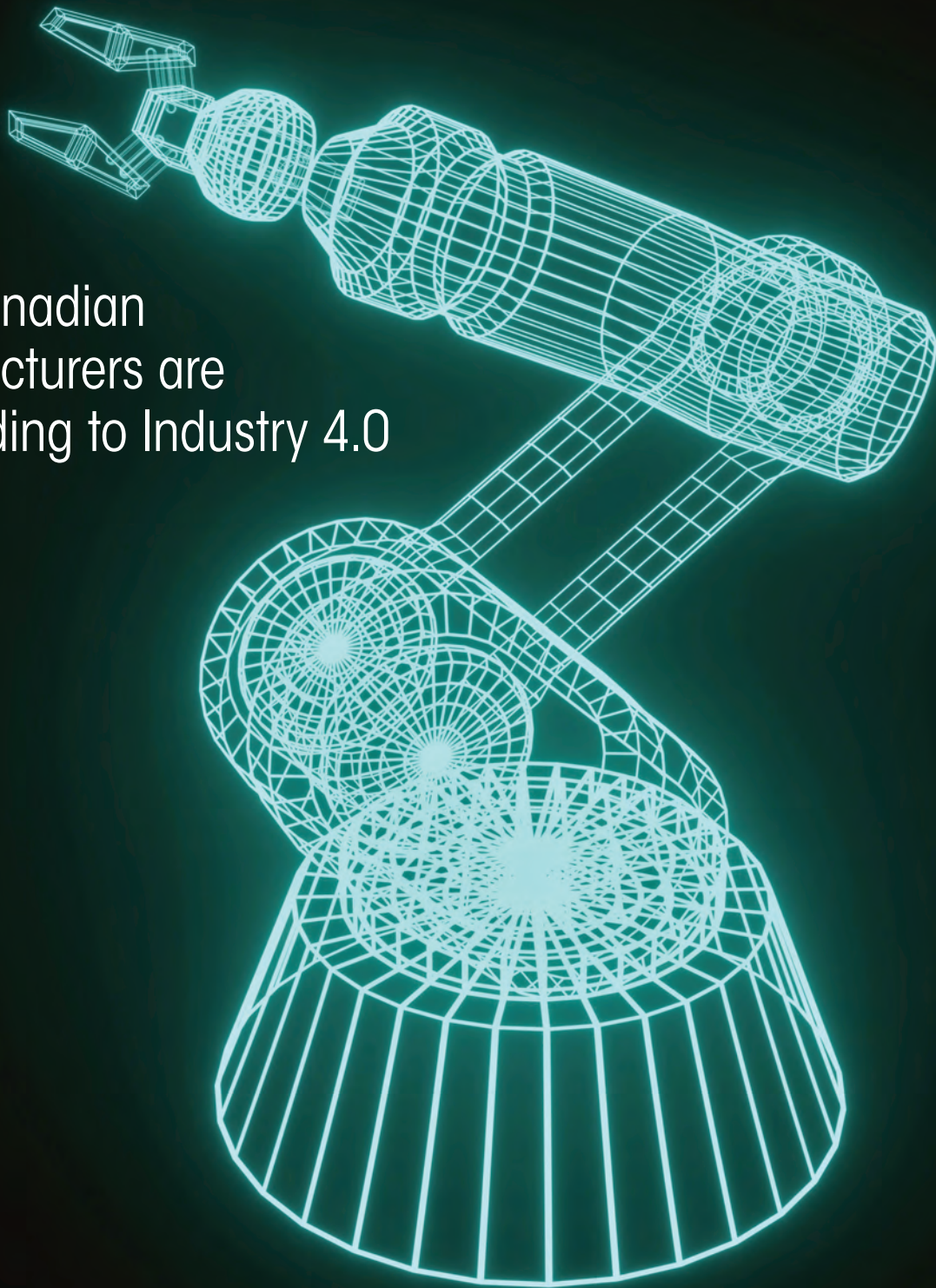


2020 ADVANCED **MANUFACTURING** REPORT

How Canadian
manufacturers are
responding to Industry 4.0



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MESSAGE FROM **BDO CANADA LLP**



Among the many valuable pieces of data in the 2020 Advanced Manufacturing Report from **PLANT**, one tidbit stands out: 64% of respondents say manufacturers with smaller operations have more to gain from Industry 4.0 than ever before.

This is welcome news. The first step to change is acknowledging the need to change. With so many manufacturers recognizing the benefits of advanced technologies for smaller manufacturers, we can establish a baseline of shared goals for our manufacturing community.

Even more encouraging is the makeup of the survey respondents who hold this view. Fifty-two per cent of the companies represented in the survey employ fewer than 50 people. As an indicator of the future for smaller Canadian manufacturers, we could not ask for better than this survey, of which BDO Canada is a proud sponsor.

Many of the small and medium-sized manufacturers we advise jump at the opportunity of advanced manufacturing. They realize Canadian manufacturers – no matter the scale of their operations – are competing with companies around the world. They can no longer benchmark their progress against domestic counterparts, which have traditionally lagged global competitors. This survey echoes our experience: 87% of respondents recognize emerging technologies allow companies to compete globally. And almost 80% see the Industrial Internet of Things (IIoT) as a business growth opportunity.

Companies also understand that today's "advanced" technologies – such as automation, IIoT and sophisticated uses of data – will one day become standard operating procedure.

Adopting Industry 4.0 is no simple matter. Canadian manufacturers express valid concerns about investing in advanced technologies. At the most basic level, upgrades cost companies money. This highlights a key barrier to investment for smaller manufacturers, which do not have the resources of larger companies.

This places Canadian small and medium-sized manufacturers in a bind: Industry 4.0 presents a unique opportunity. Yet how can they obtain it?

We advise manufacturers to treat Industry 4.0 like any other critical business investment. Think strategically. Fold it into the larger vision for your organization. Align its scope to your needs.

Adopting Industry 4.0 is a journey, not a one-time investment to generate quick returns. It's a plan that addresses how manufacturers can improve competitiveness for the future. It's a strategy that yields profitability and efficiency. At its heart, Industry 4.0 is a bet on a company's future success.

We look forward to continued success for Canada's manufacturers — enhanced by the promise of Industry 4.0.

Mike Gillespie

Partner, National Manufacturing Leader
BDO Canada LLP

EXECUTIVE SUMMARY

Manufacturers around the world are adopting Industry 4.0 technologies and are transforming their businesses. They're integrating digital technologies that optimize processes, making them more efficient and plant operations more productive.

But Canadian companies have not been quick to adopt advanced technologies, according to the 2020 Advanced Manufacturing survey of 251 owners and senior executives representing mostly small and medium-sized manufacturers.

Research firm RK Insights in Toronto conducted the survey through July and August for **PLANT** Magazine, in partnership with sponsor BDO Canada LLP, an accounting, tax and advisory firm. The margin of error is +/- 5%, 18 times out of 20.

Most of the companies are small: 52% have fewer than 50 employees and 47% of respondents hold a controlling or minority ownership, or have partners. More than half (52%) are based in Ontario, 28% in the West, 13% in Quebec and 6% in Atlantic Canada. Average annual revenue of all respondents is \$65.7 million, but 52% take in less than \$10 million.

Industry 4.0 focuses on automation, interconnectivity, machine learning and the analysis of real time data that involves the Industrial Internet of Things (IIoT), the Internet of Things (IoT), the cloud, advanced computing and artificial intelligence.

The survey looked at how manufacturers view these technologies and probed their level of adoption. The results reveal many see the value of advanced technologies but are wary of costs, return on investment and they continue to apply more traditional manufacturing methods. They're also concerned that people with the skills necessary to make the most of digital technologies and networks are in too short supply. Challenges include data being complicated and requiring special knowledge, increased cybersecurity risks, and the massive investment needed to replace machinery.

Most executives (87%) recognize emerging technologies allow companies to compete globally, while 79% see IIoT as a business growth opportunity and 64% say smaller operations have more to gain. Just 24% are currently applying IIoT while 36% are planning or evaluating, but 24% aren't familiar with the technology's capabilities and 15% stated IIoT is not applicable to their operations.

They see the top IIoT applications as: improving efficiency and productivity (33%); providing more visibility into production processes (23%); improving maintenance functions (22%); tracking materials and shop floor assets (20%); and pulling together business data from shop floor to top floor (20%). But 47% are not currently applying IIoT technology.

Most companies are using traditional means to compile

information. Seventy per cent use spreadsheets such as Excel for production and material planning, and 46% use accounting packages while 43% generate manual paperwork. Integrating ERP for the supply chain was cited by 35% of respondents and MRP by 26%. Only 14% are employing sensors to capture big data.

Executives cite the main benefits arising from technology upgrades as increased throughput (35%), reduced downtime (34%), better quality of product (33%), product innovation (21%) and reduced staff time (20%).

Challenges encountered while implementing technology strategies include resistance to change (51%), lack of skilled talent (48%), funding (46%) and integrating with legacy technology (36%).

Almost half (47%) of manufacturers are not planning to invest in technologies over the next three to five years. Those who do plan to invest will spend an average \$1.52 million during this period. Spending in 2019 focused on data capture (65%), cloud (56%), IIoT/machine-to-machine (50%), robotics and automation (48%) and digital transformation (37%).

Key to adopting advanced technologies is the management of change but just 2% described themselves as expert while 17% identified as experienced, and just 17% are applying a formal change management strategy to engage their employees. Most (62%) are training to upskill, 41% are hiring new talent and 23% are using external consultants.

Digital technologies pose cybersecurity risks and executives identified their level of concern as high (68%) and 32% are not concerned. Fifty-five per cent of companies have suffered a breach or attack, and 43% have not. Of those that have, most (44%) experienced phishing attacks.

There's a data governance policy covering cybersecurity concerns in place for 22% of companies (somewhat in place for 39%) while 40% have no policy.

Protection against an attack includes a security infrastructure (64%), data privacy controls (46%), a cybersecurity strategy (29%) and a risk assessment/review (27%). Crisis management procedures and/or a business continuity plan are in place for 22%. Seventeen per cent have no measures in place.

Sixty-five per cent of manufacturers identify falling behind the competition as the biggest threat arising from not investing in Industry 4.0 technologies but just 15% said they were very concerned for the future if businesses don't invest. Forty-two per cent were somewhat concerned while 42% were not.

Joe Terrett, Editor, **PLANT**



(Seated L-R) Darren Lawless, Lyall Watson, Steve Loftus, Walter Garrison, Robert Ciuffreda. (Back L-R): Braam Meij, Elizabeth Hall, Steve Bohner, Scott McNeil-Smith, Ed Manera, Paul Boucher, Peng-Sang Cau, Stewart Cramer, David Linton. Absent from photo: Donald Fang.

PANEL PHOTOS:
STEPHEN URHANEY

2020 Advanced Manufacturing Roundtable Panel

Steve Bohner

President

Hydra Dyne Tech

Ingersoll, Ont.

Manufactures custom hydraulic manifolds, cylinders and swivels.

Peng-Sang Cau

President & CEO

Transformix Engineering

Kingston, Ont.

