2021 ADVANCED MANUFACTURING OUTLOOK REPORT

Industry 4.0 is here, are Canadian manufacturers ready?

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High-speed industrial communication **empowers smart factories** to achieve the potential of Industry 4.0 and maximize productivity.

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LAPP

MESSAGE FROM **LAPP**

Industry 4.0 has one major driver – data. Machines are often distributed throughout a factory floor, sometimes in remote areas, requiring the relay of data back to the central PLC controller. Many manufacturing environments are expanding from simple counters to more complex temperature measurements, visual inspection instruments, and shop floor as well as overall supply chain management to create a growing volume of data. A robust industrial communication network infrastructure in a factory environment is crucial to providing fast and reliable data transmitted machine-to- machine, facility-to-facility, and organization-to-organization; often across great distance. This new interconnectivity will drive the Supply Chain of the Future, thus leading to customer and supplier transparency from order inception to delivery.

The real benefits come from leveraging these new sources of data throughout the industrial communication network to improve production line efficiency and up-time. With Industry 4.0, development and production processes become more flexible, more efficient and more customer-specific. Product development, production, logistics and customers are intermeshed with the help of the latest intelligent information and communication technology. LAPP is prepared and already actively helping shape the fourth industrial revolution.

As a solution provider for industrial automation technologies, LAPP knows how important it is to understand the environment in which our products are being used now, as well as identify where they could be applied in the future. This is one reason why we pay close attention to the trends in Industry 4.0 – to develop future-ready products ahead of these advances.

LAPP is actively working with customers wanting

to future-proof their factory automation investment, understand their industrial communications requirements and be ahead of the curve by deploying future-ready industrial ethernet (IE) cable standards. With the advanced engineering of LAPP's industrial automation products, we are providing our customers with the solutions that will meet the connectivity requirements and future advances coming with Industry 4.0, thus protecting their smart factory technology investments today.

LAPP North America is a strategic business partner relied on by many US and Canadian manufacturers, providing them with industrial communication solutions to maximize the productivity of their factory floor and facilitate future-ready factories.

Keith Myrick, CTO,
Lapp Group North America,
Florham Park, New Jersey, and Mississauga, Ont.

MESSAGE FROM **ITC**

We are thrilled to be part of this year's Advanced Manufacturing Outlook survey focused on Industry 4.0. We are very grateful to **PLANT** magazine, **Canadian Manufacturing** magazine and Annex Business Media for allowing us to partner with this initiative.

Thank you to all the survey respondents who took the time to share their valuable insights.

For Machines Italia and the Italian Trade Commission it is of paramount importance to be close to Canadian manufacturers, to be able to gather a comprehensive understanding of their functioning, their needs and challenges but also their goals.

In turn, we convey this knowledge to Italian technology solution providers so they can better help Canadian companies improve the efficiency, productivity and profitability of their operations.

While trying not to spoil your reading by revealing all the results of the report, I would like to mention a few interesting findings.

It is encouraging to learn almost half of the survey participants are currently using or have plans to invest in IIoT and advanced smart technologies. Virtually all the Industry 4.0 tool adopters experienced various degrees of benefits including reduced downtime, increased throughput, increased quality of product, product innovation, reduced staff requirements, new revenue streams, reduced time to market and more.

There is a certain consensus among respondents that SMEs – which represent over 80% of Canada's manufacturing industry – are the ones slated to benefit the most from smart technology. So, why aren't more companies investing in it?

The survey respondents mentioned a plethora of reasons, including a lack of familiarity, difficulties integrating the new technology with legacy systems, lack of skills to support investments, lack of financial support, and a lack of support or services from the government.

To this last point, while it is true bureaucracy and red tape are a barrier to accessing government programs, often there is a lack of knowledge of what initiatives are being put in place by local and central administration, consortiums and associations to support the manufacturing sector.

According to the think-thank Osservatorio Internet of Things at the School of Management of the Milano Polytechnical school, in 2019, the rate of smart manufacturing technology and IIoT market growth in Italy was 40% and the segment's market value was estimated at 250 million Euros. This double

digit growth was driven, primarily, by the Piano Nazionale Industria 4.0, a national government support program for manufacturing companies launched in 2017, which included funding and incentives to support investments in innovation and technology. The Piano Nazionale's most popular measure was arguably the 250% hyperammortization of high tech, smart processing technology. Many Italian manufacturers took advantage of this hard to pass up opportunity to upgrade their plants. Among the beneficiaries of the Piano Nazionale were the same machinery and equipment builders that used the newly acquired production tools to boost the innovation content of their technology solution offerings.

