2021 ADVANCED MANUFACTURING OUTLOOK REPORT

Industry 4.0 is here, are Canadian manufacturers ready?

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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%**

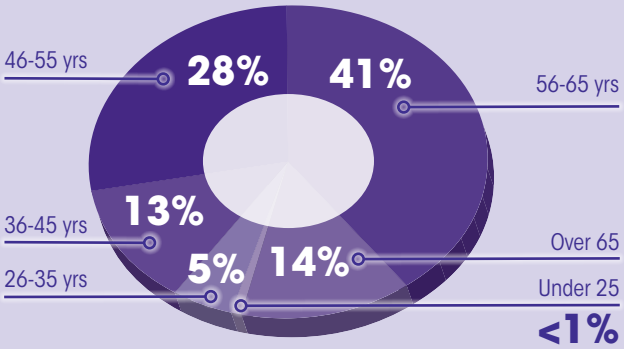
New Brunswick **3%**

Nova Scotia **1%**

Newfoundland & Labrador **1%**

PEI **<1%**

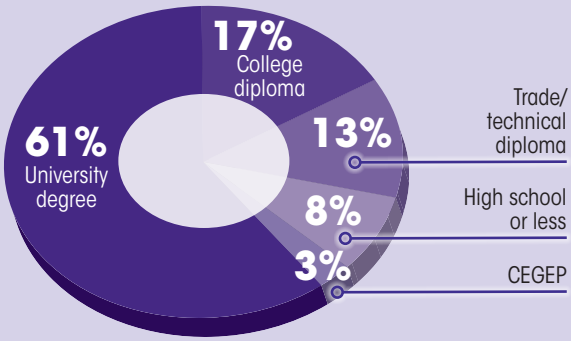
AGE – 120 replies



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.

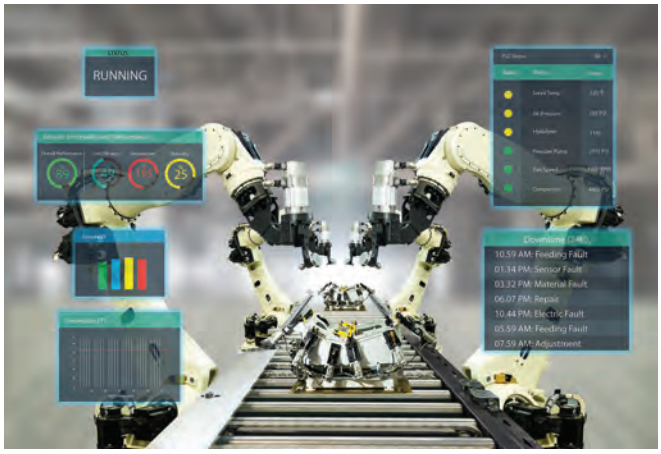
He said the pandemic presents an opportunity for businesses to re-examine how their operations are structured and staff are deployed. "We now have at least 40% of our staff working well offsite … All these tools [such as Zoom and other video communications platforms] are incredible in terms of maintaining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

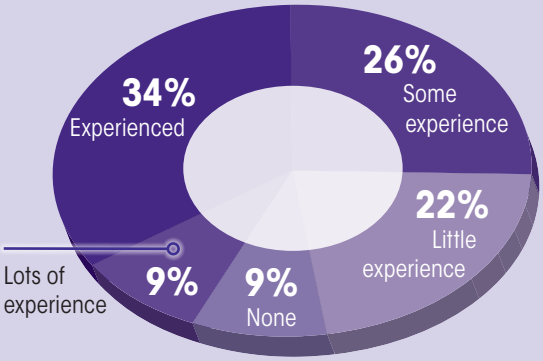
ORGANIZATION

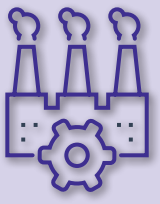
CHALLENGES IMPLEMENTING TECHNOLOGY – 116 replies