Manufacturing automation company focused on its CNC assembly technology.

Stewart Cramer

Chief Manufacturing Officer

Next Generation Manufacturing

Canada (NGen)

Hamilton

A not-for-profit that matches manufacturers with new technologies to drive advanced manufacturing in Canada.

Donald Fang

Advisor

Beneco Packaging

Mississauga, Ont.

A manufacturer of customer packaging.

Walter Garrison

Advanced Manufacturing Business Integrator

City of Mississauga

Works with the city's aerospace, automotive, food and beverage, and clean technology sectors.

Darren Lawless

Dean, Applied Research and Innovation

Applied Research & Innovation

Humber Institute of Technology and

Advanced Learning

Toronto

Department supports collaboration, applied research and innovation at the college and in the community.

Steve Loftus

President

Innovative Automation

Barrie, Ont.

Provides custom automation solutions to a range of industries.

Ed Manera

General Manager

KUKA Robotics Canada Ltd.

Mississauga, Ont.

A supplier of advanced plant manufacturing and systems technology.

Scott McNeil-Smith

National Director – Projects and Partnerships

Excellence in Manufacturing Consortium

Owen Sound, Ont.

Non-profit manufacturing consortium that helps manufacturers become more competitive.

Braam Meij

Vice-President, Industrial Sales

Siemens Canada Ltd.

Oakville, Ont.

A multinational engineering and electronics company that develops and manufactures technology for industry.

Lyall Watson

Sales Manager

SEW-Eurodrive Co. of Canada Ltd.

Bramalea, Ont.

A manufacturer of gear motors and frequency inverters, servo drive systems, decentralized drive systems, and industrial gear units.

RESEARCH

Elizabeth Hall

Managing Director
Toronto

R.K. Insights

SPONSORS

BDO Canada LLP.

Mississauga, Ont.

A member of the global accounting firm, providing assurance, accounting, tax, and advisory services.

David Linton

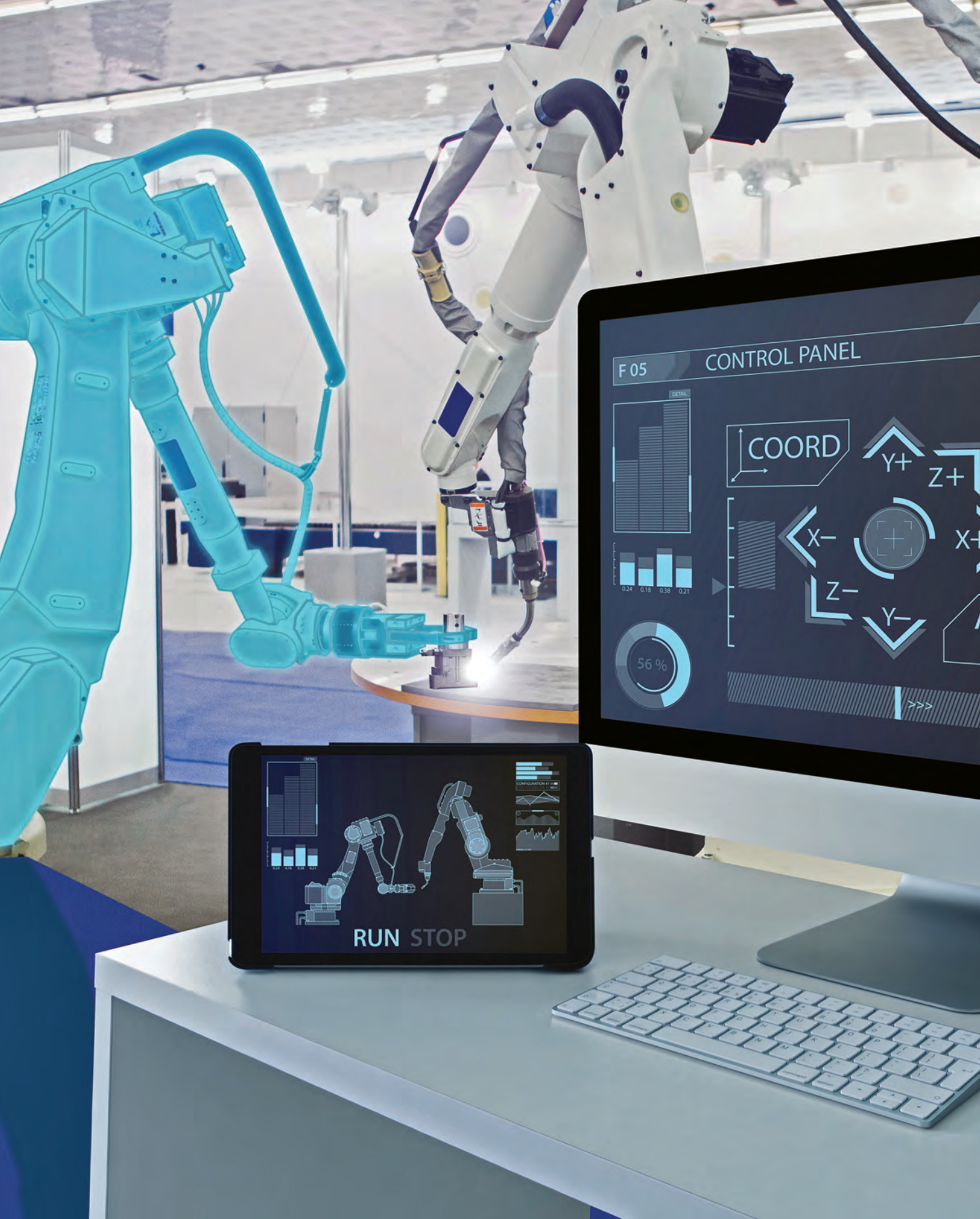
Partner, Consulting,
National Manufacturing
and Distribution Leader

Paul Boucher

Partner, SR&ED and
government incentives.

Robert Ciuffreda

Industry marketing
strategist



FACTORIES OF THE FUTURE

Filling the technology gap

By Joe Terrett, Editor, **PLANT** Magazine

SMEs see value in advanced manufacturing technology but have concerns.

Canadian manufacturers have faced ups, downs and a few hard turns during a year that has been punctuated by aluminum and steel tariffs, trade warring between the US and China, a slowing global economy and whispers of a coming recession. They're facing an uncertain business environment with heads down, eyes ahead, and doing so with confidence — although cautious — as they deal with rising costs and a seemingly endless need for skilled people with jobs begging to be filled.

Manufacturers around the world are dealing with similar conditions, and many are deploying digital technologies that optimize processes while making production more efficient and plant operations more productive.

But Canadian companies lag their international peers in machinery and equipment investment, adoption of digital technologies and capturing productivity gains. In April, Statistics Canada showed manufacturers expected to spend \$14 billion on

IMAGE: EVGENIY & KARINA GERASIMOV / SCHARFSINN86 - STOCK.ADOBE.COM

machinery and equipment (M&E) in 2019. However, Canadian Manufacturers & Exporters noted in its recent skills report M&E spending is down 4% from 2007, as investment by other OECD countries has risen significantly. Closer to home, US investment has grown 20% in the decade preceding 2016 while Canada's has declined 17%.

Conference Board of Canada research shows Canada's productivity growth also lags competing countries. Productivity increased 20% over the past 15 years (since 2002, the poorest record of the G7, except for Italy) while the US shows a 50% increase and some countries such as South Korea and Taiwan have more than doubled their gains.

It's against this backdrop that **PLANT** Magazine deployed its 2020 Advanced Manufacturing Survey, attracting responses from 251 senior executives and owners of manufacturing companies to gauge their engagement with Industry 4.0 technologies. RK Insights conducted the survey for **PLANT**, in partnership with sponsor BDO Canada LLP, an accounting, tax and advisory firm. The margin of error is +/- 5%, 18 times out of 20.

Seeing the value

Most of the companies are small with 52% having fewer than 50 employees. Forty-seven per cent of respondents have a controlling, partnership or a minority ownership. More than half (52%) of the companies are based in Ontario, 28% in the West, 13% in Quebec and 6% in Atlantic Canada. Average annual revenue of all the companies is \$65.7 million, but 52% average less than \$10 million.

The results reveal many of these manufacturers see the value of advanced technologies but are wary of costs and return on investment as they continue to apply more traditional

There's a lack of funding, a lack of human resources, but it's also indicative of Canadian culture and our lack of risk taking...

— Peng-Sang Cau



Industry 4.0 represents the catalyst and the barrier. Manufacturers can overcome some of that with the right training in place, using the technology with their existing workforce...

— Scott McNeil-Smith

production methods. They're also concerned that people with the skills necessary to make the most of digital technologies and networks are in too short supply.

The survey asked how executives rate certain statements about technology, and most (87%) recognize emerging technologies allow companies to compete globally, while 79% see the Industrial Internet of Things (IIoT) as a business growth opportunity and 64% say smaller operations have more to gain. Many also agreed there are challenges, such as data being complicated and requiring special knowledge, increased cybersecurity risks, and the investment needed to replace machinery.

Asked how concerned they are for the future if businesses don't invest in Industry 4.0 technologies, only 15% said "very," 42% said "somewhat" but 42% were not concerned. Yet 65% identified falling behind the competition as the biggest threat arising from not making the investment.

Nonetheless, 47% of the companies are not planning to invest in technologies over the next three to five years. Those who plan to invest will spend an average \$1.52 million over this period. Spending this year focused on data capture (65%), cloud (56%), IIoT/machine-to-machine (50%), robotics and automation (48%), and digital transformation (37%).

WHY TECHNOLOGY ADOPTION LAGS

The survey drew 13 participants representing manufacturing stakeholders to an Industry 4.0 roundtable held at **PLANT**'s offices in Toronto Oct. 2. They offered valuable insights into the

LOCATION



Yukon / NWT /
Nunavut
3%



British
Columbia
14%



Alberta
10%



Saskatchewan
2%



Manitoba
2%



Ontario
52%



Quebec
13%



New Brunswick
2%



Nova Scotia
2%



Newfoundland
& Labrador
1%



PEI **1%**



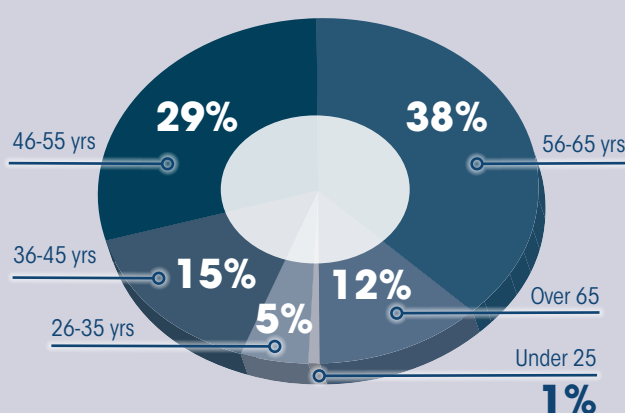
OWNERSHIP

Most of the respondents (87% male/13% female) are senior executives or managers who described their roles as owner/partners (38%) at manufacturing companies across a range of industries that are predominately small to medium-size (82%). Most (52%) have fewer than 50 employees. Average company revenue is \$65.7 million. Average age of the respondents is 53.6 years. Almost half (49%) of the owners/partners have no plans to sell but 30% are thinking about it and 21% are planning to or in the process of selling.