At the root of the Industry 4.0 plan was the willingness of Italian manufacturing executives and decision makers to equip their companies with the best possible technology to compete on a global scale against much larger corporations.

In a nutshell ... where there is a will, there is a way!

I hope you find the Advanced Manufacturing report interesting and I hope it serves you well to plan your next smart investment strategy.

And remember, whatever your future technology demands may be, make sure you visit **www.machines.org** to find out what Italian machinery manufacturers can provide you with.

Distinti saluti,

Matteo Picariello
Italian Trade Commissioner – Canada

EXECUTIVE SUMMARY

The COVID-19 pandemic has thrown Canadian manufacturers a curve ball, as they adjust to an economic downturn brought on by the virus, new supply chain pressures and a huge number of operational changes needed to comply with new regulations to keep staff safe from the virus.

However, in the face of these challenges, manufacturers are still investing in and adopting advanced technologies to optimize processes, improve productivity and create value for their stakeholders. This is according to the 2021 Advanced Manufacturing Outlook survey, which measured Industry 4.0 engagement among 183 manufacturing business owners and senior executives.

For a second consecutive year, research firm R.K. Insights in Toronto conducted the survey through June and July for **Canadian Manufacturing** and **PLANT** magazines, in partnership with our sponsors Machines Italia (The Italian Trade Commission), Lapp Group North America and Alps Welding Ltd. The margin of error is +/- 6%, 19 times out of 20.

Industry 4.0, as defined in our survey, 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 examined how manufacturers regard these technologies and how they are adopting them. The trends were generally positive compared to last year. More companies are applying IIoT or planning to invest in this technology. Also, technology investments haven't slowed much despite the pandemic, as over half of respondents said their plans haven't changed. However, there are challenges, most notably a lack of skills and talent to support investment and make technology work for businesses. Other hurdles include a lack of financing and support from government, difficulties integrating advanced technology into legacy systems, a lack of adequate information about advanced technologies, struggling with where to begin, and of course, cost.

Eighty-two per cent of companies see IIoT as an opportunity for growth, 72% said the c-suite supports Industry 4.0 and only 15% don't see the value of investing in new technologies.

However, manufacturers understand that the road to digitization is not easy, as 82% believe Industry 4.0 is a great concept but hard to implement. Only 1% of respondents reported operations that are "primarily machine driven", while 13% said they have no automation systems in place, and the rest identified with varying levels of automation.

The top IIoT applications are improving efficiency and productivity (41%), improving maintenance functions (29%), analytics (28%) and tying in business data from the shop floor to the top floor (27%). Thirty-seven per cent are not currently applying IIoT capabilities, which is down from last year (47%).

Fifty per cent of manufacturers aren't changing their planned technology spend based on the pandemic, while 35% are decreasing their spend and 15% are increasing it. In the next three to five years, manufacturers plan to spend on robotics and automation (49%), data capturing (46%), cloud (42%), analytics (41%) and 3D printing (38%). Those who are spending over this period are expected to invest an average of $1.4 million.

The most significant benefits of technology upgrades are reducing downtime (38%), increased throughput (34%), increased quality of product (33%) and product innovation (28%).

However, 19% are not convinced of the economic benefits of advanced technology and 41% said resistance to change is an issue in their organizations.

When it comes to managing change, 34% of companies described themselves as somewhat experienced, while only 9% said they had vast experience. Twenty-five per cent are using a formal change management strategy, while most respondents (56%) are training to upskill, 33% are hiring new talent and 25% are bringing in external consultants.

To collect and manage data that powers operations and decisions related to technology investments, 70% of respondents are using spreadsheets such as Excel, 48% use accounting packages, enterprise resource planning (ERP) accounts for 31%, material requirements planning (MRP) systems are used by 24%, and 32% are still using manual paperwork. Eighteen per cent are employing sensors to capture big data.

Most executives are concerned about the safety of this data (72%). 26% are not concerned about cybersecurity. 68% reported being the victim of a cyber-attack, with phishing (54%) the most common type.

Sixty-one per cent of respondents are using security infrastructure to protect against attacks, 53% are using data privacy controls, 33% have a formal cybersecurity strategy and 31% are employing risk assessments or reviews. 68% think they have done enough to protect their business from cyber-attacks, 32% don't.

The biggest threats associated with not investing in Industry 4.0 are falling behind peers (68%), pricing pressures (46%) and low margins (40%).