- **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

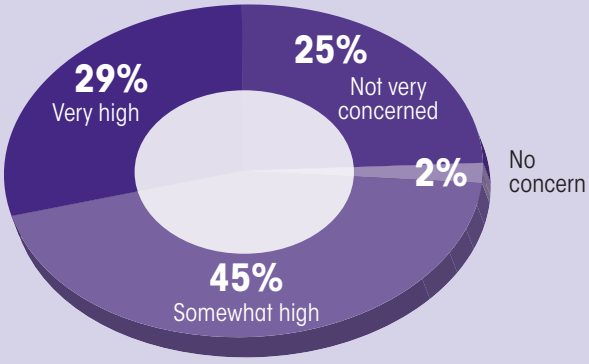
122 replies





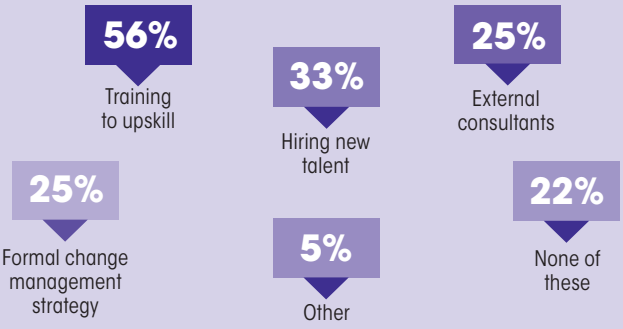
CONCERN ABOUT BUSINESSES NOT INVESTING IN INDUSTRY 4.0

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%**

[a lack of] ease of deployment, confusion in the market with lots of different tools and different suppliers, and a weak or nonexistent IT function within smaller firms that maybe can't afford to have those people available to help."

Matteo Picariello, Italy's trade commissioner to Canada, also spearheads Machines Italia, a project that helps connect Canadian manufacturers with Italian machinery. He believes the size of the company has a lot to do with how comfortable it is with new technologies.

Picariello explained, "In Italy, a few years ago, had a huge government funding to support IIoT digitalization. We found that out of the companies with more than 50 employees, 98% apply for these [funds], while companies under 50 employees, it was less than 50%."

THE VALUE OF TECHNOLOGY

Areas of IIoT use that are still lagging among our respondents are developing new products (16%) and developing new services or revenue streams (18%). However, among those who identify as currently applying IIoT, 31% are developing new services and 27% are developing new products.

Sterian said, "That may be a problem around product design and development and the capacity we have in Canada versus other places. A lot of companies manufacture, they don't design their own products. We need to link manufacturing a lot closer to design."

Myers observed, "New technologies enable a much more rapid approach to product design and engineering development, as well as much greater flexibility to manufacture more customized types of products. But it's how the data is used to create customer value that really counts," he said "Technologies are leading to more of a service focus for manufacturing."

Scott McNeil-Smith is EMC's vice-president, Manufacturing Sector Performance. The organization contributes knowledge, expertise and resources to more than 13,000 member manufacturers across Canada.

He raised the example of an EMC member company in

GREATEST THREAT IF NOT INVESTING
117 replies

Falling behind the competition	**68%**
Pricing pressure as a result of commoditization or automation	**46%**
Low margins	**40%**
Customer losses	**34%**
Disruption by industry outsiders	**29%**
Other	**6%**

INVESTING PRIORITY OVER THE PAST 12 MONTHS	%	AVERAGE
Data capturing	73%	$68,700
Cloud	65%	$61,000
Robotics, automation	56%	$129,800
Digital transformation	55%	$75,000
IIoT/M2M	49%	$65,600
3D printing, additive manufacturing	33%	$58,700
Artificial intelligence	30%	$60,800
Virtual reality	21%	$50,900

140 replies

PANDEMIC IMPACT – 130 replies

CHANGE IN INVESTMENT LEVEL		TIMEFRAME	
Decrease	35%	Longer	44%
No change	50%	No change	42%
Increase	15%	Brought forward	14%

Continued on page 17

Only 8% of 2021 Advanced Manufacturing Outlook respondents are female. Five per cent are 35 and under compared to 41% who are between 56 and 65.

IMAGE: ROGER - STOCK.ADOBE.COM

RECRUITING

Youth QUAKE

How manufacturers can increase interest in advanced manufacturing

By Alanna Fairey, Associate Editor, **Canadian Manufacturing** magazine

In an industry that is constantly evolving, there's an expectation manufacturers should invest in new technologies that reflect the times.

According to the 2021 Advanced Manufacturing Outlook survey, 56% of manufacturers are currently training to upskill employees as they implement of these new technologies.

Next Generation Manufacturing Canada (NGen) CEO Jayson Myers said that tremendous labour constraints are leading to more technology adoption.

"These are all economies with huge constraints around the amount of people going into manufacturing labour pool," Myers explained during **Canadian Manufacturing** and **PLANT's** 2021 Advanced Manufacturing Outlook roundtable.