NUMBER OF EMPLOYEES

Less than 50	52%
50 – 249	32%
250 – 499	7%
500 – 999	4%
1,000 – 4,999	2%
5,000 or more	3%

AGE



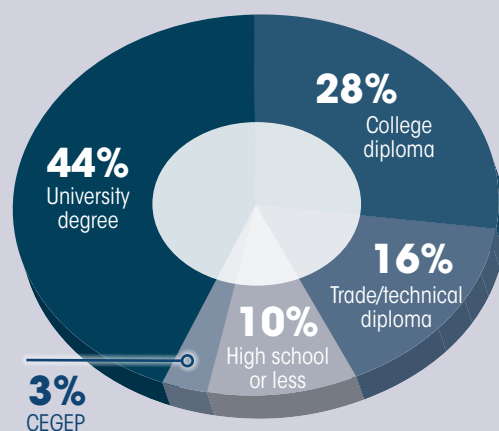
COMPANY REVENUE

\$1M to < \$10M	52%
\$10M to < \$30M	20%
\$30M to < \$50M	11%
\$50M to < \$100M	6%
\$100M to < \$250M	6%
\$250M < \$500M	2%
\$500M < \$1B	1%
\$1B plus	2%

INDUSTRY SECTORS

Industry	Per cent
Fabricated metal product	21%
Miscellaneous manufacturing	15%
Wood product; Plastics and rubber products	10%
Printing and related support activities	9%
Food manufacturing; Machinery	8%
Computer and electronic product; Electrical equipment, appliance and component	7%
Aerospace product and parts; Life sciences	4%
Paper manufacturing; Primary metal; Motor vehicle parts; Environmental	3%
Chemical; Transportation equipment; Furniture and related product; Durable goods industries	2%
Beverage and tobacco product; Textile product mills; Leather and allied product; Petroleum and coal product; Non-metallic mineral product; Motor vehicle; Motor vehicle body and trailer; Non-durable goods industries	1%

EDUCATION



tech issues affecting manufacturers, attitudes, engagement with technology and why Canadian companies lag in the adoption of advanced technologies.

Peng-Sang Cau started things off by noting that as an entrepreneur, she sees two sides of the technology adoption issue. She's president and CEO of Transformix Engineering, an automation innovator based in Kingston, Ont. that sells its CNCAssembly® technology to global markets. The system, based on patented Rapid Speed Matching technology, links and synchronizes the movements of devices and tooling for faster and more efficient assembly systems. The company's intellectual property was sold to ATS Automation last year.

Advanced manufacturing is her territory but the company also faces many of the same challenges as other small and mid-sized manufacturers.

"There's a lack of funding and a lack of human resources, but it's also indicative of Canadian culture and our lack of risk taking," Cau said. "Most of us are entrepreneurs, just putting our heads down and trying to get through the day."

Walter Garrison, advanced manufacturing business integrator for the City of Mississauga, Ont., works with the municipality's aerospace, automotive, food and beverage and clean technology sectors. Pratt & Whitney, a large manufacturer of engines



Most respondents identify the plant floor for improving data sharing.

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for aircraft, operates a design hub in the city. "It has invested heavily in how it adopts Industry 4.0 and so, it's no wonder that it's about to succeed on a global basis. The companies I see that successfully adopt technologies have a long-term plan. They put people in place to execute and they've got the patience for that."

For Darren Lawless, it's all about awareness. He's the Dean of Applied Research and Innovation at the Humber Institute of Technology and Advanced Learning in Toronto.

"The whole post-secondary system is a support network that isn't being leveraged in the way it should be. There are opportunities throughout the system to build that awareness and bring in experts to help companies grow," Lawless said.

For example, The Barrett Centre for Technology Innovation at Humber's North Campus is a place where industry and community partners work on technology issues. The centre leverages Humber's experience with automation, robotics, systems integration, testing, applied research and work-integrated learning.

Humber works with companies to determine what they need. "We can write customized training programs. Or we could go to one of our partners and say, 'Do you have a training program that we could offer?' We've tried to overcome the limitations of any post-secondary system, in the sense that at Humber we run our courses from eight in the morning to 10 at night."

Stewart Cramer is the chief manufacturing officer of Next Generation Manufacturing Canada (NGen) in Hamilton. The not-for-profit, a group of businesses, post secondary institutions and non-profits, matches companies with new technologies to drive advanced manufacturing. It also manages the Advanced Manufacturing Supercluster, which matches federal funds (up to \$230 million) and private investments with industry-led projects.

"One of the things we're seeing when we work with

“



The underlying problem I see in Canada, is our capital. It's way too expensive. We can't compete with the European capital structure...

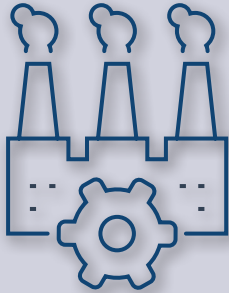
— Steve Bohner

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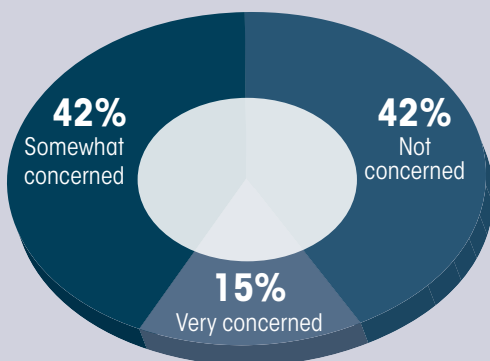
ORGANIZATION

TECHNOLOGY STRATEGIES: CHALLENGES

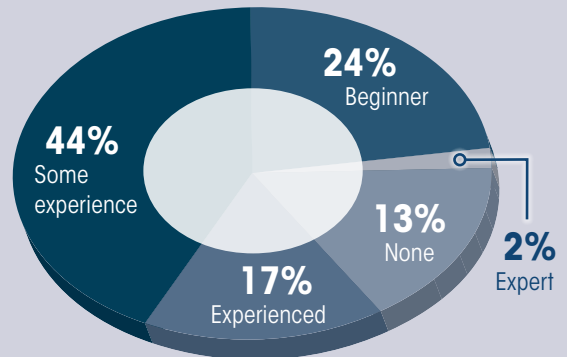
- 51%** ➤ Resistance to change
- 48%** ➤ Lack of skilled talent
- 46%** ➤ Funding challenges
- 37%** ➤ Integrating with legacy technology
- 25%** ➤ Lack of leadership vision
- 20%** ➤ Pressure to deliver short-term results
- 18%** ➤ Too many technology choices and unsure where to start
- 17%** ➤ Difficulty keeping pace with the rapid pace of change
- 16%** ➤ Fear of failure
- 14%** ➤ Not sure how to access available resources



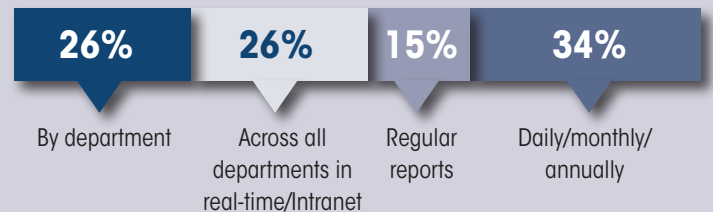
CONCERN ABOUT BUSINESSES NOT INVESTING IN INDUSTRY 4.0



CHANGE MANAGEMENT EXPERIENCE



DEPLOYING INFORMATION ACROSS THE ORGANIZATION



CHANGE MANAGEMENT ENGAGEMENT STRATEGIES





People tend to buy technology for the sake of buying technology, versus having a step-by-step methodical plan and build on the investment to reach the next level...

— Paul Boucher

companies trying to put together projects, is they miss the big picture,” Cramer said. “Industry 4.0 is a lot of things, but it’s really about business process. And it’s about optimizing the organization. It represents an opportunity to rethink how you do business. We’re hoping with NGen we can actually bridge that gap a little bit as we do an awful lot of coaching with small companies when they come to us with proposals.”

A technology decision, such as buying a 5-axis machine or a new lathe would come from the floor. The driver for a business process has to come from the CEO, he said. “The survey supports what we’re seeing. Probably the thinking is too small and it’s coming from the wrong part of the organization a lot of time. If you really want to get the benefit of Industry 4.0, you have to look at your whole organization, which will include cybersecurity and staff development. If you convey it that way, you’ll get buy in, because people will understand it in context.”

Managing change

Donald Fang is an advisor at Benco Packaging, a manufacturer of custom packaging in Mississauga. He believes a lot of companies are missing the role of change management. “How

INVESTMENT

TECHNOLOGY SPENDING	2019	3 Y	5 Y
Advanced analytics	38%	33%	29%
Artificial intelligence	22%	32%	46%
Cloud	56%	30%	14%
Data capturing	53%	33%	14%
Digital transformation	40%	32%	29%
IIoT	40%	39%	21%
Robotics, automation	44%	33%	23%
3D printing, additive manufacturing	44%	28%	29%
Virtual reality	24%	19%	57%
No investments planned	47%	19%	34%



Increase spend over three years **69%**

Same spend **27%**

5% Decrease spend

AVERAGE SPEND **\$1.52 MILLION**

SPENDING PRIORITY OVER THE PAST 12 MONTHS	% RESP	AVERAGE
Data capturing	64%	\$69,766
Cloud	56%	\$65,804
IIoT/M2M	50%	\$79,100
Robotics, automation	48%	\$147,083
Digital transformation	37%	\$90,000
3D printing, additive manufacturing	24%	\$62,292
Artificial intelligence	18%	\$69,722
Virtual reality	10%	\$39,000



Most companies (44%) planned to invest in robotics and automation in 2019.

IMAGE: PUGUN & PHOTO STUDIO - STOCK.ADOBE.COM

do we make sure that all the employees have the skill set? How do you make sure they have the appropriate training? On one side you have to focus on the operational; on the other side you have to focus on the longer term.”

One thing Paul Boucher, a partner at BDO Canada LLP, has observed in discussion with clients is the lack of a plan. “People tend to buy technology for the sake of buying technology, versus having a step-by-step methodical plan and building on the investment to reach the next level.”

Boucher, who handles SR&ED and government incentives for BDO, said manufacturers will be much more successful implementing technology with a solid plan for investments, and build technologies as they go.

Capital is another barrier for small businesses, said Steve Bohner, president of Hydra Dyne Tech, a manufacturer of custom hydraulic manifolds in Ingersoll, Ont. Its 40,000 square-foot facility is equipped with state-of-the-art computerized equipment. “The underlying problem I see in Canada is our capital. It’s way too expensive. We can’t compete with the European capital structure.”

He cited Italy as an example, where companies write down 250% of their capital against taxes. “This is incredible. How do we compete when their interest rates are nearly zero for manufacturing?”