Will Mazgay, Editor, **Canadian Manufacturing** magazine


ber Physical Systems

ADVERSITY, MEET INGENUITY

The challenge of 2020

By Will Mazgay, Editor,
Canadian Manufacturing magazine

IMAGE: ZAPP2PHOTO – STOCK.ADOBE.COM

It has been a tough year for Canadian manufacturers. A global pandemic hit our shores in March, causing unprecedented shutdowns across the sector and battering our economy.

Since then, manufacturers have had to learn to operate around COVID-19. New cleaning procedures, socially distanced work stations and revamped sick leave policies are pillars of this new normal for plant operators, as the virus tests the flexibility, ingenuity and tenacity of businesses continuously.

While the coronavirus has put intense pressure on day-to-day operations, the pandemic has squeezed not just Canada's economy but economies across the globe. Businesses are recovering from spring shutdowns and bracing for an uncertain future where supply chains and business relationships will be tested in ways previously unimagined.

As industry faces the challenges brought on by this crisis, can advanced manufacturing technology provide solutions? And if tools such as the industrial internet of things (IIoT), robotics, automation, and digital data gathering and storage can help manufacturers steer through the pandemic, are business owners ready to embrace them?

The Excellence in Manufacturing Consortium

In terms of operational excellence and execution, Canadians really have a high tolerance for inefficiency.

– Mark Corker

(EMC), a manufacturing network based in Owen Sound, Ont., conducted a recent study of Canadian manufacturing employers and found that 71% of companies don't have a digital adoption strategy in place, and 80% aren't ready to implement one in the next 12 months.

We at **Canadian Manufacturing** and **PLANT** magazines deployed our own study of manufacturers this summer. The 2021 Advanced Manufacturing Outlook survey, our second examination of how companies view and engage with technology, showed some encouraging emerging trends, quite surprising in the face of so much adversity, but also revealed Canadian industry has a long way to go before fully embracing the factory of the future.

We polled 183 senior executives and manufacturing business owners to measure their engagement with automation, digitization and other facets of Industry 4.0. We asked what technologies these firms were investing in, how they are capturing and using data, and how their leadership teams are handling implementation of technology and the challenges associated with adoption.

RK Insights conducted the survey, in partnership with our sponsors Machines Italia (part of The Italian Trade Commission), Lapp Group North America and Alps Welding Ltd.

Who took our survey?

The companies represented by the survey participants are overwhelmingly based in Ontario (58%), 20% are in western Canada, 14% are located in Quebec and 4% represent Atlantic Canada. The majority of firms are small, with 52% employing less than 50 people. Of the 48% of companies that employ more than 50 people, 24% have 50 to 249 employees, 10% have 250 to 499 and only 3% have 5,000 or more. The majority of firms (54%) average more than $10 million in total domestic revenue, but of the 46% of the firms making less than $10 million 35% are making less than $5 million.

Representatives from this collection of firms have a positive view of advanced manufacturing technologies, with 87% agreeing that emerging technology helps small companies compete globally and 82% seeing IIoT as a growth opportunity. Seventy-five per cent say upper management supports Industry 4.0, and only 15% don't see the value in investing in new technologies. Also, 63% are at least somewhat concerned for the future of businesses that don't invest in Industry 4.0 (23% are very concerned). This is an uptick from last year's survey when 53% of respondents expressed some level of concern for businesses not embracing new technology.

However, 82% of respondents also agreed that while Industry 4.0 is a great concept, implementation is challenging. Data is complicated and requires special knowledge for 73%. Sixty-five per cent see technology investment increasing cybersecurity risks, and 62% believe machinery replacement is a massive investment that will cause downtime they can't afford.

In spite of these challenges, respondents are still investing in technology, with 60% planning to increase their spending over the next three years. While this might sound surprising in the face of a global pandemic, 50% said COVID-19 has made no impact on their intended technology spend, and 42% said the timeframe for their technology spend hasn't changed because of the pandemic (14% are actually expediating tech investment). Those planning to invest over the next three years will spend an average of $1.4 million.

Significantly, 30% of respondents identify as currently applying IIoT capabilities, defined by our survey as interconnected sensors, instruments and other devices networked together with computers' industrial applications, including, but not limited to, manufacturing and energy management. A further 14% plan to invest in these technologies over the next 12 months. These figures are notable increases from last year's survey when 24% were currently applying IIoT and only 8% had plans to invest.

