year's survey. Most (88%) of their companies are SMEs, of which 40% have 24 or fewer employees, and 40% are forecasting 2017 revenues of up to $5 million. Most (82%) are privately owned, and 55% of those firms are family owned or partnerships (45%). Just 23% are subsidiaries of a multinational company.

PHOTO: RODNEY DAW

Front (L-R): Glen Gilbert, Antonietta Napoli (Machines Italia, Italian Trade Commission), Jim Menzies, Sandra Di Carlo,, David Doyle, Stewart Cramer. Back (L-R): David McPhail, Matt Chandler (ARGO, part of OPG), Ryan L'Abbe, Angelo Esposito, Wernher Verbraeken, Nathan Janzen, Joris Myny, Al Diggins.

Introducing the 2017 Manufacturers' Outlook panel

Al Diggins
President, General Manager
Excellence in Manufacturing Consortium, Owen Sound, Ont.
Not-for-profit organization that helps manufacturers compete globally.

Stewart Cramer
CEO
Vertex Precision Manufacturing, Vaughan, Ont.
Vertically integrated supply of finished small machined parts for aerospace, satellite and defense.

Sandra Di Carlo
Deputy Trade Commissioner
Machines Italia, Italian Trade Commission
Sixteen Italian machinery-manufacturing associations representing more than 10,000+ companies. Manufacturers' Outlook sponsor.

David Doyle
Customer Success Director
(at the time of the event)
SYSPRO Canada, Burnaby, BC
Provides ERP software and services. Manufacturers' Outlook sponsor.

Angelo Esposito
Vice-President of Operations
Ontario Drive and Gear, New Hamburg, Ont.
Manufacturer of gears and transmissions, and ARGO amphibious vehicles.

Glen Gilbert
Partner, Tax Services
Grant Thornton LLP, Southern Ontario
Accounting, tax and advisory firm, Manufacturers' Outlook sponsor.

Nathan Janzen
Senior Economist
RBC Economics Research, Toronto
Provides forecasts for the economy and financial markets in Canada, the US and around the world.

Ryan L'Abbe
Vice-President
GreenMantra Technologies, Brantford, Ont.
Converts waste plastics into high-value specialty chemicals such as waxes, greases and lubricants.

David McPhail
President, CEO
Memex Inc., Burlington, Ont.
Provides factory floor data communications and efficiency systems.

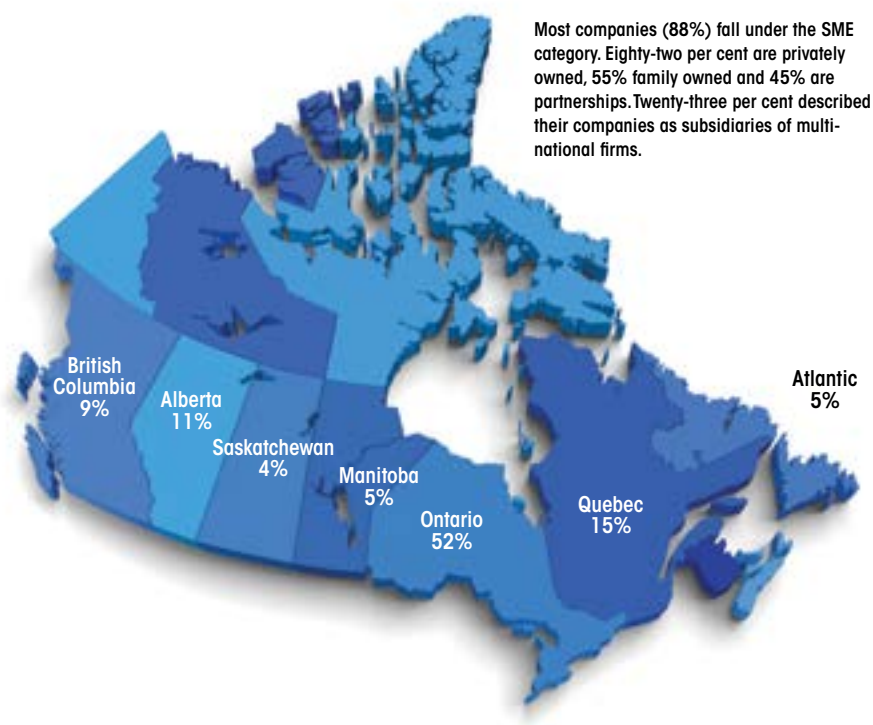
Jim Menzies
National Manufacturing & Distribution Leader
Grant Thornton LLP, Southern Ontario
Accounting, tax and advisory firm, Manufacturers' Outlook sponsor.

Joris Myny
Senior Vice-President, Digital Factor – Process Industries and Drives
Siemens Canada, Oakville, Ont.
Develops and manufactures electrification, automation and digitalization technology.

Wernher Verbraeken
General Manager
Paul Boers Manufacturing, Vineland Station, Ont.
Manufactures commercial production greenhouses and systems.

Demographics

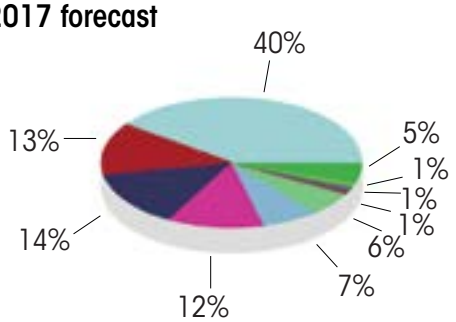
Location



Ownership

Most companies (88%) fall under the SME category. Eighty-two per cent are privately owned, 55% family owned and 45% are partnerships. Twenty-three per cent described their companies as subsidiaries of multi-national firms.

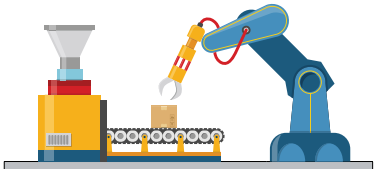
Revenue 2017 forecast



	2015	2016
Up to $5M	49%	44%
$5M-$9M	10%	12%
$10M-$24M	11%	14%
$25M-$49M	10%	10%
$50M-$99M	7%	7%
$100M-$249M	4%	4%
$250M-$499M	2%	2%
$500M-$749M	1%	1%
$750M-$999M	1%	2%
$1 Billion or more	4%	4%

Number of employees

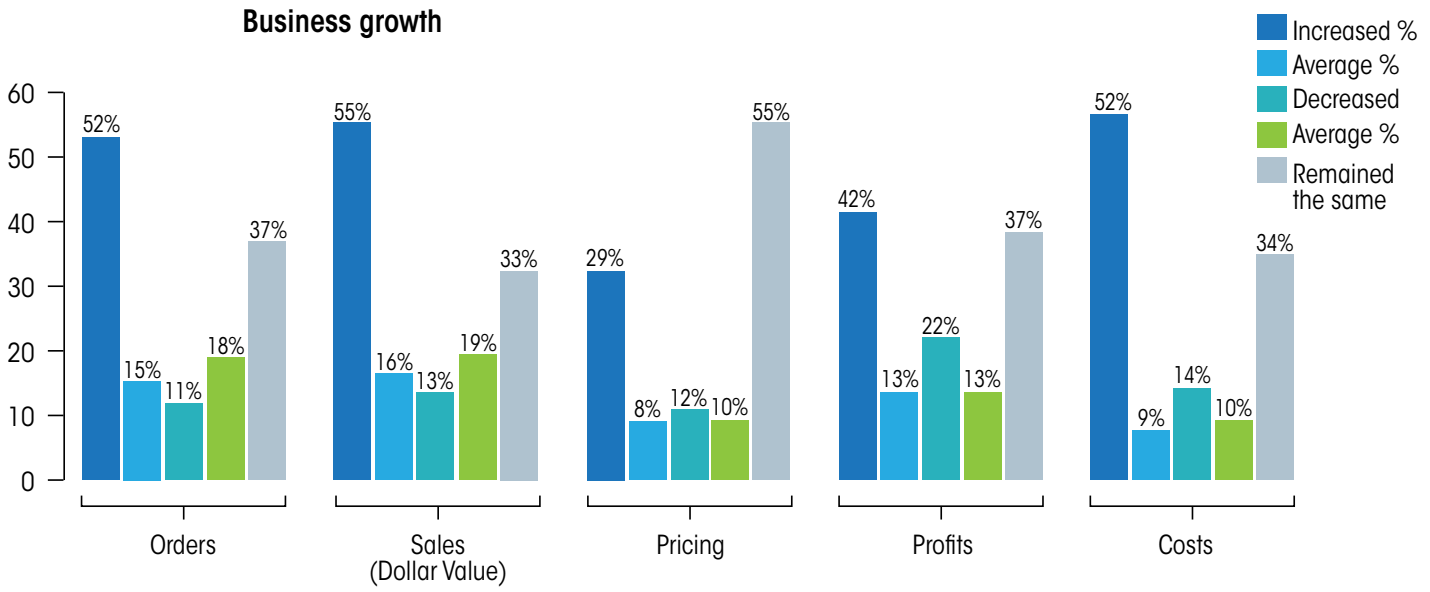
1-24	40%
25-49	12%
50-99	13%
100-199	14%
200-499	9%
500-999	3%
1,000 or more	10%