Lyall Watson, sales manager for SEW-Eurodrive Co. of Canada Ltd., a manufacturer of gear motors and drive systems in Bramalea, Ont., offered another example of a European

advantage.

“The Finnish government was giving interest-free loans for large projects. So the risk for an OEM in Finland [gives it] a strong advantage over a Canadian OEM going into a project.”

OVERCOMING INDUSTRY 4.0 CHALLENGES

Industry 4.0 is not a product that can be bought off the shelf, said Braam Meij, vice-president of industrial sales for Siemens Canada Ltd., the multinational engineering and electronics company that manufactures technology for industry. “You have to look at the whole process side. What smaller companies struggle with is they see it as too big to do. You need to have a vision and you have to have a roadmap, but a small organization can’t do everything in one go.”

He recommended piloting smaller pieces to prove there’s value. Then build on the pilots. “Connect a few things, see how you optimize your process through collecting more data. Then connect more things.”

Steve Loftus, president of Innovative Automation, a manufacturer of custom automation systems in Barrie, Ont., believes machine builders aren’t taking advantage of the opportunity to educate customers before the sale about how the technology will improve efficiency and lower costs.

“I think a lot of companies are focused on the product they’re manufacturing and selling. They need to step back and look at

Continued on page 16



Canadian spending on technology lags the US and Europe.

IMAGE: FUNTAP - STOCK.ADOBE.COM

STRATEGY

You need a **PLAN**

How to gain a competitive advantage

By Kim Laudrum

There's a "fear factor that Canadian manufacturers are not investing as much as other developed countries in technology. They are at risk of falling behind and being in an unrecoverable position before too long if they don't modernize their operations," says David Linton, partner and national manufacturing and distribution industry leader at BDO Canada LLP.

Accessing skilled labour, driving down costs, and bringing innovative products to market quickly are challenges manufacturers face every day. Linton says modernizing operations by investing in Industry 4.0 technologies is the best way to tackle them.

Canadian firms tend to be much smaller than companies in the US and Europe. Linton notes half of those responding to the 2020 Advanced Manufacturing survey were over the age of 55. "There is an element to that, that they don't

understand what the technology is. If they can't possibly see the value in it, then they don't want to invest."

What steps would companies willing to ride the learning curve and implement digital technologies have to take?

First, assess the current state of the business and production, then determine where they are now and where they want to be in three, four or five years time. "Then build a roadmap to get there. Every company's road is different. And be prepared for that roadmap to change as they learn more about the technology, and as the business evolves."

Second, consider where the funding will come from. Will the company drive the investment or are there government incentives to tap?

"They need to consider this before investing because the overall costs could be quite high," Linton warns. "The execution of a technology roadmap will have a much different price tag for a \$50 million company compared to a \$10 million firm." However, he says most manufacturers spend between 2% to 3% of annual revenues on IT.

Once the current position is assessed, a time-phased strategy is built focusing on what the technology architecture should look like to achieve the five-year business goal. Firms lacking the in-house expertise to do this should consider outside help.

"The roadmap is a great investment, even if the manufacturer decides not to fully execute the plan. It will at least give them something to aim at," Linton says.

Factors to consider when putting together the roadmap include: current challenges; current systems in place; the level of automation in the production facility; and whether all of the points of information needed to make decisions are captured.

The assessment might uncover the backbone financial accounting, or ERP system is not good. In that case, don't build on it. Maybe the data needed isn't being captured. Installing some sensors throughout the production facility and on the machinery and equipment is recommended.

If the data is captured but not used, deploy analytics to start analyzing the information. Or use artificial intelligence to predict what's going to happen in terms of product quality, or predictive

maintenance for machinery.

Getting buy-in from everyone in the organization can be a challenge. Managing such a significant cultural change will require decisions about who should be involved in the process.

Linton suggests all of the key stakeholders have valuable insights to offer. Those who should be involved in creating the roadmap include the president and CEO, the head of finance, the head of operations, representatives from the company's supply chain, and the IT department, although he emphasizes this should not be an IT-led initiative.

Modernizing technology raises fear of job loss among people who don't understand the technology. Communication is key, as is employee involvement and a robust training program. Linton suggests providing employees with a forum where they can talk and learn so they understand why the company is undertaking the changes.

Once the roadmap recommendations are decided, go for the low cost, quick win first. "You have to get that success under the belt to encourage further adoption throughout the organization," Linton says.

Modernizing technology has the added benefit of overcoming a reliance on skilled resources that are often scarce. Engineers and designers are better equipped to do their jobs while artificial intelligence offers new possibilities and CEOs have easier access to important data for making better-informed decisions.

Manufacturers should be acutely aware of the growing competitive threat posed by companies from developed and emerging economies. Investing in Industry 4.0 helps improve quality, optimize production and scheduling, and reduce downtime through predictive maintenance. It also helps bring new innovative products to market quickly. These are important advantages.

*Kim Laudrum is a Toronto-based business writer and regular contributor to **PLANT**.*

E-mail klaudrum@rogers.com.

“



Working with a number of government organizations, one thing that we found: there isn't really a comprehensive, one-stop solution for us...

— Donald Fang

how they improve processes, and how customers can actually use data to drive efficiency.”

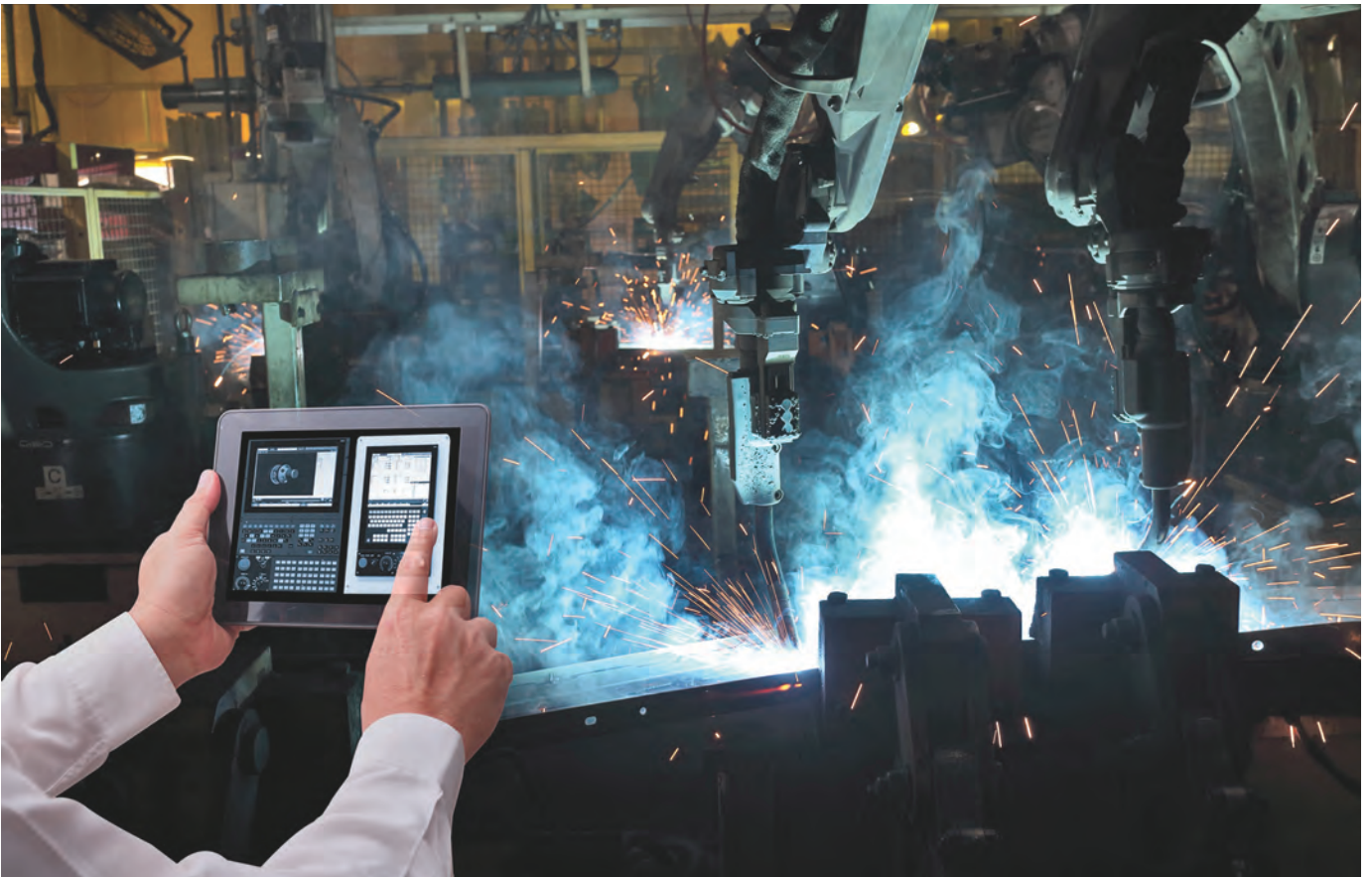
Ed Manera, general manager of KUKA Robotics Canada Ltd., a supplier of advanced manufacturing technology in Mississauga, Ont., addressed the risk issue.

“I spent 10 years helping companies get into robotic automation. I found the biggest thing you were never told was that they're afraid of failing. And that perhaps leads to the culture of being risk averse. So, one of the things we do is help de-risk.”

De-risking projects

He said the company has found that whenever there's fear or perceived risk, it can be overcome with knowledge. KUKA partners with companies or post-secondary institutions such as Humber (and others), lending robots that are used to de-risk projects over a three-month period. “We try to help them with system integrators that have expertise in an area they're trying to succeed in.”

Meij suggested working with suppliers and changing business models to share some of the risk. Take energy efficiency: “Okay, I'll implement my system. I'll monitor your energy and you pay me out of the savings. That's a zero upfront cost, and



Using data to drive efficiency.

IMAGE: SITTINAN - STOCK.ADOBE.COM

TECHNOLOGY



APPLYING IIoT

	TOTAL	Currently applying	Have a plan	Evaluating	Not familiar	NA
Improving efficiency/productivity	33%	74%	67%	28%	3%	3%
Providing more visibility into production processes	23%	52%	48%	18%	2%	3%
Improving maintenance functions	22%	49%	43%	20%	3%	3%
Tracking materials, shop floor assets	20%	44%	38%	20%	3%	0%
Tying in business data from shop floor to top floor	20%	44%	43%	13%	5%	3%
Analytics functionality	14%	34%	33%	11%	0%	0%
Developing smart products	10%	26%	19%	7%	2%	0%
Developing new services/revenue streams	10%	23%	14%	10%	3%	0%
Consolidating control rooms	4%	10%	14%	3%	0%	0%
Not currently applying IIoT	47%			41%	86%	95%

IIoT ENGAGEMENT

24% Currently applying IIoT capabilities

8% Have a plan, investing in technology for deployment in next 12 months

28% In the process of evaluating its relevance to operations

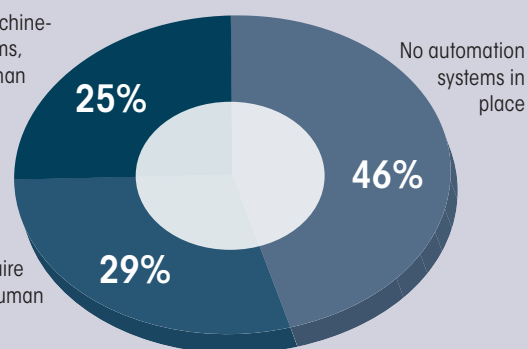
24% Not familiar with IIoT capabilities

15% Not applicable

LEVEL OF AUTOMATION

Primarily machine-driven systems, minimal human intervention

Machines, process require significant human involvement



BENEFITS FROM TECHNOLOGY UPGRADES

	TOTAL
Increased throughput	35%
Reducing downtime	34%
Increased quality of product	33%
Product innovation	21%
Reduced staff requirements	20%
Reducing time to market	16%
New revenue streams	10%
None of these	29%
Other	6%

NOT INVESTING IN INDUSTRY 4.0?