THE FACTORY OF THE FUTURE

To help contextualize the results of our Advanced Manufacturing Outlook survey, we gathered 12 industry experts in a virtual roundtable held on Aug. 24. They discussed where Canadian manufacturers are in terms of Industry 4.0 adoption, the pain points and challenges they are experiencing, and what the future looks like.

DEMOGRAPHICS

RESPONDENT PROFILE

Those who participated in the survey were overwhelmingly male (92%), senior manufacturing executives and managers (average age 55.5 years) who for the most part have a management only role in their companies (42%). Owners comprise 34% of the sample, 10% have a minority ownership stake and 7% are in an equal partnership. Most companies (54%) have revenues greater than $10 million. Fifty two per cent have fewer than 50 employees, part of the 86% of companies that are SMEs, but the average number of employees overall is 441.

NUMBER OF EMPLOYEES

117 replies

Less than 50	**52%**
50+	**48%**
50 – 249	**24%**
250 – 499	**10%**
500 – 999	**8%**
1,000 – 4,999	**3%**
5,000 or more	**3%**

COMPANY REVENUE – 110 replies

$1M to <$5M	**35%**
$5M to <$10M	**12%**
$10M to <$30M	**20%**
$30M to <$50M	**10%**
$50M to <$100M	**7%**
$100M to <$250M	**6%**
$250M to <$500M	**4%**
$500M to <$1B	**4%**
$1B plus	**3%**

LOCATION

118 replies

Yukon / NWT / Nunavut **<1%**

British Columbia **9%**

Alberta **8%**

Saskatchewan **<1%**

Manitoba **3%**

Ontario **58%**

Quebec **14%**

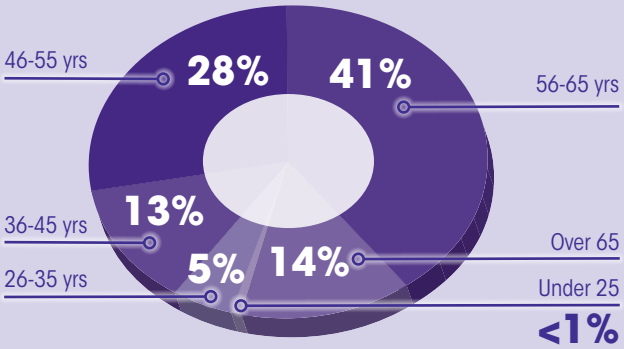
New Brunswick **3%**

Nova Scotia **1%**

Newfoundland & Labrador **1%**

PEI **<1%**

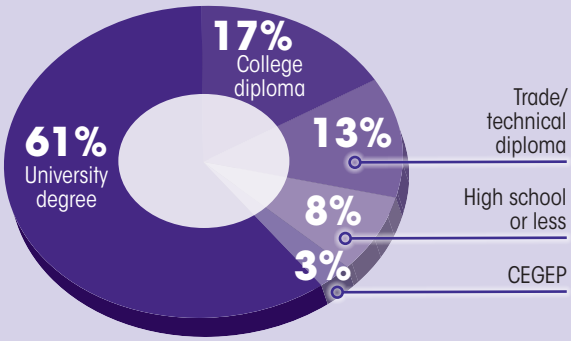
AGE – 120 replies



INDUSTRY SECTORS – 119 replies

Industry	%
Fabricated metal product	**21%**
Machinery	**13%**
Computer and electronic product	**13%**
Miscellaneous manufacturing	**12%**
Plastics and rubber products	**8%**
Electrical equipment, appliance and component	**8%**
Food manufacturing	**7%**
Wood product	**7%**
Transportation equipment	**7%**
Aerospace product and parts	**6%**
Motor vehicle parts	**5%**
Life Sciences	**5%**
Environmental	**5%**
Chemical	**4%**
Motor vehicle	**4%**
Paper manufacturing	**3%**
Durable goods industries	**3%**
Printing and related support activities	**3%**
Petroleum and coal product	**3%**
Ship and boat building	**3%**

EDUCATION – 119 replies



FLAGS: ADOBE STOCK

Steve Loftus began the discussion by talking about the gradual adoption of advanced manufacturing technology. He is the president of Innovative Automation, a Barrie, Ont.-based automation solutions provider.

"I think it will be a gradual growth," Loftus said. "People have to be ready, they have to be educated, look for the cost benefit and then move forward. I would call that slower growth, but it is substantial and it is moving in the right direction."

Jayson Myers leads Next Generation Manufacturing Canada (NGen) in Hamilton, Ont., the not-for-profit corporation managing Canada's Advanced Manufacturing Supercluster. As the organization's chief executive officer, he will oversee more than $500 million of federal money over the next three years that will help fund collaborative, industry-led advanced manufacturing projects.