"In Canada, we've got 25% of the workforce retiring by 2030. And if you look at the first generation cohort coming into the manufacturing workforce, that is about 6% of the entire manufacturing labour force in Canada."

If this trend continues, he predicts manufacturers will need a 30% increase in productivity to maintain current levels of output.

"The adoption of digital and advanced technologies is really becoming much more of a priority because of the many labour shortages and constraints to accessing people. The technology requires a very different approach to the skills and the capabilities of the workforce," Myers said.

Not all manufacturers share his enthusiasm for advanced manufacturing technologies.

Noting 41% of the respondents are in the 56-65 age demographic, the survey shows 44% believe that decision-making at their company is in the hands of elders who are frightened of change. Meanwhile, 15% do not see the value in investing in new technologies at their age.

Reasons for not investing in advanced manufacturing technology are a lack of skilled talent (47%), resistance to change (41%) and a lack of skills to support the investment (28%).

Dennis Dussin, president of Alps Welding Ltd., said that the investment of new technology does not eliminate the need for staff, but rather creates the need for different kinds of employees with different skill sets.

"I think that's maybe a false promise of technology – that you're going to somehow have massive efficiencies in the number of people you need, but it doesn't work that way. You have to hire more people to maintain [the technology], more people to implement it and different people trained to operate it. [Technology] doesn't reduce the staff requirement – it leads to other benefits."

According to the survey results, 33% of manufacturers are hiring new talent to pave the way for a new generation of employees.

Speaking on behalf of Myant Inc., marketing director Hannah Fung said there is a perception – especially among young people – that manufacturing is "standing on the line. "

"There's a perception problem that we as an industry need to solve, along with the academic institutions, to provide proper training that's relevant for advanced manufacturing, but also to develop curriculum specifically to support it," Fung explained. "That is very challenging and requires a lot of coordination between industry, academia and government."

Fung said Myant is finding it challenging to recruit young talent locally, as the textile industry in Canada is not as strong as it is in other parts of the world.

"We're hiring people from Southeast Asia, South Asia, South America – wherever that talent is, we have go get them. The truth is at the end of the day, we'd like to grow that talent here. We want to hire new talent. That requires training and so much groundwork. We're not nearly where we need to be yet."

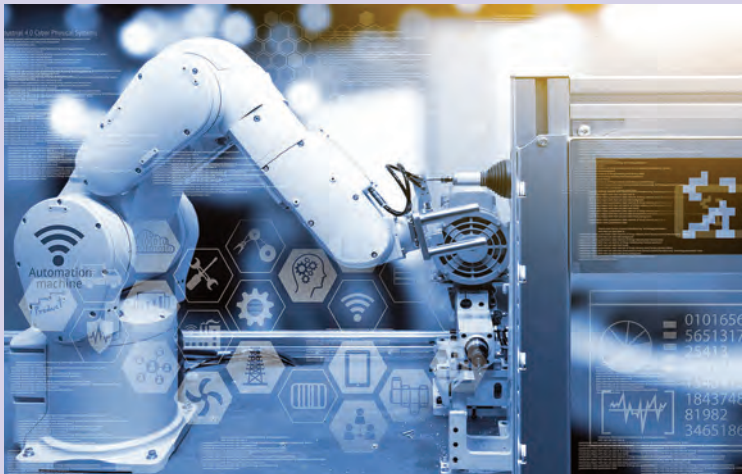
Italy's Trade Commissioner to Canada, Matteo Picariello, agreed the younger demographic has an old-fashioned idea about working in manufacturing.

While this issue is also prominent in Italy and other parts of Europe, Picariello said Germany is an exception due to its "fantastic" apprenticeships.

"They [Germany] have all these technical schools, which have 90% employment after the kids leave and it is very efficient," Picariello explained. "They set up a similar system in North America, and they're building up their own training schools for all their [manufacturing] subsidiaries there, which is a system that's working.

"From the system provider and from the IIoT manufacturer [perspective], we need to do a lot in order to tackle a different way of training and attracting the young people."

Several advanced manufacturing companies offer co-op opportunities to students as a means to close the generational gap and put an end to the misconceptions about the industry.



33% of manufacturers surveyed are hiring new talent.

IMAGE: ZAPP2PHOTO - STOCK.ADOBE.COM

On a mission

For Innovative Automation President Steve Loftus, offering co-ops and jobs to students is a personal mission. His philosophy? If he hasn't trained as many people as he has employed, he is "a robber."