Senior executives cited these factors as the greatest threats resulting from not investing in Industry 4.0 technologies.

65% Falling behind the competition

37% Low margins

32% Pricing pressure as a result of commoditization or automation

25% Customer losses

22% Disruption by industry outsiders

9% Other

REASONS FOR NOT INVESTING IN TECHNOLOGY

29%	Difficulties integrating advanced technologies in existing systems
25%	Too costly
23%	Lack of financing and support
23%	Lack of skills to support investment
21%	Not convinced of economic benefit
18%	Lack of adequate information about advanced technologies
17%	Investment not necessary for continuing operations
17%	Not sure where to start
16%	Concerned about exposure to cyber security threats
13%	Weak customer demand
10%	Uncertainty, risk and disruption
7%	Lack of support or services from external vendors
7%	Lack of support or services from government

RATE THE FOLLOWING

87%	Emerging technologies allow small companies to compete globally
79%	I see IIoT as a business growth opportunity
71%	Data is complicated and requires special knowledge
64%	There is more to gain from new technologies for the smaller operations
63%	Investing in new technology raises the company's cyber security risk
56%	Canada is a world leader in adopting new technologies
49%	Machinery replacement is a massive investment, will cause downtime we can't afford
45%	I know where to find government programs to help with new technology investments
12%	At my age, I don't see the value in investing in new technologies



Top reason for not investing in technology: difficulty integrating it into existing systems.

IMAGE: ©PHUCHIT AUNMUANG – PIXEL_B - STOCK.ADOBE.COM

that's upside for both parties. If there's more energy savings, the supplier gets more money; if there's less energy savings, less money."

Lawless described how leveraging the post-secondary system to try out a prototype helps de-risk the technology.

"You don't need a trained workforce. If you're de-risking and doing a project in partnership with a company to validate claims or show how it can enhance the process, or doing the analytics, you don't need to engage people who understand that process. We're there to demonstrate it and look at whether it works. And then create training programs by working with partners."

Cramer identified the need for large technology companies to collaborate with customers. "There are lots of times you walk into a shop and you'll see a \$6 million investment in a system and half the machines aren't running. [Suppliers] need to help [manufacturers] understand how it all fits together as part of the big picture. Small companies don't have everything they need to do this out of the box."

He noted the symbiotic relationship between large solutions providers and SMEs who are the backbone of the supply chain. "If they start to fail there's not going to be anyone to sell anything to and the larger companies are not going to have a supply chain. So collaboration is essential and a broader conversation is really important if you want to sell something today and sell something else tomorrow."

ROLE OF GOVERNMENT

How does government fit in the mix? Ground level, Fang and Bohner highlighted typical difficulties encountered by smaller manufacturers.

"Working with a number of government organizations, one thing that we found: there isn't really a comprehensive, one-stop solution for us," Fang said. "If we want resources on exports we have to talk to one side of government, and if we want something else we'll talk to different people. It's very hard to keep track of everyone."

"On the government funding side of it, if you're an organization of between 50 and a hundred employees, it's extremely difficult to navigate that quagmire of different organizations to try to get any money," Bohner said. "You fill out all these forms and do reports, which we don't have the resources to do anyway; we stretch to try to get enough resources and people in that can actually help. Then [paper work] is sent off and you never hear anything about it. All you get back is one e-mail, 'Sorry you didn't make it. See ya.'"

Watson, noting SEW-Eurodrive has about 250 employees in Canada, said the company doesn't deal directly with the

*The companies I see
that are successful
in adopting the
technologies have a
long-term game plan...*

— Walter Garrison



government, preferring to use an advisory firm with expertise in that area. "We simply don't have the resources to dedicate to that... This is not an easy process to navigate."

Cau offered an anecdote illustrating how working with government can be a challenge.

"We were looking for investment a couple of years ago. There was a program that was supposed to help my sector. The individual came in, didn't inventory my plant or walk around. She sat in my boardroom for an hour and asked, 'What is your company, are you a software or a hardware?' I said, 'Both. I am advanced manufacturing, my CNCAssembly is no different than a robotic system. Without hardware, my software has nowhere to go. This is proprietary technology. In fact, it's architectural. Without my software, my hardware is metals. Her reply, 'If you can't decide if you're software or hardware, I cannot invest in you.'"

Willing to help

Boucher offered a defence of the government. "There are a lot of programs out there and there is the willingness to help. The disconnect is each program has its own setup initiatives. If you don't understand what those objectives are, you're not going to be successful in the program."

Programs are also "very poorly advertised," he said. "The administrative process in many cases is quite burdensome. And so it's a barrier for a lot of companies to achieve that funding."

Another consideration is size of the companies in the survey. Half of the respondents are under \$10 million. "So, what types of funding programs are specifically targeted to half our population? There aren't that many. On the larger side,

“

The Finnish government was giving interest-free loans for large projects. So the risk for an OEM in Finland versus a Canadian OEM, gives them such a strong advantage going into a project...

— Lyall Watson



”

there are some great programs, but I think trying to take the initiatives with NGen, which is relatively new, and get those to match the needs of these companies, that's the discrepancy between the government programs and the needs on the manufacturing side.”

ENGAGEMENT WITH ADVANCED TECHNOLOGY

Another barrier to the adoption of advanced technology could be generational: older employees and managers more comfortable working in the mechanical world rather than digital.

“I think one of the very telling points of the survey was more than half the respondents said that the owner was 55 and above,” said David Linton, BDO Canada’s national manufacturing and distribution leader. “At the risk of stereotyping every owner of a manufacturing organization in Canada, that’s a barrier to technology adoption. If you don’t

Industry 4.0 FEEDBACK

Manufacturing executives responding to the 2020 Advanced Manufacturing survey were asked: What do you think are the main reasons for Canada lagging other countries adopting new technologies? Here are some of their insights (edited):

GENERATIONAL

- Most companies are owned/managed by a generation that may not embrace new technologies. This pattern will likely change over the next 10-20 years.

- An aging workforce in decision making roles not trusting newer generation solutions. Middle management is not given the authority to explore new technologies. Individuals do not want to take responsibility for fear of failure.
- Antiquated mentality to adopting new technologies at the same pace as European/Asian companies. The old way of doing things that made the previous generation so successful and its lack of relevance in a globally competitive economy.

COST

- Ability to source new technology in a cost effective way.
- Investment costs are high relative to revenue since the majority of manufacturing enterprises are small firms.

VISION

- Restricted vision. Thinking rules and regulations are more than innovation.
- In general I think it's getting the right level of talent and the right mindset of upper management to invest.
- Followers are in lower tiers of manufacturing. Too much focus on older products and maintaining share. For example, Tesla has much more robotic manufacturing than traditional car manufacturers.

understand technology, you're not going to see the value, and if you don't see the value, you're not going to invest."

For those who do see a need to invest, key to the adoption of advanced technologies is the management of change. Executives were asked how much experience their organizations have with change management. The answer: not a lot. Only 2% described themselves as expert and 17% identified as experienced.

Information is communicated across the organization mostly by daily, monthly or annual reports (34%), by department (26%) or by department in real time via an intranet (26%).

Challenges encountered while implementing technology strategies include resistance to change (noted by 51% of respondents), lack of skilled talent (48%), funding (46%) and integrating with legacy technology (37%).

Only 17% are applying a formal change management strategy to engage their employees. Most (62%) are training to upskill, 41% are hiring new talent and 23% are using external consultants.

Executives were asked how they rate their companies' level of engagement with the Industrial Internet of Things (IIoT). The survey defined IIoT as interconnected sensors, instruments and other devices networked together with computers and industrial applications. Only 24% are currently applying IIoT, while 47% are not. Their responses showed engagement was not particularly high with 24% admitting they aren't familiar with IIoT capabilities and 15% stating IIoT is not applicable to their operations.

“



*If you don't understand
technology, you're not
going to see the value, and
if you don't see the value,
you're not going to invest...*

— David Linton

”

IIoT



It's a WIRED WORLD

Industry 4.0 technology
is good for business

By Kim Laudrum

“Canadian manufacturers lag their global competitors when it comes to realizing the benefits of Industry 4.0 technology.” So says Mike Gillespie, BDO Canada LLP's national manufacturing leader.

He shared observations stemming from the results of **PLANT** Magazine's 2020 Advanced Manufacturing survey, sponsored by BDO Canada LLP.

For Gillespie the survey confirmed “Canadian industry is behind the curve in terms of adopting Industry 4.0



Better decision making from sharing of data.

IMAGE: STOCK.ADOBE.COM

technologies in a significant enough way to show concern, particularly in regard to European competition.”

Over the years, BDO Canada has been a cheerleader for Canadian manufacturers, encouraging and helping them to adopt Industry 4.0 technology plans in the face of what the business consulting firm saw happening around the world.

Gillespie says it’s good to see one-third of the Canadian manufacturing companies responding to the survey have implemented or are in the process of adopting Industry Internet of Things (IIoT), but “two-thirds have not taken any particular action. While that’s not surprising, it is a concern.”

At the top of the survey’s list of adoption challenges were cost and availability of financing. He was surprised government support wound up at the bottom.

“I believe government should play a role, and there are programs out there. But there are so many of them, they change all the time, they get funded and then they’re oversubscribed. The challenge is finding the right incentives.”

A lack of focus on sharing data within the supply chain is another area of concern the survey uncovers. “Data sharing appears to stop at the corporate level,” he observes. “There wasn’t a focus on sharing mutual data within the supply chain, as opposed to just using it for your own purposes.”

Organizations such as NGen have pointed out the best way for Canadian industry to set itself apart from competition abroad “is to create a collaborative supply chain,” Gillespie says.

Yet a collaborative supply chain isn’t the top benefit manufacturers cite for implementing Industry 4.0 technology. Increased efficiency and productivity head the list.

“If we aren’t efficient and productive, we won’t be competitive. This is a high-cost country to do business,” says Gillespie, who notes there are many other advantages to IIoT that need to be realized.

Although respondents indicated they’re spending in various areas of IIoT, their current spend was much less than their anticipated spend. Gillespie says that confirms there’s pent up spending on IIoT.