Industry sectors served

Industry	Per cent
Other manufacturing	25%
Miscellaneous manufacturing	16%
Electrical equipment, appliances and components	15%
Fabricated metal products	13%
Machinery	13%
Printing and related support activities	12%
Automotive products, parts, components, systems	11%
Plastics and rubber products	10%
Wood products	9%
Computer and electronic products	9%
Food and beverage	8%
Petroleum and coal products	7%
Chemicals	7%
Paper manufacturing	5%
Aerospace products, parts, components, systems	5%
Primary metal	4%
Other transportation, related equipment	4%
Textiles	3%
Ship and boat building	3%
Furniture and related products	3%
Durable goods industries	3%
Clothing	2%
Non-metallic mineral products	2%
Railroad rolling stock	1%
Non-durable goods industries	1%

Business Outlook



They're spread across Canada, more than half (52%) coming from Ontario's manufacturing heartland, 29% from the West, 15% from Quebec and 5% from Atlantic Canada.

How do they see the factors affecting business growth in the year ahead? More than half (52%) forecast orders increasing by an average of 15%, and 55% predict sales will be 16% higher. One third (33%) expect pricing to increase an average of 8% and 52% say costs will go up 9%.

Cautious optimism? Panellist Stewart Cramer thinks that's just about right – certainly for the markets he serves. He's the CEO of Vertex Precision Manufacturing in Vaughan, Ont., an integrated group that supplies machined parts to the aerospace, satellite and defence sectors.

He has noticed customers are having a tough time in the global market "and they're reacting in real time." He told roundtable participants that sometimes the ground shifts fast. "You finish a negotiation and you think you've got yourself locked in on a contract and then a new initiative comes out a month later and they're renegotiating the same contract. You're back to where you were, except you've already made concessions. And that's not something I had experienced before."

Greatest business challenges

- 50% Pressures on pricing
- 50% Controlling/reducing costs
- 48% Increasing sales/orders
- 45% Economic conditions
- 42% Value of the Canadian dollar
- 36% Improving productivity
- 35% Skills gaps, management/employees
- 33% Entering new markets
- 30% Gaining market share
- 30% Investing in new machinery, equipment, technology
- 26% Developing new products
- 23% Production capacity
- 22% Government regulations: red tape, associated costs
- 16% Environmental issues, regulations
- 9% Accessing credit/financing

Revenue by country

Canada	62%
United States	25%
China	3%
Western Europe	2%
Mexico	1%
Other Central and South America	1%
Central and Eastern Europe	1%
Australia/New Zealand	1%
Brazil	0%
Japan	0%
Korea	0%
India	0%
Other	3%

Entering new markets over the next three years

Canada	33%
United States	32%
Other Central and South America	15%
Mexico	14%
Western Europe	12%
China	9%
Central and Eastern Europe	9%
India	8%
Australia/New Zealand	8%
Brazil	7%
Japan	4%
Korea	4%
Other	20%

It seems companies in the US [were] just waiting to see what [would] happen in the election...

— Jim Menzies

Export services used

Export Development Canada (EDC)	18%
Business Development Bank (BDC)	11%
Services offered by private sector (banks, consulting firms, etc.)	11%
Industry Canada Trade Data Online	8%
Services offered by provincial governments	8%
Canadian Manufacturing & Exporter's Global Business Services	7%
The Canadian Trade Commissioner Service	6%
Canadian Commercial Corporation	4%
Forum for International Trade Training programs	2%
Not applicable/haven't used	63%

Skills gaps

- **33%** IT/cybersecurity
- **31%** Sales/marketing/ customer support
- **29%** Production/ production support
- **27%** General labour
- **21%** Engineering
- **19%** Management
- **13%** R&D
- **11%** Digital/social media
- **5%** Other
- **18%** Not applicable

Business Outlook

Change in export volumes

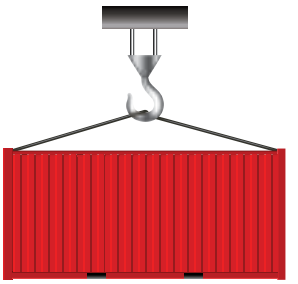
9% Significant increase

23% Increased somewhat

14% Decreased

20% No significant change

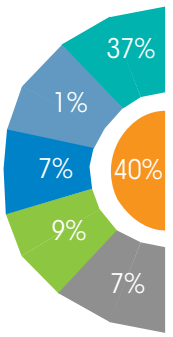
35% Not applicable



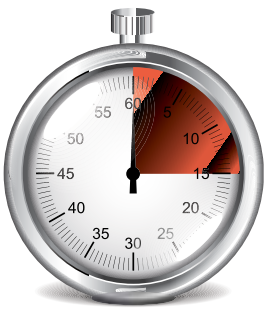
There's low-hanging fruit, you can hit a couple of them, but then you start having to climb up into the tree...

— Wernher Verbraeken

Years exporting



- Not exporting
- Less than a year
- 1-5 years
- 6-10 years
- 11-15 years
- More than 15 years



Yet opportunity beckons. Cramer described it as anticipating the customer's environment. "We understand where our customers are scaling back internal resources and our thinking is that we need to start providing those as services, in addition to providing parts."

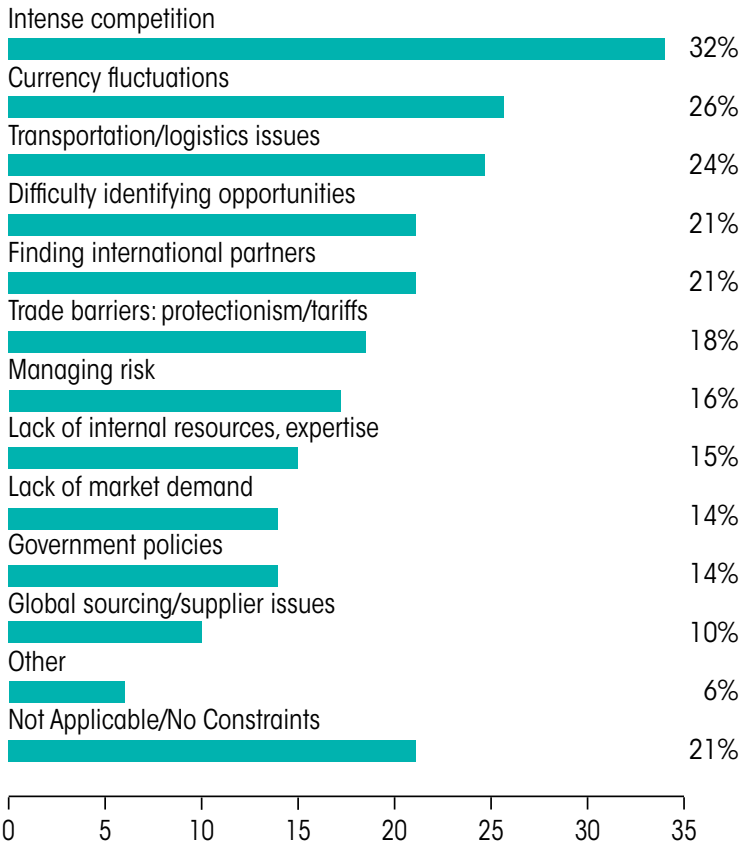
The pressure is high in the aerospace and automotive sectors, which spills over into the machine-building industry and the sub-suppliers, said Joris Myny, senior vice-president, digital factor – process industries and drives at Siemens Canada. The company is headquartered in Oakville, Ont., part of the German global industrial giant that develops and manufactures electrification, automation and digitalization technology.

Take Industry 4.0. He said the OEMs can't afford to design, manufacture and test a product on the plant floor. They have to do it in a virtual world, creating a digital twin and mapping out how they will manufacture it so they can anticipate problems before production.

"When you design an airplane, sometimes these companies rely on up to 80 sub-suppliers," Myny said. "…That pressure of creating a digital twin is now on the sub-suppliers. And that's where some of them are struggling. You get these new demands from your customer, which require an investment, and very knowledgeable, competent resources that may not be there."

Economic factors also have some bearing on everyone's expectations for the coming year. Nathan Janzen, a senior economist with RBC

Constraints to increasing revenue outside North America



The plant I saw in China that made pistons was at least 10 times the size of the biggest plant I've seen in North America...

— David McPhail

Economics Research in Toronto, provided the macro view.