"We've taken a lot of time from an HR perspective to make sure – whether it's day one of their first co-op or a 15-year employee – they're productive and adding value to the company. Every time that happens, it creates an

15% of manufacturers don't see the value in investing in new technologies.

IMAGE: BLUE PLANET STUDIO - STOCK.ADOBE.COM

opportunity for some other young person to step up and grow their skill set."

The Excellence in Manufacturing Consortium (EMC) has an agreement with the federal government to receive a thousand placements in co-ops, which in turn provides incentives to employers. According to EMC President Jean-Pierre Giroux, this opportunity was designed to help the manufacturing sector create more opportunities for youth.

"I know a lot of companies are using co-op, but we're hoping to bring in the smaller and the medium-size companies that make connections with universities and colleges with the hope it brings youth to manufacturing, knowing the demographics we're facing."

Mike Tidy, general manager of Digital Solutions at Cambridge, Ont.-based ATS Automation Tooling Systems Inc., said ATS offers co-ops as a way to help train new talent, then see if there's a match and an interest in the organization.

"We have heavily invested in co-ops in a variety of different places … That backs the discussion of our post-secondary education institutions and preparing people for work," Tidy said. "I think the co-op program is a great way to leverage that, and it's something we do a significant amount of, as well as providing the training."

While co-ops help to provide experience to youth and train them for working in the field, Jason Dowd, CCRM vice-president of science and technology, argues co-op programs are not long enough to fully train new talent. "By the time I've trained them, they're out the door. Co-ops need to be at least a year."

Noting Canada does not have robust apprenticeship programs, Dowd praises the German model for apprentice programs and believes Canada should be looking to other countries to see what they're offering in terms of co-ops and apprenticeships.

"It might be good to see what reports are generated in model countries, where things work well," Dowd added. "Germany seems to have a lot of mid-sized companies and it appears to be uniform across the country."

Acknowledging the importance of co-ops, Irene Sterian, CEO of ReMAP Network, highlighted another challenge the Canadian market faces – a lack of manufacturing-focused incubators and accelerators, where employers can find young talent.

"There's too much emphasis on the software and AI type of incubators," she said. "You need a mix of that talent and you need someplace to draw from."

Sterian cited Waterloo, Ont.-based Communitech and its VeloCity hub, an incubator for early-stage, pre-seed tech startups that helps commercially experienced graduates with co-op work experience.

Communitech previously offered another program called Foundry, which is now obsolete, making the list of manufacturing programs for youth even more limited.

"Other than colleges and universities that have manufacturing-focused labs, we don't have that kind of talent, that sort of capacity or a place to develop that talent," Sterian said.

Myers acknowledged there are education and training systems in Canada, where parts of the solution are provided, "but not the whole thing." He emphasized the need for a more integrated system.

"We need to have some way of integrating both the business and the tech sides, recognizing that operating systems are changing at the same time."

That requires manufacturers to be proactive and as part of the education system, provide work-integrated learning opportunities to engage with young people and show them there really are great careers in manufacturing.

Continued from page 13

Prince Edward Island that has learned to harness data to improve its bottom line. It has traditional manufacturing processes on a fairly small scale, and the company's first step was to look at process and productivity improvement through Lean and other methods. From there it got into metering and gathering more detailed measurements and data points from its production lines. "Now they're at a point where they're collecting a few thousand data points every day."

He said the company is looking at artificial intelligence and other analytics to help crunch the numbers and take it to the next level.

"They're using the technology to help bump up how many widgets they can get out the door, and getting them out the door faster with lower production costs. That's a progression that we're seeing with many smaller companies as they go through this process," McNeil-Smith concluded.

"Every company that produces hard goods is looking for ways to increase the revenue stream," said Tidy, who sees ATS as more of a service business, providing services for the machines it sells. "We're helping with your reliability, operational excellence services and software."

He said having a data stream and using IIoT is one way of tracking knowledge from almost cradle to grave. "It allows the companies to open up that broader spectrum of services they can offer that are great ways of generating high-margin revenues."

KNOWLEDGE IS POWER

Loftus said analytics are crucial to make the right decisions and pick the right technology implementations. "For any proper business plan, I need to collect information that's factual and stop with the gut-feel. The only way to properly do that is to collect that information and do the analytics on it and understand where the lowest hanging fruit is."