Even if manufacturers agree there are advantages to adopting the technology, many are still reluctant to do so. Why don’t they do it?

He cites complacency as one reason. Some business owners recognize

competition is growing so they may plan to sell rather than invest in technology. Many companies are SMEs, led by sole proprietors, likely in their mid-fifties. Decisions for some are based on short-term needs. “Without a strategic planning process, people invest sporadically without a thought about doing it the best way.”

It’s also a change management issue on a larger scale. The survey shows the use of external support or consultants to help companies deal with their scarcity of skilled resources in change management was a relatively small minority. Only one in four companies take advantage of the skill set that is out there.

Gillespie says it comes at a cost, but given the fact so many companies are missing out on the benefits and don’t have the capacity to manage these kind of projects themselves, one would expect them to draw more on external expertise.

Invest or divest? That’s what BDO Canada consultants ask entrepreneurs of small to medium-sized companies.

“The time is right for either one,” Gillespie says. Investing in IIoT and all of the connectivity that brings can make a company globally competitive. “On the other hand, companies are getting good valuations and dollars when they sell, if they are profitable.”

Even if you’re thinking of selling the company, it makes sense to upgrade operations to be as efficient and productive as possible. That means implementing IIoT.

Kim Laudrum is a Toronto-based business writer and regular contributor to PLANT. E-mail klaudrum@rogers.com.

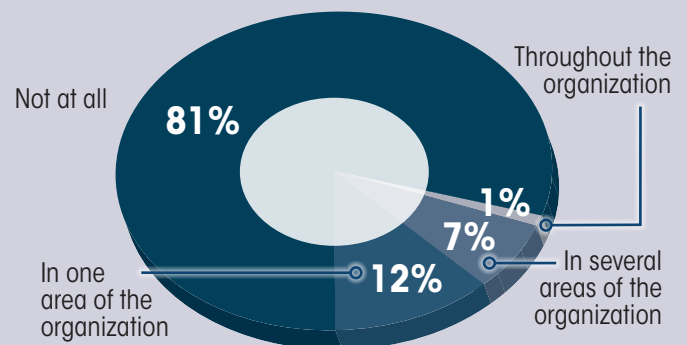
COLLECTING AND USING DATA



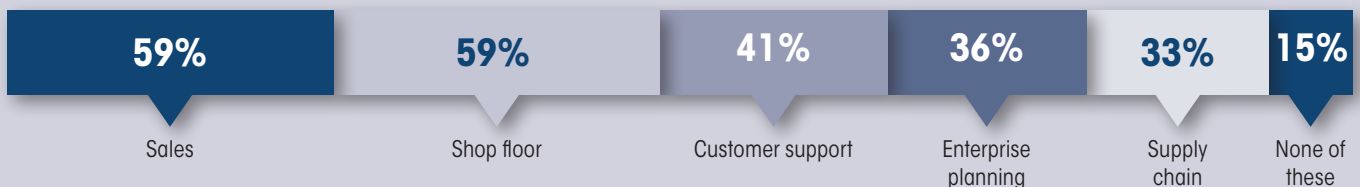
MONETIZING DATA



USING MACHINE LEARNING / AI TO PREDICT DATA PATTERNS



AREAS FOR IMPROVING DATA SHARING



Of those who have deployed IIoT, the top six applications are: doing so to improve efficiency and productivity (33%); providing more visibility into production processes (23%); improving maintenance functions (22%); tracking materials and shop floor assets (20%); and tying in business data from shop floor to top floor.

Topping the list of main benefits arising from technology upgrades is increased throughput noted by 35% of executives,

followed by reduced downtime (34%), better quality of product (33%), product innovation (21%) and reduced staff time (20%).

DATA AND HOW THE INFORMATION IS USED

Central to Industry 4.0 is data and how the information is used. Most companies (70%) are using spreadsheets such as Excel

for production and material planning, accounting packages (46%) and an astounding 43% are still dealing with manual paperwork. Integrating ERP for the supply chain was cited by 35% and MRP by 26%. Only 14% are employing sensors to capture big data.

“Collecting data and putting it on Excel sheets: that’s insane to me,” Bohner remarked. “We have people in our plant that write apps for iPads to get information to the people who can actually make a difference. I have a gentleman who’s over 55, who rarely logs onto a computer. He uses an iPad, 100%. We have 150 people in the plant, we have 100 iPads, and all the information they want is at their fingertips. Bringing technology into the plant has made a huge difference.”

Almost three quarters (74%) of the surveyed companies are monetizing data. Improving efficiencies tops the list (56%) followed by adding new services to existing offerings (29%).

Almost half (49%) are using the cloud to store operational data. Just over half of the companies are automated, 29% say machines and processes require considerable human involvement, and 25% are mostly machine driven requiring minimal human intervention. But there is very little application of machine learning and artificial intelligence to predict data patterns; 12% do so in one area of the company; 7% in several areas; and 1% in all areas.

Linton said there is a number of ways data can be monetized internally. Identifying inefficiencies and streamlining processes lead to quicker, better decision-making that’s potentially revenue generating in terms of improved customer service. But there is also opportunity to find new revenue streams beyond the sale of a product. “If it’s a product where they can capture data, you don’t necessarily need to sell [the product]. You can rent it and monitor it remotely. But even if you sell it, you can also sell services to clients, or sell the data itself.”

Take GPS tracking devices. He said the true value in the device is the data it produces, which can then be sold or subscribed back to the customers on a recurrent basis, or potentially sold to third parties.

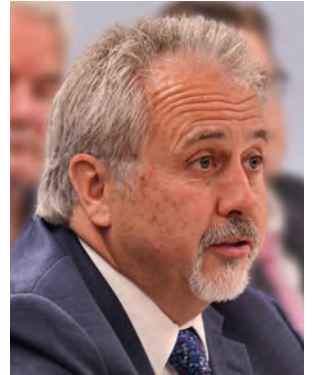
Actionable data

Cramer said data has to be actionable to drive a cost-benefit. The real way to get results is to harvest information that drives a reaction at the point of capture. “Anything that has to go back up to senior management for decisions is a lot less likely to generate results,” he said. Start with metrics and how they flow through an organization, then look at the lowest level where an action is taken on the basis of those metrics. “If you get that connection, then you start to get measurable improvements very quickly.”

Meij offered an example involving energy management and an auto parts company that was heating an oven for a five-days-a-week operation. “The oven needed to be heated to a certain

I think a lot of companies are focused on the product they’re manufacturing and selling. They need to step back and look at how they improve processes, and how customers can actually use data to drive efficiency...

— Steve Loftus



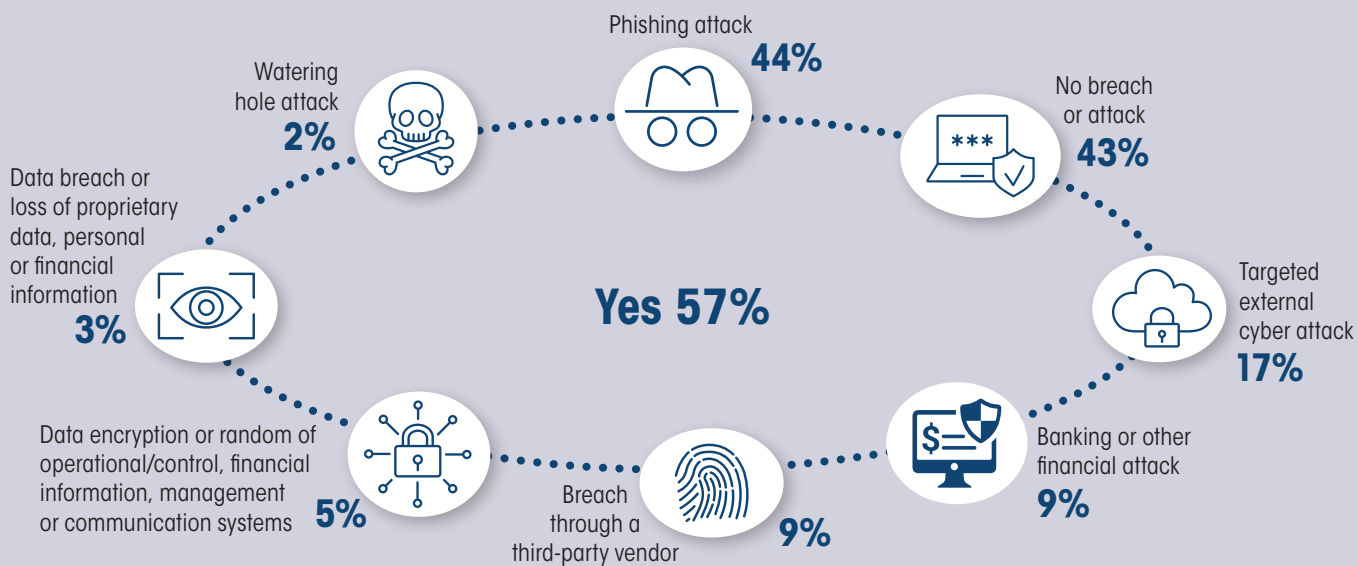
level on the Monday morning. The old practice was to have someone come in on Sunday to switch it on. Analysing the data proved they could switch that oven on a number of hours later and still have it at the right temperature on the Monday morning. This resulted in a large energy consumption reduction and saved the company a tremendous amount of cost.”

Cau believes the challenge is at an executive level and goes back to Industry 4.0. “How do you tie all the different business and manufacturing processes together to provide a couple of data points that immediately help make those decisions? At a micro level, which is the most critical to attack? It depends on the organization’s pain points, whether it’s operational costs such as energy, or labour. I think that’s a bigger discussion than, how do you monetize data? We all know how to do it. We don’t all know how to take advantage of it. There’s so much data being caught. But what’s good, what’s bad? How do you decipher all that information into something that’s useful?”

At Hydra Dyne Tech, Bohner keeps the data collection simple. “We had data everywhere coming at us from machine tools and everything else. I turned 80% of it off. And I just dialled it down to a few points where the guys could actually make a change. Do not overwhelm them with too much data. Keep it to a point form.”