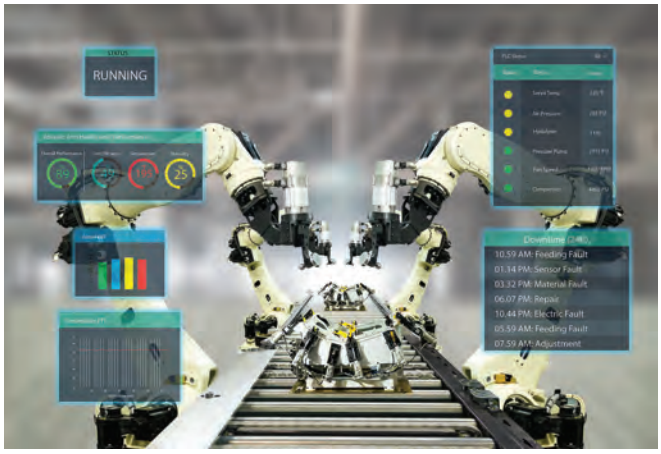
He said the pandemic presents an opportunity for businesses to re-examine how their operations are structured and staff are deployed. "We now have at least 40% of our staff working well offsite … All these tools [such as Zoom and other video communications platforms] are incredible in terms of maintaining culture, even though we're distant."

Irene Sterian is the president and CEO of ReMAP Network, a Toronto-based technology accelerator that is working with Canadian manufacturers to enable innovations to help fight COVID-19.

Sterian elaborated on the shift to remote work. "I see a shift between physical and digital. People who are essential need to be on the manufacturing floor and work day-to-day [while] support staff such as engineering and supply chain are the digital shift [working remotely]."

Technologies are leading to more of a service focus for manufacturing.

– Jayson Myers



30% of respondents are currently applying IIoT capabilities.

IMAGE: MONOPOLY919 - STOCK.ADOBE.COM

Sterian explained that more remote work will push more IIoT, more sensors deployed, and more data collected and managed.

Keith Myrick is the chief technology officer for New Jersey-based Lapp Group North America, an industrial cable and connector manufacturer. He identified a move toward manufacturing execution systems (MES) – computerized systems that track and document the transformation of raw materials into finished goods – to manage the shop floor, along with predictive maintenance and digital twins – simulations of machinery that update and change as their physical counterparts change).

"[Manufacturers] are looking to be able to analyze and solve problems on a remote basis and understand the operations and how the operations are moving forward and functioning every day. The whole drive will be around ensuring they can gain efficiencies and continue to improve their operations while maintaining a minimal amount of staff in a facility. This is the new normal. It takes a fundamental shift in mindset"

Mark Corker is the executive director of MTech Hub, a Burlington, Ont.-based non-profit manufacturing accelerator focused on Industry 4.0 innovations. MTech's industry partners include Seradex, Microsoft, Soctia Bank, Bell Mobility, Dell, 3CX and Logitech.

Corker said one of the unintended consequences of the pandemic is a shift away from paper, which can physically infect people when it is passed around a workplace.

"Even basic things like printing, stuffing, mailing cheques – 90% of Canadian manufacturers are still using paper. By going digital on the payment side, we're negating having to have people in the office handling paper, handing it to the post office, receiving it on the other end. So, it's just accelerating the move to digitize some paper-based processes just because it's safer."

"We are hitting an inflection point in the adoption of manufacturing technology," according to Dennis Dussin,

DEMOGRAPHICS (continued)

TITLE – 120 replies

Owner / Partner	26%
CEO / President	24%
Design Engineering	13%
Vice-president	11%
Production / Operations Manager	11%
Plant Engineering	9%
Administrative Management	8%
Director	6%
Quality Assurance Manager	5%
Safety Manager	5%
Technician / Technologist	3%
Maintenance Manager	3%
Plant Manager	2%
Purchasing / Supply Manager	2%
Logistics Manager	2%
IT / Systems Manager	2%
Materials Manager	1%