"Last year at this time there was probably a lot of optimism about the manufacturing sector. Oil prices were down, the Canadian dollar was significantly weaker. Everybody was expecting stronger US growth. Historically, that's been the kind of environment in which Canada's manufacturers have done well."

But the numbers tell a different story. Manufacturing output only rose about 0.03% in 2015 and the first half of this year; "about a percent above the comparable period a year ago, but not really emerging as a growth leader in Canada," Janzen said.

Drilling down, the oil price shock and the pullback in investment hit manufacturers serving the energy sector. Meanwhile, business investment in fabrication and manufacturing has underperformed, as it has in the US in energy, manufacturing and mining. Currency fluctuations aren't helping either.

"The US dollar appreciated about 12% on a trade-weighted basis in 2015. I believe that was the largest appreciation since 1984 so that had a big impact on US external demand for US products, which flows into US business investment but also directly into exports. We tend to ignore the impact of US exports on Canadian exports. But that's forgetting we're in a world with trade integration that has occurred over the last 20, 30 years. A lot of the stuff we ship to the US is intermediate imports that get incorporated into either US

business investment or exports."

So a higher US dollar and a Canadian dollar down about 20% looks good for a Canadian company versus a US company; except the loonie is up about 15% relative to the Mexican peso, up against the euro, and up significantly against the pound (thanks to Brexit).

The good news is the US dollar isn't appreciating as much as it was. "We're starting to see more demand for US products from the external side. We suspect that as long as that drag from the external sector continues to ease, you will see more business investment in the US," Janzen said.

Domestically, the downturn in the oil and gas sector looks like it has bottomed out. Prices haven't moved high enough to lead to a big rebound, but "at least the worst might be over," he said, noting business investment has been growing at a "modest" rate.

Interest rates will remain low for some time, and Janzen paraphrased Bank of Canada governor Stephen Poloz's message to business that going forward, the cost of capital will be lower than in the past.

In terms of trade, Janzen reminded panellists China (population 1.5 billion with a burgeoning middle class) is where the growth will be, highlighting its shift away from growth driven by export business investment to more of a consumer-oriented path as an importer of final products.

As in past roundtables, concern was expressed about China, the security of intellectual property and the potential threat coming from such a manufacturing juggernaut should it enter into a free trade agreement with Canada. But Ryan L'Abbe is more concerned about protecting his company's unique technology.

We believe people will not pay additional money for an environmental benefit, and if anybody tells you otherwise...

— Ryan L'Abbe

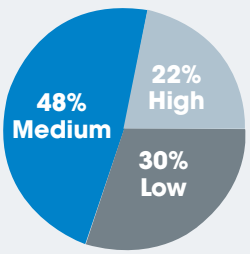
Cybersecurity

Building a defence

Even small companies are subject to attacks

By Matt Powell, Associate Editor

Cyber risks: Level of concern



Canadian manufacturers appear to be disconnected from the very real threat of a cyber attack.

"In many ways, companies are woefully unprepared to handle a cybersecurity incident," says Sandy Boucher, Grant Thornton LLP's senior manager in the fraud and corruption investigations division. "Much of that unpreparedness is related to management awareness and a lack of understanding about the relevant impacts on their businesses."

The **PLANT** Manufacturers' Outlook survey shows half the 526 respondents rate their concern at a "medium" level. Fifty per cent say they're prepared for a threat, but only 27% have developed a formal cybersecurity strategy, and 17% have not taken any steps to defend a potential cyber attack.

"[Cybersecurity] hasn't been top of mind for smaller businesses because they don't think they're a point of attack," says Robert Scott, national advisory service line leader at Grant Thornton. "But they're increasingly becoming targets because larger companies are doing a better job of protecting themselves. Smaller companies may not be the main target, but they're an entry point to the bigger target."

Canada's digital marketplace is now valued at 3.6% of the country's $1.84 trillion GDP, so the importance of being prepared for a cyber threat cannot be overstated.

The Canadian Chamber of Commerce says small and medium-sized companies make up 99.7% of the economy. They have fewer resources, making them attractive targets. In fact, StaySafeOnline.org research reveals small businesses are victims to 71% of all data breaches.

And the Chamber of Commerce notes cyber crimes cost businesses

0.17% of GDP, or $3.12 billion per year, as a result of fraud, lost business and damaged reputation, as well as stolen intellectual property and innovations.

Case in point: Target suffered a massive data breach in 2013 when more than 40 million customer credit card numbers were stolen. The perpetrators were able to access the big-box retailer's point-of-sale network by penetrating the network of an HVAC vendor. The breach ended up costing the retailer more than $110 million in settlement costs to banks and credit card suppliers.

And a 2015 malware attack on Home Depot's point-of-sale system exposed the credit card information of 56 million customers. Costs of the breach were in the $3 billion range.

In the past, cybersecurity has focused on building a defence, but the growing sophistication of attacks forced companies to evolve to an "I have to assume I'm going to be attacked" approach, Scott says.

"You must understand how to respond to the attack because there are tangible results that can occur from these breaches, including loss of revenue."

As cyber attacks become more sophisticated, having a formal strategy helps protect your company but also provides a competitive advantage.

"Manufacturers should be anticipating that customers and suppliers are going to expect cyber readiness. They'll be able to gain market share by showing customers they're prepared for cyber threats," says Scott.

It's best to take a four-pronged approach to cybersecurity:

Prepare: What don't we understand about existing vulnerabilities? What does our information security strategy look like? Does the organization meet obligations for information assurance? What should we be asking third party organizations when considering a partnership? How do existing third party service providers affect our vulnerability to cyber attacks?

Protect: What should our cyber governance and controls look like? How do we identify and repair system vulnerabilities? Can we improve the security of information we store in the cloud? How can we design processes to minimize security risks?

Small companies are becoming more attractive targets for cyber crooks.

Prepared for cybersecurity risks

	Very prepared	Preparation underway	Not prepared
Data breach or loss of proprietary data	53%	33%	14%
Data encryption or ransom of operational/control, financial information, management or communications systems	51%	29%	20%
Phishing attack	54%	27%	18%
Breach through a third party vendor	43%	33%	24%
Targeted external cyber attack	44%	29%	26%

Cyber protection measures

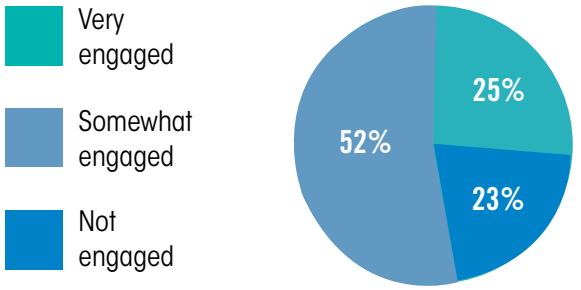
React: Can existing systems adapt to meet new regulations for security and privacy of data? Do we have a response protocol if a cyber attack occurs? What options do we have if our system is breached or our data is encrypted? What are our options if a third party breach exposes customer data? Can our system recover from internet worms, malware or Trojans that take over employee computers?

Change: How do we raise awareness of cyber risks throughout the organization? Can we show management a return on investment from cybersecurity measures? How do we instil cyber-secure awareness within our culture?

It's likely your business will be subject to an attack. No company is too small. Prepare to deal with the fallout. Doing so might even put you ahead of your competition.

Environment

How engaged are you in reducing carbon footprint?



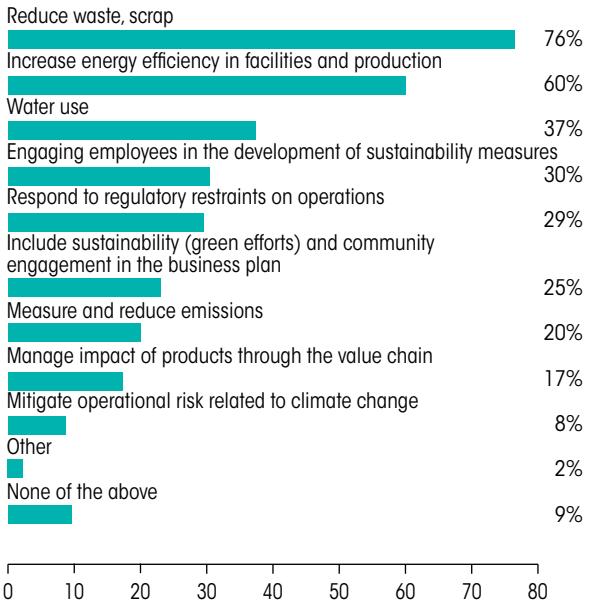
Have government moves raised the priority level?

21% Yes **51%** No **27%** Not Applicable

Are carbon reduction measures part of your company's business strategy?

17% Yes **18%** Working on it **20%** Applying informally **46%** No

Priorities for managing environmental impact



He's the vice-president of GreenMantra Technologies in Brantford, Ont., which converts waste plastics into high-value, specialty chemicals such as waxes, greases and lubricants.