Manera offered an example of how measurement data proved to be useful in a CNC application where online inspection led to making cost adjustments as required to compensate for tool wear. Another use is anomaly detection, such as the temperature

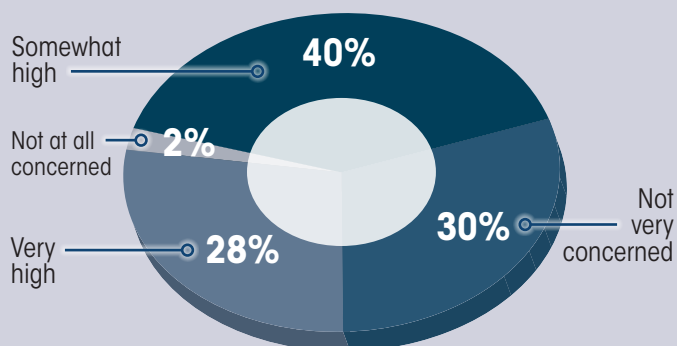
TYPES OF ATTACKS/BREACHES



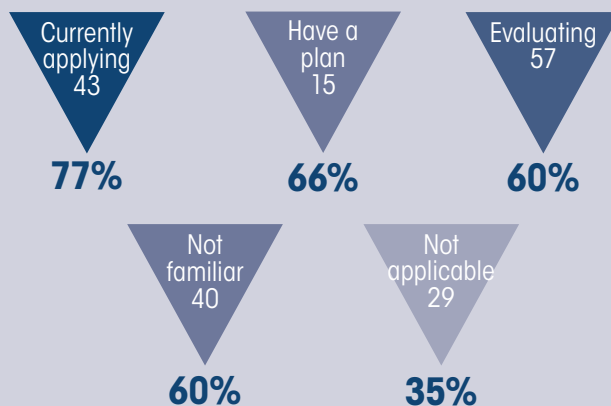
SECURITY MEASURES TAKEN

	Total	Currently applying 43	Have a plan 15	Evaluating 57	Not familiar 39	Not applicable 28
Any	83%	88%	93%	86%	79%	68%
Security infrastructure	64%	77%	80%	63%	54%	54%
Data privacy controls	46%	58%	47%	53%	36%	32%
A cybersecurity strategy	29%	30%	27%	39%	18%	21%
Cybersecurity risk assessments/review	27%	35%	27%	32%	18%	14%
Crisis management procedures and/or a business continuity plan	22%	33%	13%	21%	26%	7%
A cyber breach response plan	16%	30%	13%	21%	8%	0%
None of the above	17%	12%	7%	14%	21%	32%

LEVEL OF CONCERN



CYBER GOVERNANCE POLICY



of a motor, current draw or vibration sensing. “These allow you to look at something when it gets to a certain range. The next step beyond that is to gather more data, then look at what point can we predict the life of that particular component, and if it’s going to fail in the next two or three months.”

When assembling products at SEW-Eurodrive, Watson said customers have the ability in real time to change an order, as long as it hasn’t progressed past a certain process in the material flow.

Data’s important, but so is employee engagement. Cramer described one of the companies he worked for building a visual workplace that came from the machinists and planners. “We spent about four months in all-hands meetings mapping processes until we understood the problems that they had on the floor and we built the system to solve it. When we were done we no longer had a central scheduling function. The people who designed the system were the people who used it. It was a great opportunity for engagement. And the worse part is all of our engineers, myself included, when we thought we knew what the answer was, we were wrong.”

Lesson learned. Cramer added: “The first thing you’ve got to do is ask them, ‘If I wanted you to get higher throughput what would help? What are the things that cost us throughput? Or what are the things that cost us downtime? And what are the things you think we should know more about?’”

RISKS RELATED TO CYBERSECURITY

While there are certainly advantages to the digital universe, advanced manufacturing technologies add to the risk of cybersecurity issues.

Respondents to the survey identified their level of concern as high (68%). Although 43% claim they have not suffered a breach or attack, 57% have and 44% of those attacks were phishing.

Do companies have a data governance policy? Yes, say 22% of executives, 39% admit to having “somewhat” of a policy while 40% have no policy.

Measures in place to protect against an attack include a security infrastructure (64%), data privacy controls (46%), a cybersecurity strategy (29%) and a risk assessment/review (27%). Only 22% have crisis management procedures and/or a business continuity plan in place. Seventeen per cent have no measures in place.

The two most common types of attack BDO sees are ransomware and phishing, which Linton said are “low-effort” for the people trying to get into organizations. “There’s a limit to how much IT can do to prevent that. I think everybody has to remember IT only plays one part in your cybersecurity policy. You must educate your staff and

continue to educate them.”

Transformix was attacked. A controller received what appeared to be a legitimate request for a transfer of funds from Cau. “Without thinking, he transferred the funds. Except we have a process in place where nobody authorizes except me. After several days, he asked, ‘Why haven’t you authorized [the transfer] that you asked for?’ I’m like, “What are you talking about?””

Transformix’s business is all about intellectual property so it has multiple backup plans in place. “We can’t risk it being stolen or destroyed, because we probably couldn’t pay whatever ransom they would want,” Cau said.

Expert advice

The company is vigilant. It brought in an IT expert who specializes in cybersecurity and every year does an assessment, then adds what’s needed. “Listen to advice, do our own research and then put a plan together,” she said.

Hydra Dyne Tech was hit by a ransomware attack. The company has cloud backup, off-site backup, and it uses safes. All of the backups except for one were okay. “They were in our system for months. They knew exactly how the backups were working. They knew everything about us — everything. And they changed one little thing on the backups internally. We

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I spent 10 years helping companies get into robotic automation. I found the biggest thing you were never told was that they’re afraid of failing...

— Ed Manera

”

didn't have a backup for that," Bohner said.

He warned the cost of getting up and running again could dwarf the cost of the incursion. "We had to update everything to Windows 10, which none of our other systems were capable of running. We were crippled for weeks. The overall costs just in IT services and extra people ran into hundreds of thousands of dollars."

Innovative Automation's newsletter reminds employees to be vigilant and advises them on what to look for before opening an e-mail. But it also tests them with fake phishing e-mails. Anyone who clicks on one has to do a course.

"It's a pain if you make that mistake," Loftus admitted. "Usually, if you do make a mistake, it's when you're distracted. The bottom line is pay attention."

ATTRACTING MORE PEOPLE TO MANUFACTURING

Technology is great but you need people to operate it. Scott McNeil-Smith noted the skills shortage has overtaken cost control as the number one issue identified by manufacturing management. He's the national director of the Excellence in Manufacturing Consortium (EMC), the Owen Sound, Ont.-based non-profit that helps manufacturers improve their competitiveness.

He observed the skills shortage has two parts: one is the lack of skills, and a lack of people with needed skills to fill positions. "Industry 4.0 represents the catalyst and the barrier. Manufacturers can overcome some of that with the right training in place, using the technology with their existing workforce."



The whole post-secondary system is a support network that isn't being leveraged in the way it should be...

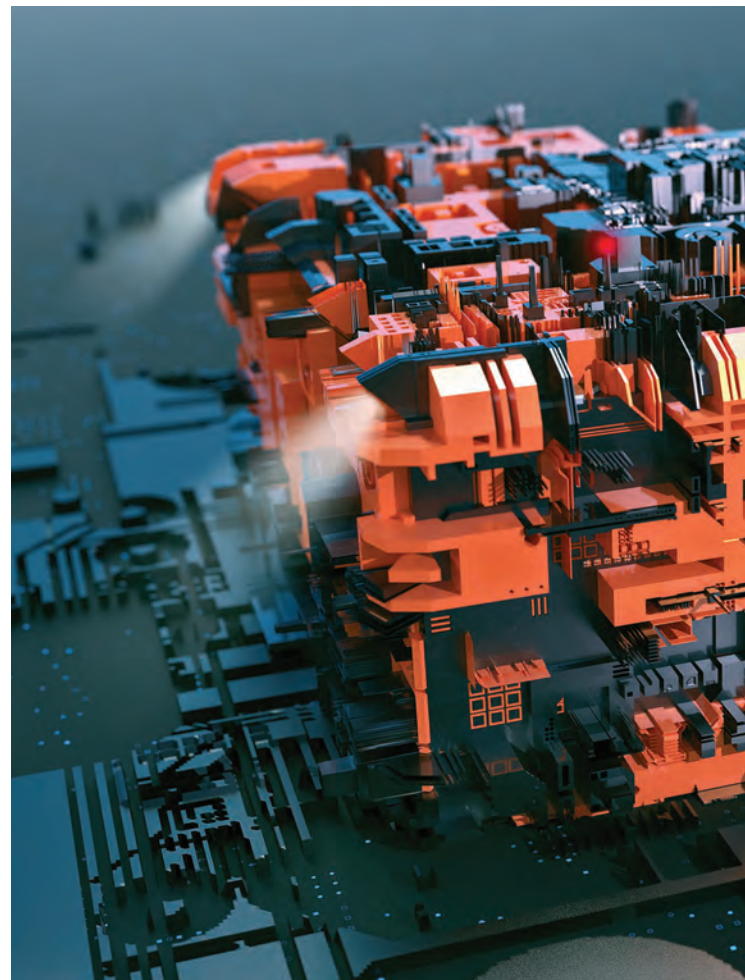
— Darren Lawless

But effort must also go into attracting more young people, women (note 87% of the survey respondents were men), Indigenous people and other diverse groups. There's a problem, though. Manufacturing continues to be perceived by many as 3D: dirty, dull and dangerous. Several roundtable participants noted a new image is needed to attract people who can fill technology needs.

Meij suggested IoT is an opportunity to make manufacturing sexy. "If we can leverage that in our environment and through our organizations, wow, that could make a big difference."

In a well-run manufacturing operation 20 years ago, you could eat off the floor, Cramer said. "And anyone of us who's been in manufacturing knows we didn't wait for Industry 4.0 to run a clean shop. It was always a great job for a smart kid. But we haven't really done a great job of making that clear. The bigger question is, what does manufacturing do to get kids to understand exactly what kind of careers we create?"

Hydra Dyne Tech sponsors an outreach program offering



Most companies (81%) are not using machine learning/artificial intelligence to predict data patterns.

robotics courses aimed at young people 14 to 18.

How different generations view technology is another factor for manufacturers to consider, Bohner said. One of the reasons for putting iPads in the plant was to address a communication gap that existed between older employees and a fairly young workforce. “How do you find out anything about the facility? How do you do something? They’re not used to talking at all, they want to look it up themselves and they want to understand how to do it. That was a huge infrastructure change for us, to be able to let the young kids look for themselves and learn.”

He also emphasized the importance of documenting what mentors teach the younger people who can then reference it on their devices, their preferred way to learn.

Importance of education

Innovative Automation is approaching the skills challenge with education, internally and externally. Looking to grow the 40-employee company to 180 in four years, it aimed to

If you really want to get the benefit of Industry 4.0, you have to look at your whole organization and that will include cybersecurity and staff development...