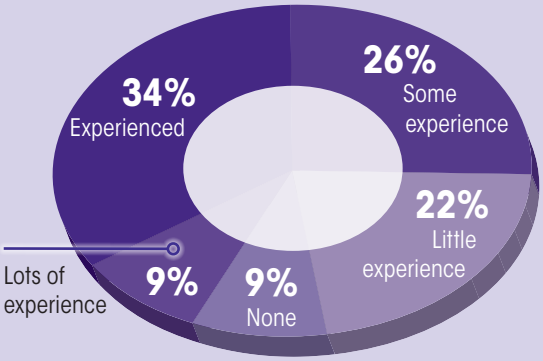
ORGANIZATION

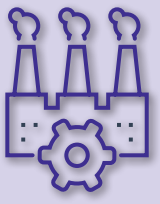
CHALLENGES IMPLEMENTING TECHNOLOGY – 116 replies

- **60%** Funding challenges
- **47%** Lack of skilled talent
- **41%** Resistance to change
- **40%** Integrating with legacy technology
- **33%** Pressure to deliver short-term results
- **27%** Lack of leadership vision
- **20%** Too many technology choices and unsure where to start
- **19%** Difficulty keeping pace with the rapid pace of change
- **19%** Fear of failure
- **10%** Not sure how to access available resources

CHANGE MANAGEMENT EXPERIENCE

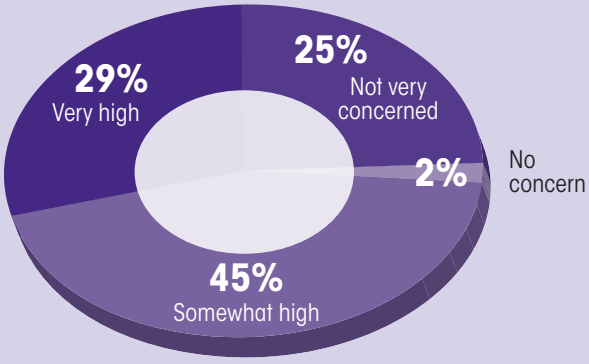
122 replies





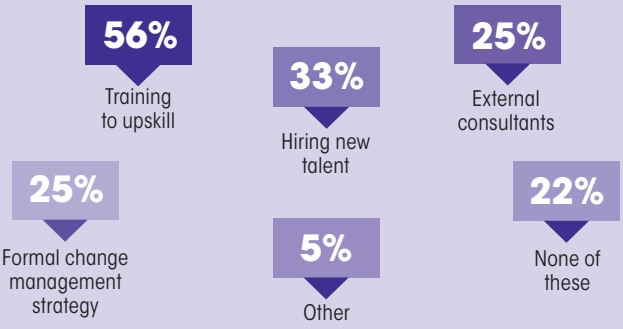
CONCERN ABOUT BUSINESSES NOT INVESTING IN INDUSTRY 4.0

121 replies



HOW EMPLOYEE ENGAGEMENT IS MANAGED

122 replies



president of Alps Welding, a Woodbridge, Ont.-based metal fabricator and pressure vessel manufacturer.

"The workforce is expecting new technology. As managers, we don't have to worry as much about how are we going to convince people to use technology. We have to worry more about how we are going to keep up with the tools people want and request. The people I'm hiring now were born in the 1990s."

Hurdles and hesitations

While the shift to remote work and a younger workforce are pushing the manufacturing sector towards a digitized future, our panelists stressed there are still many hurdles for firms to clear as they attempt to integrate advanced technologies into their operations.

Mike Tidy, general manager of the Digital Solutions division at Cambridge, Ont.-based automation system manufacturer ATS Automation Tooling Systems Inc., explained some of the issues that trip up businesses before they even get started, such as, "a perception of availability,

Having [supervisors] well-trained, having them understanding the basics of problem-solving, continuous improvement, and lean will lead to [well-thought-out] projects.

– Jean-Pierre Giroux

INVESTMENT

AVERAGE SPEND OVER 3 YEARS **$1.4 MILLION**

($1.5 million in 2020)

TECHNOLOGY PRIORITIES	2020	1 Y	3 Y	5 Y
Robotics, automation	49%	24%	20%	7%
Data capturing	46%	33%	11%	8%
Cloud	42%	26%	16%	3%
IIoT	41%	22%	15%	9%
Advanced analytics	41%	18%	20%	9%
3D printing, additive manufacturing	38%	14%	17%	11%
Digital transformation	38%	22%	12%	6%
Artificial intelligence	34%	13%	13%	14%
Virtual reality	28%	8%	8%	12%

183 replies

INVESTMENT DRIVERS

130 replies

- **9%** Want custom solutions
- **25%** Buying what's available based on needs
- **48%** Both
- **15%** Neither
- **2%** Other

SUPPLIER OFFERED SHARED RISK RE:TECHNOLOGY

129 replies

YES **36%** NO **64%**