"I'm more fearful of China taking our technology and replicating it and eliminating the advantage of intellectual capital that we're trying to develop here in North America," he said. "We're trying to take steps to make sure that pieces of our puzzle are not shared in one location, that they're not available openly anywhere, and to ensure that they stay within our walls."

David McPhail, president and CEO of MEMEX Inc., a Burlington, Ont. developer of factory floor data communications and efficiency systems, visited China in 2014. He saw ultra-modern, automated facilities, some of the most automated he has seen over 28 years in the industrial automation space. Yet despite the market's massive size, he has opted not to take the MEMEX product to China, fearing it would be sold back to the North American market at a fraction of the real price.

Siemens faces the same challenges, Myny said. "But our answer is short innovation cycles. You update fast, make sure that your product constantly innovates, constantly changes, so the copiers can't keep up."

GreenMantra is relying less on patents and more on a trade secret strategy.

"The patent logic is, provide widespread knowledge of your technology and [the courts] will protect you. But in China, I don't get a feeling that that's an accepted principle. I've heard many stories of people launching products and within two weeks [Chinese competitors] tear down, replicate and issue to market, products that are coming from North America. There will be elements of our technology we'll patent protect and there will be key components of the puzzle we'll simply make a trade secret and not show how they're constructed or how they're compiled."

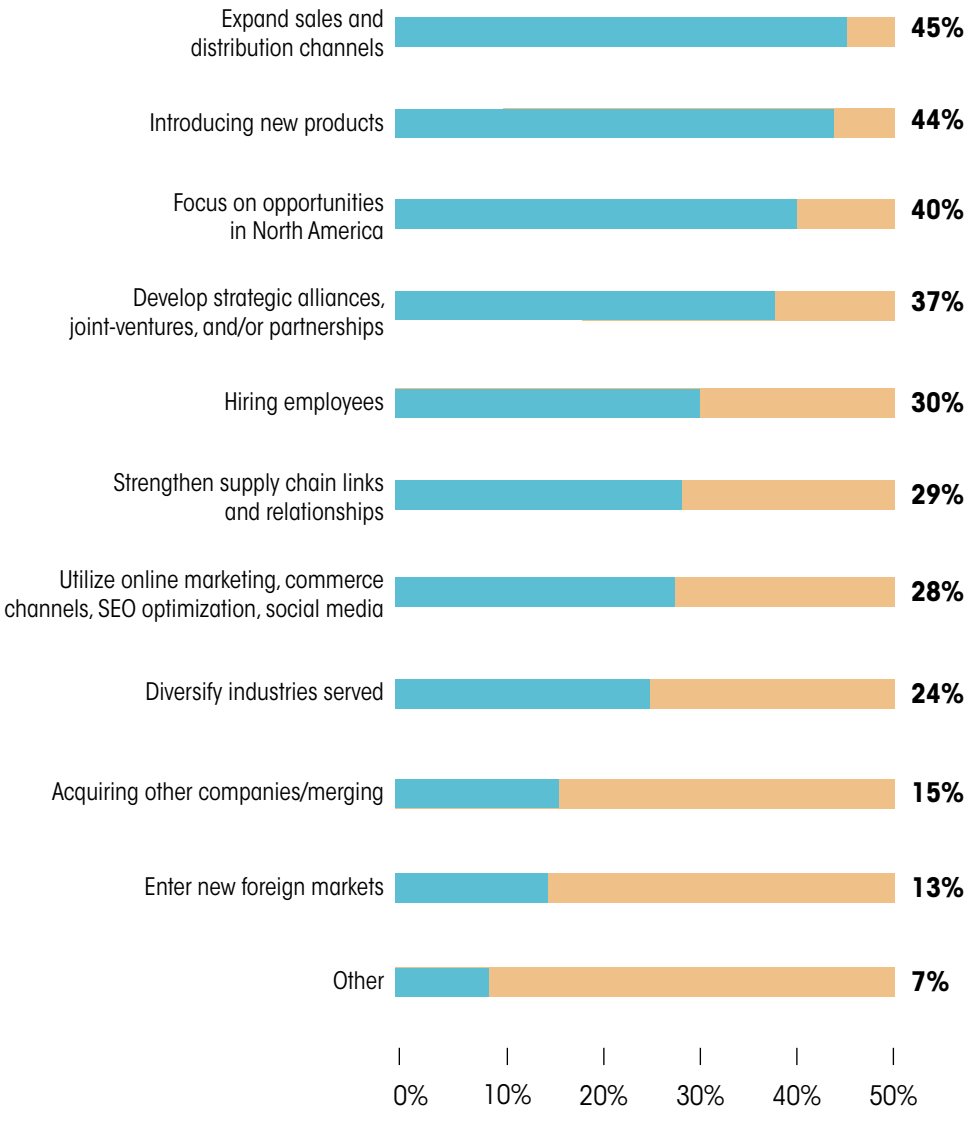
China's enthusiasm for a free trade deal with Canada is a concern for panellists who shared their observations and experience. McPhail warned that if such a massive infrastructure, primarily for domestic consumption, ever turned to non-tariff export, there would be trouble here. He said Chinese manufacturers could easily satisfy the market.

"I've been to camshaft and piston plants in North America. The piston plant I saw in China was at least 10 times the biggest plant I've seen in North America."

Cramer recounted how a former company he was involved with that did business with General Electric for 15 years lost that

Strategy

Growth strategy over the next three years



Strategy linked to budget

28%

Key strategic projects and major capital items to support strategy are included in the budget

10%

Department, cross-department, and key strategic projects are included in department budgets.

34%

Budget development is integrated with the strategy planning process.

28%

Changes to the plan trigger revisions to the organization and department budgets, as required.

Strategy development and planning

28%

Annual plans are developed within the organization and selected departments using existing company data

11%

A formal process is in place to develop plans using various measurement tools and performance analysis.

9%

Plans are developed to implement the strategies using a formal process of strategic planning tools, third-party data and assessments

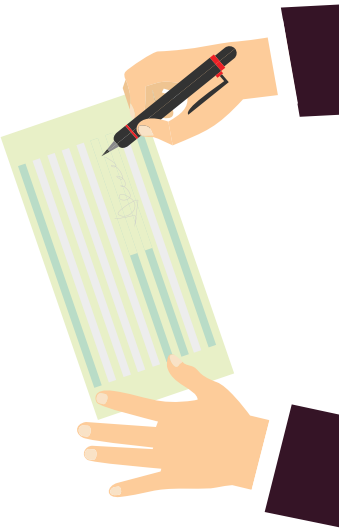
52%

Plans are both developed and refined throughout the year, as needed

Strategy

Financing methods over the next three years

42% Internally-generated cash flow (retained earnings)
28% Bank financing
23% Private investors
18% Government programs
17% Private equity
10% Leasing
9% Asset based financing
6% BDC
3% Public offering
3% EDC
0% Subordinated/mezzanine debt
5% Other
16% Not applicable/don't know



We suspect that as long as that drag from the external sector continues to ease, you will see more business investment in the US...
— Nathan Janzen

business to a Chinese company selling finished parts for less than his raw material costs.

"When our customer came back and showed us what they were paying, and said, 'Match this,' we showed them our raw material spending for the same parts and said, 'Good luck. We can't touch it.' We didn't get the work back."

Angelo Esposito agreed free trade would be dangerous. The vice-president of operations at Ontario Drive and Gear in New Hamburg, Ont. – a manufacturer of gears and transmissions, as well as the ARGO amphibious vehicle – had a similar experience. Yet on the other side of that problem, a couple of current customers were buying Chinese product, but because of quality issues, they couldn't sustain their supply. "We identified what the problem was, and gave them the solution and parts and everything else to get them going again. Quality is an issue, but it's only going to be for a short time until [Chinese manufacturers] figure out what their issues are."

Growth strategies

The Outlook survey results show manufacturers' top five growth strategies are expanding sales and distribution channels (identified by 45%); introducing new products (44%); focusing on opportunities in North America (40%) while only 13% intend to enter foreign markets; develop strategic alliances, joint ventures and partnerships (37%); and hiring employees (30%).

Most companies (42%) intend to finance growth through internally generated cash flow, followed by bank financing (28%) and private investors (23%).

When linking strategy deployment to the budgeting process, 34% said budget development is integrated with the strategy planning process; 28% said key strategic projects and major capital items are included in the budget; 28% said changes to the plan trigger revisions as required; and 10% said department, cross-department and key strategic projects are included in department budgets.

Senior executives were also asked to indicate what best describes how they develop strategy and planning. Fifty-two per cent said their plans are developed and refined through the year as needed; 28% develop plans within the organization and selected departments using company data; 11% have a formal process in place to develop plans using various measurement tools and performance analysis;

and 9% said a formal process of strategic planning tools and third-party data assessments are used.