16% of respondents are developing new products.

IMAGE: WLADIMIR1804 - STOCK.ADOBE.COM

[On security] There's training to be done with people on new systems, so they learn what the proper protocol is for behaving. It's protecting the integrity of the entire ecosystem.

– Hannah Fung

He explained that collecting, analyzing and making decisions based on data "minimizes the investment for your company and it maximizes your return."

This appears to be something our survey respondents recognize as their use of analytics has risen to 28% compared to 14% in last year's survey.

Hannah Fung is the marketing director of textile manufacturer Myant Inc. The Etobicoke, Ont., company knits sensors and actuators into textiles, giving them the ability to sense and react to the human body. She said increased analytics functionality can be explained by "the fact that you must have more people on board with IIoT."

Jason Dowd is the vice-president of science and technology for CCRM, a Toronto-based accelerator that develops and commercializes cell and gene therapies and regenerative medicine technologies. He believes when it comes to engagement with analytics, equipment manufacturers have really stepped up their game. "We have companies that are providing pieces of equipment where every piece of data that's generated will go back to their headquarters.

"They often have proprietary tech embedded in their equipment. At least two in our labs right now send back information about: who is running [the equipment] when, what was the protocol run on it, and all the rest, so they get that constant harvesting of data."

Myrick said, "Analytics also play a heavy role in companies trying to shift from preventive maintenance to predictive maintenance type operations, and trying to understand how equipment is running, what their failure points are."

Every company that produces hard goods is looking for ways to increase the revenue stream.

– Mike Tidy

Tidy said more integrative software that has the ability to communicate across different systems has helped foster engagement with analytics.

"It's one thing if I'm collecting data, but if I can't talk to the other machines collecting it or even interface with my other systems to aggregate the data, that becomes a bit of an issue. We're starting to see that being overcome."

Managing the data

To capture and manage the crucial data required for advanced manufacturing operations, 69% of respondents are using spreadsheets, enterprise resource planning (ERP) makes up 31%, material requirements planning (MRP) systems are used by 24% and 32% still use manual paperwork. Only 18% are employing sensors to capture data.

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

"In Canada, 90% of small and midsize manufacturers aren't even using barcoding on the shop floor. So, we've got a way to go to get things like ERP and MRP implemented. Then the challenge will be how do we integrate that with the sensors and IIoT."

Myrick, describing ERP as an Industry 3.0 technology, said it's a last era system that should have been developed more.

"The problem has become a lot of your ERP systems are a cookie-cutter, one-system-fits-all approach … Unless you have the resources to really invest in making the ERP system or MRP system work for you, the system is not helping enhance your business and how it operates."

Dussin sees a lot of companies that have bought an MRP or ERP system, but people aren't necessarily using them because the process on the shop floor hasn't changed. Paperwork systems alongside ERP systems create parallel processes. "If you're not going to change the way you do things, the technology isn't going to be used or isn't going to help you."

Tidy agreed, "If you don't have proper operational procedures and aren't making enhancements and improvements on that, it makes no difference."

Use of sensors and big data was much higher among respondents who are applying IIoT (47%), and Myers said this makes a lot of sense. "The companies that do adopt Manufacturing 4.0 systems are further ahead [in data collection], but we've got a lot of companies that have yet to enter into the realm of Manufacturing 3.0."

Cloud 9

With respect to storing data, 65% of respondents have invested in cloud technology in the last 12 months, 42% plan to invest over the next three to five years and 47% use cloud systems to store operational data (this is 69% for those who identify as currently applying IIoT).

Myrick said the move to cloud is encouraging. It means that security concerns around cloud storage are being solved. He explained, "A lot of reluctance to put information on the cloud in the past was more a fear of protecting intellectual property. Now as solutions start to emerge, and they demonstrate their security, it will continue to be more and more adapted as we go forward in the future."

Corker said one barrier to cloud adoption is Canada lagging in getting internet bandwidth to factories. "[There] are lot of bandwidth bottlenecks in place right now."

"If we look at what options are available for operational data, I would always start with the business case first, then figure out where you want to put it. Whether it's on-premise or cloud, whatever's going to work out well for you."

Corker said more manufacturers need to adopt ERP, sensors and more sophisticated data gathering. "That infrastructure's got to be underway before we can really take advantage of using cloud for anything."

Use of anlyatics has risen to 28% compared to 14% in last year's survey.