— Stewart Cramer

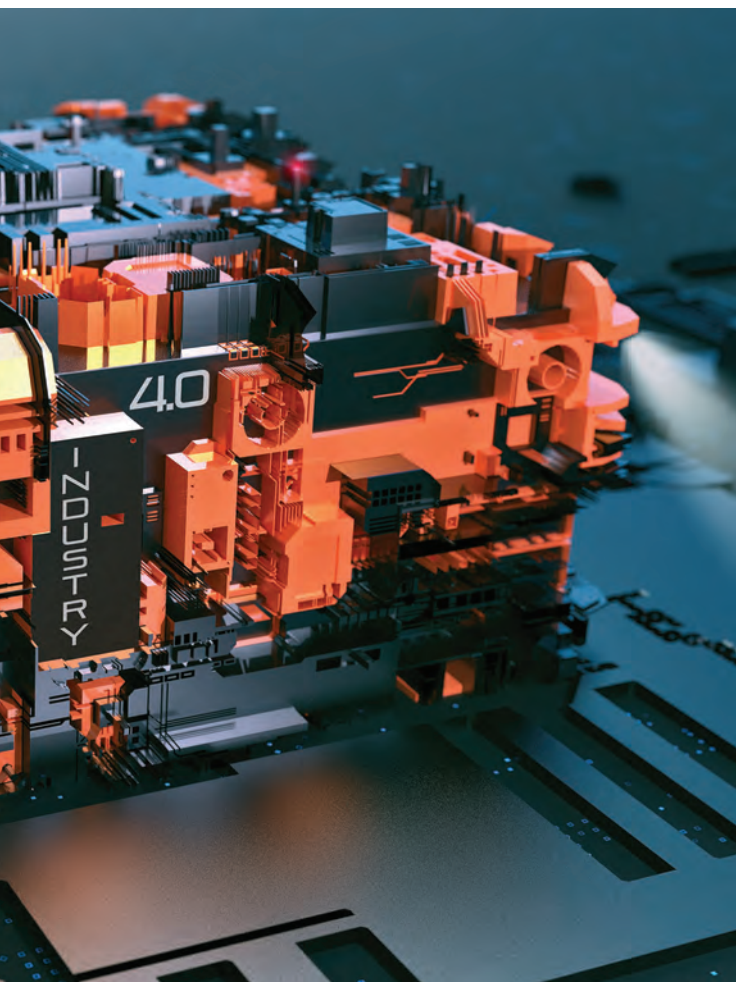


IMAGE: PETR CIZ - STOCK.ADOBE.COM

fill the void with youth, but Loftus said it was tough to find people. So the company is targeting Grade 10 students in the area. Once a year it hosts a mini trade show. “So the Siemens of the world put a booth in our shop; it’s an opportunity to educate our employees on new products, but it’s also a great opportunity to bring in high school students.”

This year the company is conducting a project called Innovative in the Classroom, a 72-minute module that engages employees with students on their turf in the Simcoe and Muskoka regions. Three employees take the demo into high school classrooms and involve students in a project covering design, manufacturing and testing.

“At the end we talk about careers and opportunities: ‘Which portion of this did you prefer? Did you like the designing? Did you like the manufacturing? Did you like the testing?’ It’s to generate interest and make people understand that within a manufacturing facility there are lots of different opportunities. And then we talk about career paths.”

This involved an investment that Loftus estimated to be more than \$125,000, but there has been a payoff. More than 25 students who did the first tour and are now at university have submitted resumes. It’s also important to note these are candidates who are familiar with the area’s lifestyle will likely stick around.

When young workers join the company, they’re partnered with older employees to build mentor/mentee relationships. “There’s nothing better than being a mentor and seeing your protégé succeed. That gives you a real sense of accomplishment. And we push that with our employees. We talk about it all the time and how great a job they’ve done

“



*You need to have a vision
and you have to have
a roadmap, but a small
organization can't do
everything in one go...*

— Braam Meij

”

bringing people to the next level. That generates excitement.”

This model has helped build up staff by more than a hundred people, Loftus said. “We’ve taken our average working age to under 30 from the high 40s in five years. And 95% of our staff have a post-secondary education.”

Students ‘at risk’

McNeil-Smith emphasized the importance of collaboration with post-secondary institutions.

“We’ve done a lot of work with various school boards throughout Canada and we’ve identified the two biggest barriers to a high school student pursuing a career in manufacturing: one is the parents, and two is the actual teachers in high schools. In most cases, the high school teachers went through an academic stream in secondary school, on to university and teacher’s college, and then into teaching. They had little or no exposure to a manufacturing environment or what it entails, and they’re conveying that message to the students. In several school boards in Canada, they deem a student that’s going to pursue a career in the trades or manufacturing as being ‘at-risk’. And that’s a quote.”

He said a lot of the companies EMC works with have decided to hire for fit and teach the rest. “They’ve looked to us, other organizations and colleges to put programs together.”

One of EMC’s programs is Manufacturing Essentials Certification (www.emccanada.org/mec-essential-skills-certificate) for supervisors and production workers. It provides the foundation they need to be successful, while adding a productivity element and delivering a workplace performance project while they’re learning and training.

“There’s a direct value to the employer to provide that sort of exposure and it also helps them onboard youth more rapidly. A lot of companies need to look at it from a skills perspective: how do you more rapidly onboard the younger and other populations you need to fill those vacancies in your building so they can hit the ground running?”

Employers also need to consider compensation, Fang said. “For the younger generation, money is definitely one focus, but other than the money, perhaps flexible hours, and how they work. It’s quite different than the previous generation.”

Garrison referenced a Mississauga company where the human resources person has subdivided the workforce into five age categories from Boomers to Gen Zers. “Their motivations are very different — beyond money. Managing those groups within an organization becomes very challenging.”

FINAL THOUGHTS

At the conclusion of the roundtable discussion, participants offered some final thoughts on technology and the role of Industry 4.0 in Canadian manufacturing.

Cao summed up the challenge for smaller manufacturers. She said Industry 4.0 is a great concept but there are practicalities to consider. The significant costs mean engaging SMEs will be difficult.

For manufacturers to chart a path they need to understand where it could lead and what the benefit would be, said McNeil-Smith. “Everything else is fitting in the pieces of the puzzle – skills, technology and other capabilities.”

Industry 4.0 is about data and the importance of involving people in change, Bohner said. “All the data in the world isn’t going to help you if you can’t get people to change.”

Lawless emphasized the importance of technology awareness, Loftus the need to learn and understand processes, and Fang recommended taking baby steps to deal with specific issues, while Boucher noted the importance of having an integrated plan and a roadmap (see *Breaking Down Industry 4.0: Manufacturing Strategies in 2019*, www.bdo.ca/en-ca/insights/industries/manufacturing-distribution/manufacturing-strategies-2019/).

Cramer described Industry 4.0 as a toolbox. “Start with the problem you’re trying to solve and find the right tools to solve it... Approach this in terms of the change you want to

make rather than the change you want to avoid.”

Identify the pain point that’s most pressing and find a solution provider that helps solve the problem, rather than just selling you a product, Meij advised.

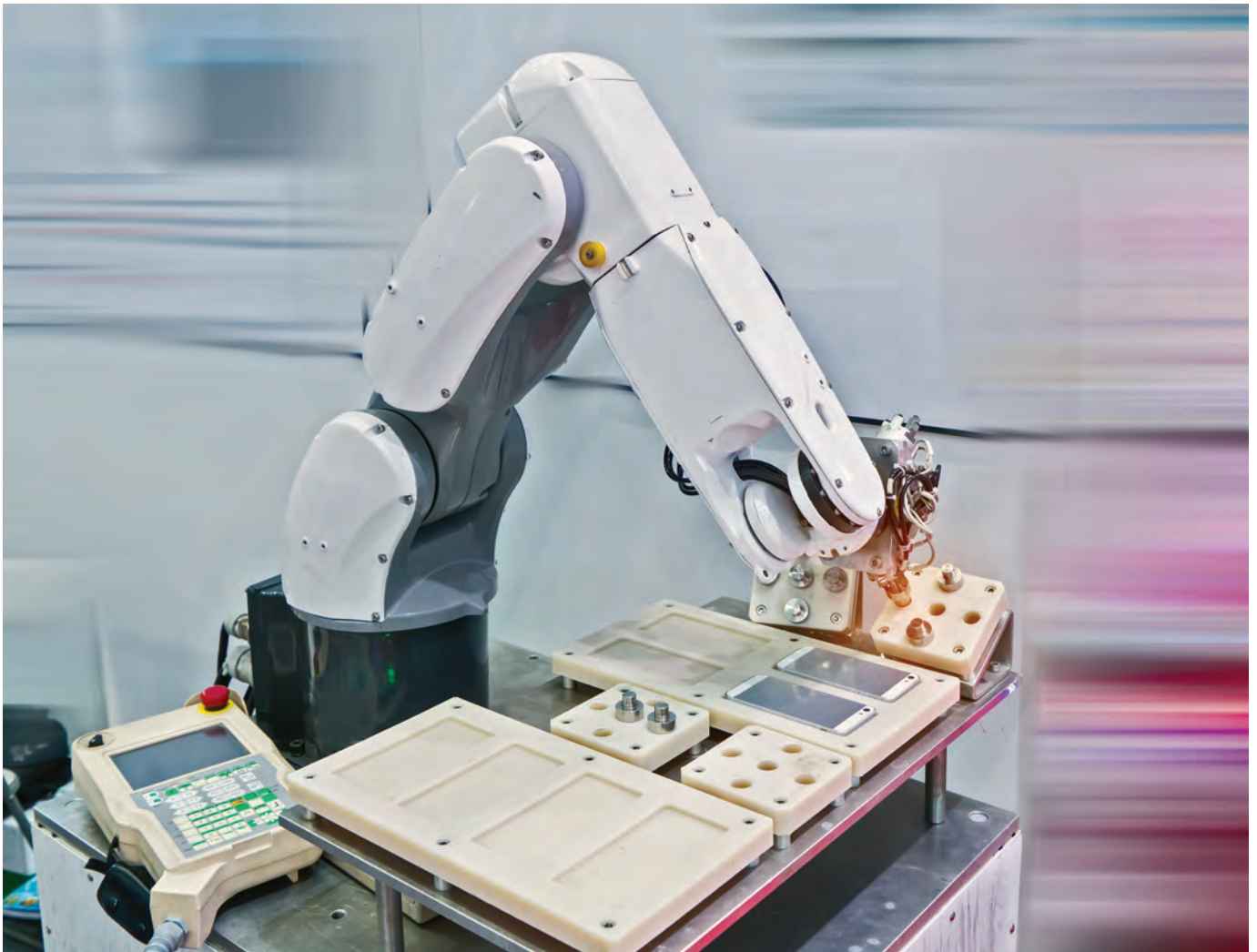
Garrison said in Mississauga, continuous improvement sessions with third party facilitators is starting to achieve buy-in on process improvements from manufacturers who look at adopting technologies where it makes sense.

Watson calls for more government involvement, not just for funding but as a facilitator to bring together the innovators and educators.

Linton highlighted funding. He said interest rates and the tax structure don’t compare well with other countries, while government incentives to help implement and adopt technologies are cumbersome and difficult to access. “If the government could be educated a little more maybe it would change the tax rules and the way that incentives are accessed to encourage technology [adoption].”

Finally, why should manufacturers embark on an Industry 4.0 journey? Because they have to, said Manera who noted the Comprehensive and Progressive Agreement for Trans-Pacific Partnership opens up trade with the Asia-Pacific region, but that door swings both ways.

And the same applies to Canada’s other trade agreements. Small and even medium-sized manufacturers may have seemingly good reasons for holding off on significant technology implementations, but they will be facing competitors that have made or are making those investments. There is no safety zone from global competitors, even for companies serving the domestic market. It’s about levelling the field so Canadian manufacturers can gain advantage through quality, creativity, innovation and service. Advanced manufacturing technologies will drive factories of the future. Companies that aren’t preparing for the future will soon discover the past offers a very short time line.



Senior executives cited increased throughput, reduced downtime and increased product quality as the chief benefits of technology upgrades.

IMAGE: XIAOLIANGGE - STOCK.ADOBE.COM



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