Hacking into government or company networks to steal confidential information or create havoc has become a growing concern leading to greater emphasis on the need for cybersecurity measures. Most companies (48%) see risk to be at a medium level, 22% list it as high and 30% identify it as a low risk.

Nonetheless, most are readying themselves for trouble. Eighty-six per cent are prepared or preparing for data breaches and loss of proprietary data; 80% for data encryption or ransom attacks; 81% for phishing attacks; 76% for a breach through a third party vendor; and 73% for targeted external cyber attacks. Most (60%) have established a security infrastructure and data controls (51%), but only 27% have a cybersecurity strategy.

One of the factors driving cybersecurity measures for several panellists has come from customers.

"We've had some pretty stringent flowdowns from our customers, and had to get approvals on cybersecurity policies," said Cramer. "We have started putting in basic controls, encryptions, requiring people to change passwords a bit more in terms of procedure, and we're looking at ways to enforce those procedures. But that's about as far as we've gone. We don't think anybody's eagerly looking to break into our network, but we don't think it's an option to ignore cybersecurity, either."

Manufacturers continue to derive most of their revenue from North America. Breaking

Getting the skilled people, acquiring the skills, right down to the mismatch geographically and getting the right people at the right moment are all at the top of the chart...

— Al Diggins

it down, 62% comes from Canada, 25% from the US, 3% from China, 2% from Western Europe, and less than that from all other markets. Looking ahead three years, North America is still the preferred region for market expansion (32% to the US and 33% to new markets in Canada), followed by other Central and South America (14%), and Mexico (13%), Western Europe (12%) and China (9%).

What's holding them back from expanding their exports beyond North America? Intense competition (32%), currency fluctuations (26%), transportation and logistics issues (24%) and difficulty identifying opportunities (21%).

Companies are investing in their businesses. Priorities are training (60%), machinery and equipment (55%), R&D (37%) and productivity projects (33%). But most (66%) don't know how much they will invest in machinery, equipment and technology over the next three years. Of those who do, 14% will come in under $100,000 while 10% will invest up to $499,999 and 10% will spend $500,000 or more.

There is much uncertainty about spending on expanding, upgrading or building new facilities for 72% of respondents, compared to 11% who intend to spend up to $100,000.

Top reasons for not investing in assets or facilities? They have recently completed significant investments (27%) and weak market demand (25%).

Challenges ahead

Pricing and controlling costs are identified by 50% of manufacturers as the top challenges over the next three years, followed closely by increasing sales (48%), economic conditions (45%), value of the loonie (42%), improving productivity (36%)

We decided that it takes five years to grow a machinist, so we better get started...

— Stewart Cramer

Innovation

SR&ED headache relief

Programs that will boost your R&D activities

By Matt Powell, Associate Editor

The Scientific Research and Experimental Development (SR&ED) tax incentive program is designed to encourage manufacturers to develop new technologies and bring them to market.

But the program's cumbersome application and documentation requirements have confused and frustrated manufacturers looking to offset massive upfront R&D costs. Many manufacturers aren't convinced the program is doing enough for them, which is impacting their willingness to invest in the development of new products and processes.

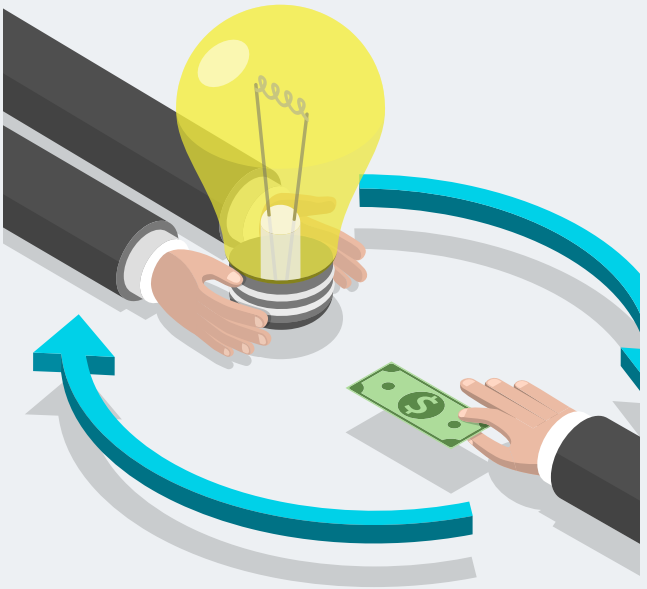
"There's a lack of consistency in the application of the CRA's tax legislation during site visits, and manufacturers are seeing a discrepancy between the definitions of technological uncertainty and technological advancements and the link to business R&D," says Martha Oner, national leader on R&D and government incentives at Grant Thornton LLP.

Given the federal government's focus on boosting innovation in its 2016 budget and the breadth of programs available, it would be wise to consider funding outside of SR&ED if it's causing too many headaches.

Here's a look at a few programs available to manufacturers:

Automotive Innovation Fund. It provides $500 million to support an automotive firm's strategic, large-scale automotive R&D projects aimed at building innovative, greener, more fuel-efficient vehicles.

It's a good program for companies considering robotics and



Investing in innovation over five years

334 replies

48%	Increase	**3%**	Decrease	**49%**	Remain at the same level

advanced IT systems to improve their processes, but not for smaller businesses. Proposals involve private sector investments of $75 million over five years.

Canadian International Innovation Program (CIIP). It supports collaborative industrial R&D projects with potential for commercialization between Canada and partner countries. The program accesses support and funding; accesses intelligence on technology and markets; accesses new markets through technology partnering; leverages investment to reduce risk for R&D projects that support commercialization of Canadian technology; and reduces market entry risk plus costs associated with technology adaptation, co-development and validation.

Consider this program if you can source knowledge from abroad to address technical gaps. Avoid it if you're going beyond Israel, Brazil, India, China or South Korea.

CanExport. It provides up to $50 million over five years in direct financial support to SMEs looking to export in high-growth, priority markets and sectors.

The program covers: travel costs for up to two employees; the cost of registration for conferences or a trade fairs for two employees; translation/interpretation costs; and legal fees pertaining to incremental activities targeting the export of products and/or services.

Use this program if you're going to a tradeshow, but don't apply if

Continued on page 23

and skills gaps among employees and management (35%). The greatest skills gaps are IT/cyber security (33%), sales/marketing/customer support (31%), production/production support (29%) and general labour (27%).

Although skills issues didn't head the list of challenges, they were top of mind for members of the roundtable panel who are missing qualified employees in specific areas but are dealing with these challenges in a variety of ways.

Skills are certainly a concern for those participating in the Excellence in Manufacturing Consortium's (EMC's) Manufacturing GPS initiative, a searchable system that provides in-depth labour market data to manufacturers.

"Getting the skilled people, acquiring the skills, right down to the mismatch geographically, and getting the right people at the right moment are all at the top of the chart," said Al Diggins, the president and general manager of EMC, based in Owen Sound, Ont. The not-for-profit organization helps manufacturers compete globally by providing a range of educational opportunities, services and training programs.

Greenhouses require specific skills on the manufacturing end but Wernher Verbraeken identified sales as an area of particular concern. He's the general manager of Paul Boers Manufacturing in Vineland Station, Ont., a manufacturer of commercial production greenhouses and systems. "[Commercial greenhouses] is a unique market – and there's a tremendous amount training that's involved as well and knowledge of product."

Ontario Drive and Gear, GreenMantra and Siemens have had some difficulty finding the right people for the right job, but the panellists shared some solutions to the problem.

"We have a number of operations in Canada and in the end we decided to start our own academy – the Siemens Canada Engineering and Technology Academy," said Myny. "We select students going into their third and fourth year of college or university and add on a training program."

After the students graduate, they're offered positions at Siemens in manufacturing or R&D.

"We see that these very talented people are approached by US-based companies and are made attractive offers before they graduate. So we approach them early, at the end of the second year, to make a connection and to build up their skills," Myny said.

Ontario Drive and Gear also draws from universities. "They come in and intern for a while. We have several who are working and studying at the same time," said Esposito.

Vertex is making contact earlier, going into high schools where they nurture interest in manufacturing and even have students on the plant floor.

"We donated old equipment to a high school in one of our communities (Fort Erie, Ont.), so kids were using equipment similar to what they would find on our floor and we're doing co-ops and internships," Cramer said. "We decided that it takes five years to grow a machinist, so we better get started."

Vertex also has college kids on the floor and Cramer described retention as "great."

EMC is bringing in students from the secondary and post-secondary levels for plant tours to get a sense of what manufacturing is about. "In Owen Sound, we had teachers take tours through the plants. We bring their awareness up because that's quite often where the problem is," said Diggins.

But the panellists acknowledged dealing with millennials (18 to 35 as of 2015) requires a different approach from how they would work with baby boomers and Generation Xers.