IMAGE: ANDREY ARMYAGOV - STOCK.ADOBE.COM

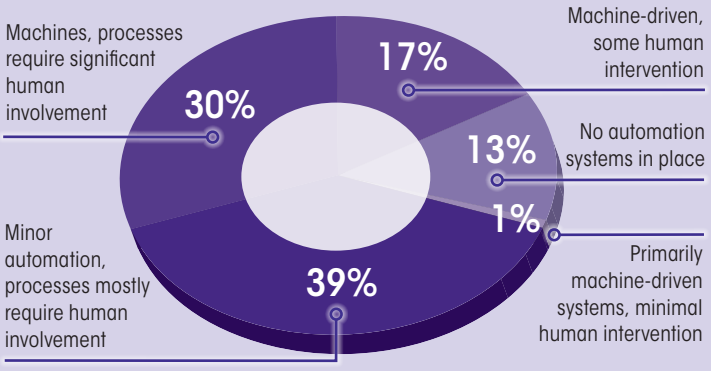
TECHNOLOGY

APPLYING IIoT – 179 replies	Total	Currently applying	Have a plan	Evaluating	Not familiar
Improving efficiency/productivity	41%	73%	60%	30%	3%
Improving maintenance functions	29%	55%	43%	23%	0%
Analytics functionality	28%	53%	50%	15%	0%
Tying in business data shop floor to top floor	27%	51%	37%	23%	0%
Tracking materials, shop floor assets	27%	49%	40%	18%	3%
Developing new services/revenue streams	18%	31%	33%	15%	0%
Developing smart products	16%	27%	30%	8%	3%
Consolidating control rooms	11%	16%	27%	3%	0%
Not currently applying IIoT	38%	—	—	—	90%

IIoT ENGAGEMENT – 122 replies

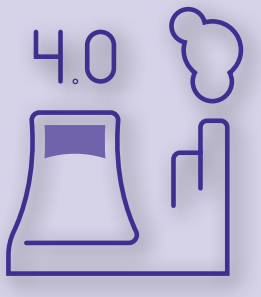
30%	Currently applying IIoT capabilities
17%	Have plan, investing in technology for deployment in next 12 months
23%	In the process of evaluating its relevance to operations
16%	Not familiar with IIoT capabilities
14%	Not applicable

LEVEL OF AUTOMATION – 122 replies



BENEFITS FROM TECHNOLOGY UPGRADES 180 replies	TOTAL
Experienced a benefit	76%
Reducing downtime	38%
Increased throughput	34%
Increased quality of product	33%
Product innovation	28%
Reduced staff requirements	23%
New revenue streams	19%
Reducing time to market	19%
Other	9%
None of these	24%

USING MACHINE LEARNING – 123 replies



REASONS FOR NOT INVESTING IN INDUSTRY 4.0 – 151 replies

28%	Difficulties integrating advanced technologies in existing systems
28%	Lack of skills to support investment
25%	Lack of financing and support
23%	Lack of adequate information about advanced technologies
23%	Not sure where to start
23%	Too costly
21%	Investment not necessary for continuing operations
19%	Not convinced of economic benefit
19%	Uncertainty, risk and disruption
17%	Lack of support or services from government
14%	Concerned about exposure to cybersecurity threats
14%	Weak customer demand

RATE THE FOLLOWING – 155 replies

87%	Emerging technologies allow small companies to compete globally
82%	I see IIoT as a business growth opportunity
82%	Industry 4.0 is a great concept, but challenging to implement
77%	Systems are designed with input from those who use them
75%	Employees are empowered to ask "Why" and challenge processes
75%	Upper management at our company supports Industry 4.0
73%	Data is complicated and requires special knowledge
65%	Investing in new technology raises the company's cybersecurity risk
65%	There is more to gain from new technologies for the smaller operations
62%	Canadian culture is risk averse
62%	Machinery replacement is a massive investment and will cause downtime we can't afford
62%	Our company will pay more for innovation
50%	Canada is a world leader in adopting new technologies
44%	Decision making at our company is in the hands of elders who can be frightened of new tech
42%	I know where to find government programs to help with new technology investments
15%	At my age, I don't see the value in investing in new technologies

Tidy also recommended caution. "Just because it's cloud doesn't mean it's better. It just means it can be easier, but not always. If you're doing IIoT and its higher level functions, you get into some of those communications and connectivity issues that certainly can be challenging."