"I find that older generation, we've got a lot of lifers, loyal as anything," Verbraeken noted. "They come to work at 7:00 in the morning every day and leave at 4:00 and they run their machines, they're happy to do work and they're happy to get a paycheque. The next generation?" 'Well, what about flex hours? What about working from home?' How do you shift a company's operating principle from 9:00 to 5:00 to, 'Oh, can I come to work when I want to come to work?' "

Vertex loves millennials. "We've got great young workers who work very, very hard. But we have a different approach," Cramer said. "They need to know the 'why'. "

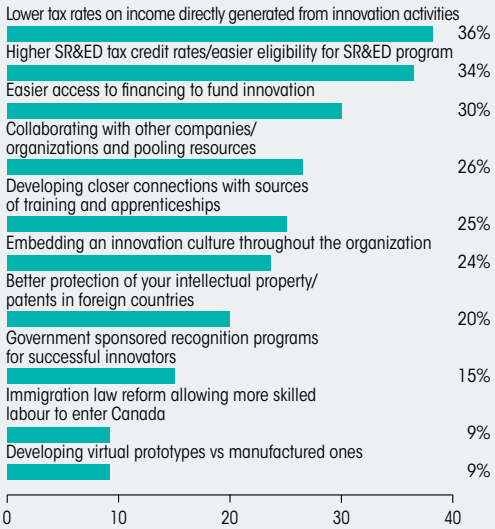
"We teach a lot and I do jungle walks and spend a lot of time on the floor lecturing. But I talk about our business and where we are going and I talk about our customers and what they're asking for and why we're doing the things we're doing. I find that if they understand why we need something, we don't get a lot of pressure for flex hours."

Vertex's plant floors are mostly computerized. Everybody has a tablet and they can run the floor, Cramer said. "We want them to make good decisions without us having to tell them, and so we need to give them enough information so that they can be creative in a way that you know, at least you bat for percentage."

One aspect of the millennial relationship is dealing with expectations.

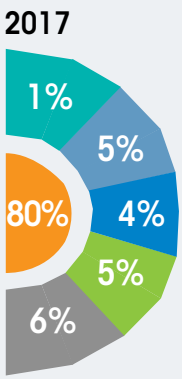
At GreenMantra, rather than say 'you're going to have a 30-year career', it's about building a career, L'Abbe said. "We give it to them in bite-sized, one-year pieces. Here's your first step, and

What executives say would make innovation easier

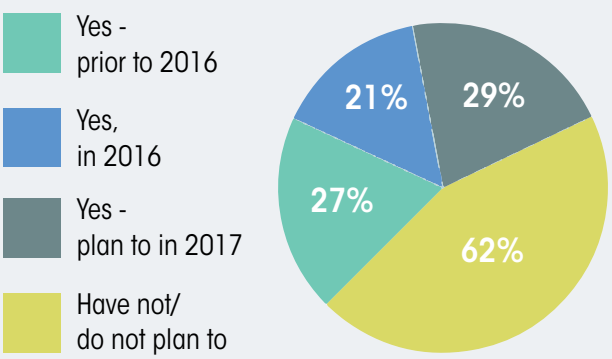


Percentage of revenue invested in innovation

	2015	2016
0%	1%	1%
1-3%	5%	6%
4-6%	5%	4%
7-10%	3%	4%
More than 10%	5%	6%
Don't know/not sure	80%	79%



Plan to use SR&ED tax credit



From page 21

your revenue is less than $200,000 or more than $50 million.

Energy Efficiency for Industry. It offers cost-shared assistance to industrial companies to implement energy management projects, including ISO 50001 Energy Management Systems Standard pilots; and process integration and computational fluid dynamics energy studies. Natural Resources Canada provides up to 50% of eligible costs to a maximum of $40,000.

Use this program if you're looking at implementing the ISO 50001 standard, but don't choose long duration projects – cost-shared financial assistance is available for projects completed by March 31, 2017.

Industrial Research Assistance Program (IRAP). It provides financial support to qualified SMEs to help with technology innovation. You have to show business and management capabilities and potential to achieve the expected results and outcomes; financial capabilities and a plan to commercialize the developed technologies; and technical aspects of the project and its potential impact on your company.

Apply to this program if your business has fewer than 500 employees. You can stack innovation programs by reducing costs with the funds you receive, but still claim SR&ED on your excess spend.

MITACS Accelerate Program. It solves research challenges with university expertise, matching funds, and one-to-one support. Internships start at four months and scale up as much as needed. Contributions start at $7,500 and are matched dollar for dollar.

The program requires on-site supervision to develop the student's business acumen by working in the "real world."

SDTC. There are different funds to support innovative cleantech projects through development and demonstration. Funding rounds are opened annually or bi-annually.

Eligible projects must displace an existing technology and deliver quantifiable reductions to GHG emissions; water, soil or air contaminants; and water consumption.

Use this program to go for the big dollars. SDTC funds 33% of eligible project costs, assuming your project is going to cost at least $750,000, and you must retain the rights to the IP.

No matter which market your company serves, there's innovation funding available, but you have to look beyond research costs and instead consider R&D spending over the next 12 months. A planned approach to innovation funding helps your business become more competitive, productive and will enhance your bottom line.

here's where you're going to go on your second step, and here's where you're going to go on your third step. There's a progression and growth that they can visualize and aspire to. "If you don't cut it up that way and then match training to get there, they lose interest."

Esposito emphasized the need for mentoring. Ontario Drive & Gear visualizes its operating system, showing how the business works. "We show things like foundations and foundational elements and how competition happens and how we can be efficient. We teach them all the steps and how it goes together.… We use the term, 'flawless execution' a lot, because we want these people to understand that everything we do has a consequence."

SYSPRO Canada has formed educational alliances with universities across Canada. "We introduced our software solution as part of their operations planning programs, so that people taking those programs would see the software being used in the Ops Training Program," said David Doyle, (now former) customer success director for SYSPRO Canada, an Outlook sponsor. The company provides ERP software and services to a variety of customers, including manufacturers. "We recruit out of those programs to fill our technical support positions. That's really our primary human resource intake area."

People are into the support team as a starting place, which gives them some manufacturing and operations education. Nationally, the company opens career paths laterally, vertically, and educational programs are in place, he said.

"If somebody's in tech support and they're really interested in being a programmer, or maybe they have an interest in sales, or maybe they want to move into some admin role, we can help them do that."

Improving productivity

Manufacturers find themselves in the fourth industrial revolution, or Industry 4.0, which describes the "smart factory." It's characterized by interoperability, virtualization, decentralization, real-time capability, service orientation and modularity. This draws in the promise of Industrial Internet of Things (IIoT) and Internet of Services (IoS) technologies, which can potentially accelerate productivity improvements, an area of chronic weakness in Canada.

Most companies (55%) have room to comfortably add production volume, 33% are at near or full capacity and 12% note they have excess capacity.

Most companies (87%) are providing or intend to provide

Investment

Investment over three years

Training	**60%**
Machinery, equipment, or technology	**55%**
Research and development	**37%**
Productivity projects	**33%**
More production capacity	**30%**
Upgraded, new plant facilities	**29%**
Business intelligence, data analysis software systems	**25%**
Sustainability, reduce carbon footprint	**13%**
No investments planned	**11%**

We use the term, 'flawless execution' a lot, because we want these people to understand that everything we do has a consequence...

— Angelo Esposito

Investment in expansion, upgrades or new facilities

365 replies	2015	2016	Forecast 2017
Up to $99,999	14%	13%	11%
$100,000 to $499,999	4%	4%	7%
$500,000 or more	5%	8%	8%
Don't Know/Not sure	75%	73%	72%
None	2%	2%	2%

Investment in new machinery, equipment or technology

365 replies	2015	2016	Forecast 2017
Up to $99,999	14%	17%	14%
$100,000 to $499,999	9%	11%	10%
$500,000 or more	10%	10%	10%
Don't Know/Not sure	67%	62%	66%
None	0%	0%	0%

Reasons for not investing in assets or expansion

Recently completed significant investments	27%
Weak market demand	25%
Depreciation of the Canadian dollar	19%
Shortage of qualified staff	10%
Government policies	6%
Other	13%
Not applicable	33%

employee training over the next 12 months, and 60% have developed or intend to develop a productivity improvement strategy. Most are not planning to outsource production (69%), support roles (70%) or implement lean, Six Sigma and continuous improvement (55%).

Canada has a lead in productivity growth over the US in some sectors of the economy (such as natural resources), but in manufacturing the US has the advantage. Statistics Canada gives it an 18% edge over the typical Canadian worker. There are several possible reasons for the difference: lower capital intensity; an innovation gap; an under-developed technology sector; proportionately fewer scientists and R&D engineers, and more limited economy of scale. However, Canadian companies could improve their productivity by investing in technology, yet respondents have demonstrated over several versions of the Outlook study that most prefer old school methods.

Shop floor production equipment and operations data are mostly collected, analyzed and reviewed manually (42%), while 30% use automatic collection methods and 28% don't measure. Twenty-nine per cent have done or intend to connect the shop floor to the top floor over the next 12 months, and 61% have declared it's not part of their plan.

Of those who are applying advanced technologies to improve productivity, 46% are favouring CAD/CAE/CAM; data acquisition, information integration and/or control technologies (34%); and computerized processing, fabrication and assembly technologies (27%), but 32% are using none of the listed technologies, which include automated material handling, 3D printing and advanced robotics.

These findings frustrate McPhail, whose business is based on manufacturing excellence technology that works with the ERP system, measures production data in real time, and allows manufacturers to make more efficient and productive use of their machines.

Based on extensive experience with customers, he places the average internal return rate of capital at 300% with a four-month payback. Yet 95% of MEMEX's sales are outside Canada. "We still have three or four sales meetings with Canadian manufacturers while I have one in the US. We'll knock on the door, prove it, put them in touch with our customer base, step out of the way. And then we're into an implementation. I can't explain it."

He points out this curious outcome is aiding Canadian companies' competitors become more efficient. "Then they come back and compete against us, and work moves there."

From a small company's perspective, Verbraeken suggested this reluctance to automate measurement has a lot to do with fear of spending capital.

"Maybe a lot of Canadian companies are much more averse to risk than Americans. There's low-hanging fruit, you can hit a couple of them, but then you start having to climb up into the tree…Companies don't seem to like to part with their money without a guarantee that the thing is going to make something back that's tangible. Software is always a tough one."

But McPhail counters resistance with another compelling argument. By taking the financial piece from the ERP system and calculating the cost of poor performance in real time – income from operations contribution, asset by asset, hour-by-hour – you give managers another piece of information that everybody understands. Money.

"If you can corroborate the data on the factory floor with the cost that's in the ERP system and do it in real time, your management team on the factory floor can make much better decisions."

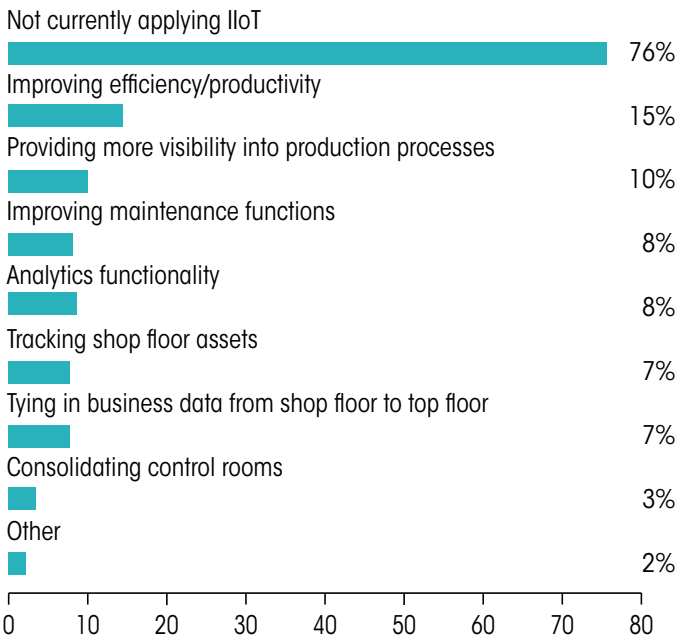
Smarter plant

Productivity presents a unique challenge for Vertex. Cramer explained the plant floor is more productive than it has ever been, but the cost structure is changing because of the increasing complexity of what the company's customers are asking it to provide.

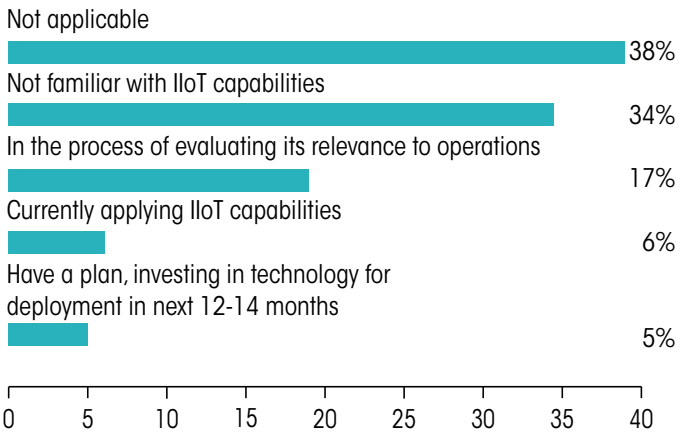
The engineering workload has increased compared to three

The IIoT wave

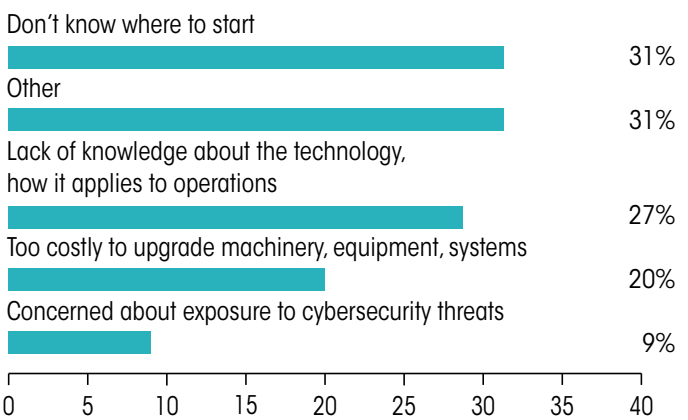
How IIoT is applied



IIoT engagement

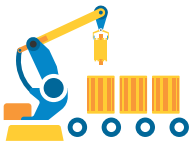


Obstacles to deployment



Advanced technologies used (*365 replies*)

CAD/CAE/CAM	46%
Data acquisition, information integration and/or control technologies	34%
Computerized processing, fabrication and assembly technologies	27%
Automated material handling technologies	16%
3D Printing/Rapid Prototyping	12%
Advanced robotics	10%
None of the above	32%

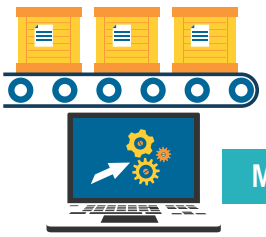


Capacity utilization

33% Nearly or full capacity (90%-100%)

55% Room to comfortably add production volume

12% Excess capacity



Measuring shop floor data

42% Measure manual data collection, analysis and review

30% Automatic data collection, analysis and review

28% Not currently measured

How productivity will be improved over next 12 months

	Have Taken	Plan to Take	Do not Plan
Developed a formal productivity improvement strategy	24%	36%	41%
Lean, Six Sigma, other CI measures	24%	21%	55%
Investing in technologies	32%	42%	26%
Automation	26%	28%	46%
Outsourcing manufacturing	19%	12%	69%
Outsourcing support roles	15%	15%	70%
Employee training	51%	36%	13%
Specialization of product offering	24%	24%	52%
Connect shop floor equipment to the top floor	17%	22%	61%

years ago when Vertex was not really involved in product development and the integrity of data packages. Now it's very much involved.

"We are routinely finding it necessary to check in detail new work packages and go back to our customers and say 'there are problems here, here and here' to avoid incredible time loss and waste," he explained.

Now the cost structure is tougher, while floor productivity is much better, but Vertex has more engineers and technical people on the payroll, all services Cramer's customers aren't paying for.

In terms of Industry 4.0, his plant is much smarter. The focus is on information flow. There is plenty of information available in the ERP systems of the companies Vertex acquired. Cramer observed that it's easy to put information in, but not as easy to get it out in a meaningful way. Rather than change ERP systems, tools were developed to leverage information seamlessly and in the same way wherever Vertex goes.

"We've pushed decision processes out onto the floor. So we don't have master schedulers anymore. The floor is self-scheduled and self-planned. We train

in how to make decisions based on good information, and we provide good information. It makes us much more nimble, which we need to be right now, and that's driven productivity up at our shop."

Doyle explained the ERP's role in the productivity equation: the first thing to remember is that an ERP system, when properly implemented, supports the transaction level processing requirements of the business. He described the system as great at collecting data, automating and streamlining transactional processes, but one piece that a lot of people leave off the table is, what to do with all those gigabytes of data. Manufacturers have to tell their ERP vendors what key business information needs to appear where, and how often it needs to be refreshed according to the business process, rules and the management framework.

"You can have the best infrastructure, you can buy the software, you can buy great machines, but the business culture is what enables the productivity," he said.

Questions about the Industrial Internet of Things (IIoT) were added to this year's survey because of its relationship to productivity and technology adoption. It represents the next wave of manufacturing innovation by connecting and optimizing industrial machines through the use of sensors, advanced analytics, business intelligence and decision-making.

Survey results reveal only 6% of those who responded to the question are engaged with IIoT while 17% are in the process of evaluating its relevance, but 38% said it wasn't applicable and 76% aren't applying it.

Of the 24% who said they were applying IIoT, most (15%) are doing so to improve efficiency and productivity, and 10% to provide more visibility into their production processes. The biggest obstacles to deploying IIoT are not knowing how to start (31%) or lacking knowledge about the technology and how it would apply to operations (27%).

Myny described how IIOT enables new opportunities, fitting in as one pillar of Industry 4.0, which will allow manufacturers to change the rules of the game.

For example, a manufacturer of gas or air compressors will sell them to customers in heavy industries with a service contract to ensure that the asset continues to operate. "What Internet of Things now allows companies to say is, 'Wait a second. We aren't going to sell the compressor. We're going to ask the customers to pay for the air they use.' "

But he said that would involve ensuring the compressor is always online and streams continuous information about usage, maintenance and other information into a cloud environment

that allows supplier and customer, anywhere in the world, to stay up-to-date.

Green engagement

There's growing emphasis on climate change and the reduction of emissions in developed economies, which in Canada is resulting in regulatory levers such as cap and trade and carbon pricing. The survey revealed most companies (77%) were very or somewhat engaged with reducing their carbon footprints. But 51% said government moves to reduce emissions have not raised the priority level of their response and 46% do not include carbon reduction measures in their formal business strategies. Seventeen per cent are doing so, 18% are working on it and 20% are applying measures informally.

The environment is not high on companies' priority lists. Verbraeken offered some perspective. "There's only so much a

company can set as priorities and initiatives, other than doing the basic stuff, things like recycling and energy conservation. We're putting in LED lighting shortly …but the approach from the company is still – before thinking about what benefits the environment – what benefits the company?"

Financial and health and safety benefits are higher priorities, but he expects that to change over time when the focus will shift to the bigger picture.

GreenMantra is all about the environment. It's saving carbon by converting waste plastics into high-value specialty chemicals such as waxes, lubricants and greases.

"We believe people will not pay additional money for an environmental benefit, and if anybody tells you otherwise, there's a long list of companies that have gone bankrupt based on that premise," said L'Abbe. "We're converting people to a better way of doing things with the hopes of saving them money."

GreenMantra has demonstrated that it knows its carbon offset from its process versus traditional processes. Companies who believe in that are adopting its products. "Those who are a little less reluctant to adopt it for an environmental advantage, are adopting it because we can show a cost savings. So we're justifying our existence by a better, lower cost alternative rather than necessarily a carbon offset."

"Recyclers or re-processors are always fighting against brand new, and trying to convert people to a better way with not a lot of bullets in the chamber. For us, it's understanding what we do, understanding what the offsets are," said L'Abbe, noting LEED certification on its products provides a measurable, justifiable benefit that helps get adoptions.

Investing in innovation

Manufacturers are unsure about innovation investment next year: 80% don't know how much of their revenue they'll put towards R&D projects, while 11% will invest 7% or more. There's an almost even split among the 334 respondents who looked ahead five years and intend to increase (48%) or invest the same amount (49%).

Jim Menzies, national manufacturing and distribution leader for Outlook sponsor Grant Thornton LLP, has noticed a number of the manufacturers the accounting, tax and advisory firm works with, particularly those selling into the US, have put innovation plans on hold.

"It seems companies in the US [were] just waiting to see what [would] happen in the election. As a result, some of the shorter and longer-term innovation initiatives have been put on hold by some Canadian manufacturers, as well. They believe that the election uncertainty merits a cautious approach to their investments in the US in general."

The federal SR&ED tax credit/refund for scientific research or experimental development would help with the funding of innovation activities, but it's not a significant incentive for manufacturers. Sixty-two per cent of respondents have not or do not plan to take advantage of SR&ED, and as it exists today, it has had no impact on innovation for 69% of companies. When asked what would make innovation easier, 36% said lower tax rates on income directly generated from innovation activities, 34% identified higher SR&ED tax credit rates and easier eligibility for the program and 30% are looking for easier access to financing for funding of innovation.

As of 2014, the federal government reduced the benefits available from the SR&ED tax credit and made the program more difficult to access. In fact, L'Abbe observed navigating the innovation funding network is very difficult, whether it's SDTC,

IRAP, SR&ED funding, BDC and EDC incentives, or other provincial and federal funding.

"I think there's a real need for different levels of government to integrate those services so that they're easier to access and innovators and start-up entrepreneurs can find the funding, then make the transition to a production operation," he said.

Rather than parsing support over different companies, Myny recommended bundling it around a manufacturing hub – a university or a cluster of universities that includes participation from government, the education sector and industry. Companies, especially small to mid-size, could test new technologies in a safe environment and have access to very qualified people who are tied into the university. "You can draw on all these people; they may look for jobs in the end. Building that connection while they're still at university is very valuable."

Working with universities has paid off for Vertex. Cramer said an investment of $5,000 with leverage from NSERC (the Natural Sciences and Engineering Council of Canada) and others translated into a $200,000 annual saving. "One project was eating us alive on throughput. The engineers came on our floor, they worked with our machinist, they took our process apart, they went back to the university. They re-engineered the entire process, came back and told us how to run the process better. We got an old piece of equipment off our floor, which we were thrilled with."

Canadian Manufacturers & Exporters (CME) recently released its Industrie 2030 initiative, which calls for manufacturers to double output and exports by 2030. Are manufacturers up to the task?

We have very, very bright minds in Canada, good universities, good colleges and we need to tap into these resources…

— Joris Myny

Myny sees this as a great opportunity. The emphasis 10 to 15 years ago was to shift manufacturing to low-cost labour countries. Today there is opportunity in mass customization that will move work back to Canada and the US. He noted innovation cycles are getting shorter, and as the Outlook study indicates, manufacturers are concerned about sales.

"But what is behind the sales? Are we comfortable that we are designing the products that our customers will buy in the future? We have very, very bright minds in Canada, good universities, good colleges and we need to tap into these resources. These are the people that can design, that can develop products that the world likes. If we continue to invest in that, and we ensure that once they graduate, they can find positions here, they'll do great things."

High manufacturing costs

Historically, Ontario has been Canada's manufacturing heartland, yet it's a high-cost place in which to manufacture.

Nonetheless, there are some very good reasons to invest in the province. Indeed, Siemens has invested a lot in Ontario and Myny cited its acquisition of Ruggedcom in Concord, Ont., as an example. The technology company makes sophisticated industrial communication products that allow substations in the power distribution network to exchange data in a highly secure way.

"We see young people, very bright minds, developing these products. And that is for us a critical business. We tap into these bright minds that come from universities and colleges here. That is the strength in Ontario. And it's education level, good work ethic and flexibility. I see that as an opportunity."

But high-energy costs are challenge for companies like GreenMantra, where, as a percentage, they're higher than labour. L'Abbe is concerned about the uncompetitive nature of the province's energy infrastructure, where he pegs pricing at almost double that of other jurisdictions.

"To be frank, that's driving some of our decision making to look outside Ontario to find our next foothold for expansion."

Ontario does offer incentives to invest in the province, which attracted GE to Welland, Ont. The global industrial company announced a $240 million plant that will manufacture power generation machinery, creating 220 jobs. GE cited the availability of a skilled workforce, proximity to the US and access the St. Lawrence Seaway as key selling points. But a $26.6 million conditional grant from the province and concessions on taxes and other industrial charges from the city and region didn't hurt either.

Jurisdictions are all competing for the big plants, said Verbraeken. "These companies will drop a factory anywhere they can that's most lucrative for them. And once that government subsidy box is opened…. It's unfortunate because it's not the small companies that receive these big subsidies, it's the big internationals."

McPhail believes for the province to be competitive, it will have to address the right-to-work issue. There are 26 right-to-work states in the US, which prohibit employers and unions from requiring employees to pay union fees if they don't want to be part of the collective bargaining unit. Michigan is right-to-work, just hours from Ontario's border.

"Look at all the companies that have been closed down in Ontario and moved to Indiana. Why? The total cost of ownership is a lot less because the cost of living is less, the cost of energy is less, the cost of labour is less, because they don't have the same collective bargaining restrictions that we have here."

And there's the Trump factor. Janzen highlighted in his economic update the political backlash against trade agreements, such as the near miss with CETA, and (now US president-elect) Donald Trump's antipathy to NAFTA plus the expected outright rejection of the TPP.

Should manufacturers be concerned?

Protectionism hasn't been a successful strategy, said Cramer, noting Brazil's economy has stalled, largely because it's hard to do business there.

"There's a lot of fear in the world and people react to it with protectionist rhetoric. But governments tend to understand a little better than that. And I can't imagine how you would put globalization back on the shelf. We've gone too far and we're too interdependent."

Keeping that in mind, and based on successive Outlook surveys, manufacturers will need to invest more in technology and innovation, improve their productivity, continue to diversify their markets, and think bigger as they forge ahead in a changing, unpredictable world.

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