Dussin said Alps Welding added fibre internet to its factory in February. "Only because we paid for it and we pushed and kicked to get it there. A lot of our neighbours still don't have it. We were moving towards more cloud services before that. And we were just running into a brick wall. We couldn't get anything done because of it. The bandwidth wasn't there … When we bought our ERP system a couple of years ago we decided to keep it on-premise because we just knew it wouldn't work if it was cloud-based. We didn't have the bandwidth. Now we do. But it's still not a clear choice – that the cloud is always better."

Dussin explained cloud services can lock businesses into annual payments, while on-premise solutions give more financial flexibility. "If you've got software and you want to freeze a version [instead of upgrading] for a while, you have an option to do that. But once you're in the cloud, you're really locked into a software-as-a-service model."

Loftus said when Innovative Automation implemented an

updated ERP system, "the cost modeling to go on-premise versus cloud was about a 19-month crossover. At 19 months it became more cost effective to host internally than to go to cloud … The point here is, it's new, but it may not be better."

Building moats

Most respondents are concerned about the safety of this data, with 72% rating a high level of concern over cybersecurity. Sixty-eight per cent reported being the victim of a cyber-attack, with the most common form being phishing (54%). Sixty-eight per cent of respondents think they have done enough to protect their business from cyber-attacks, while 32% don't.

Myrick said when LAPP was introducing a new MES system, it had to work with possible integrators on security plans. "Once we decided where we wanted to go, we had to put together a full-scale training program to talk about what can be done, what can't be done, what kind of links we were going to put in place, what kind of links we weren't going to put in place and how we were actually going to manage that system to ensure we had the proper firewalls in place … We actually delayed our project for about a year and a half while we made sure we had the security piece of it in place," Myrick said.

"You see the horror stories of companies being breached and it presented a real challenge, but at the end of the day, it came down to really evaluating what we needed to put on the cloud, understanding how we're going to protect the data and then train our employees."

Fung said Myant's chief security concern as a textile manufacturer is intellectual property theft. "A lot of these garments that we're knitting are programmed, so there are programs for specific designs and that stuff is protected in the cloud.

"When you analyze that system, that process, a lot of the challenges are in the human bottlenecks. If you look at something like a phishing attack, the weakness of the system is where the humans are … There's training to be done with people on new systems, so they learn what the proper protocol is for behaving. It's protecting the integrity of the entire ecosystem."

Sterian said industries such as aerospace and defense are setting the bar for security. "No USBs are allowed on any machine or in the factory, simple things like two-step verification when working remote … Things that have already been established in high reliability, high-risk industries can be implemented across the board."

Building on the foundation

As managers and executives seek to improve operations, a particularly thorny issue is how they can integrate new technology into their existing legacy systems. Twenty-eight per cent of respondents said that integrating advanced tech into existing systems is a significant challenge.

> ***A lot of reluctance to put information on the cloud in the past was more a fear of protecting intellectual property.***
>
> ***– Keith Myrick***

Fung said Myant is in a unique position. "We knit sensors and actuators into textiles. This is not something that can be done with traditional processes, so everything we do, it's advanced manufacturing. It's 3D robotic knitting," she said.

If Myant were to help another company create a similar operation, it wouldn't be possible to just layer advanced technology over top of traditional machine processes. For that reason, she isn't surprised manufacturers struggle upgrading legacy systems.

At the same time, Fung noted people are also cutting, sewing and hand-piecing things together on sewing machines. "That's where the real challenge is. We're in a very nascent stage of integrating human-powered operations with the machine-powered operations."

Getting legacy systems to speak to advanced software is a tall order, Myrick said. "You have to make sure you design a common platform or platforms that can co-speak to each other. There are technologies coming out now that actually accomplish that. In fact, you have some of the integration companies that are saying they specifically tailor toward ensuring equipment can speak to each other in different formats."

Tidy said ATS has worked on the issue of integrating their automation technology with legacy systems, using a platform called Illuminate Manufacturing Intelligence. "A lot of companies getting into automation, they start with a simple process. They may start with a workstation or a few workstations, and from there, they semi-automate, then they fully automate. And then, they're collecting lots of data."

> *People are spending more time trying to make the new system do things the way the old system did them, rather than adapting to a new way of doing things.*
>
> *– Scott McNeil-Smith*

He said helping customers move from that manual stage to automation and their hybrids in-between is something most IIoT systems don't deal with. They just want to deal with the new, shiny, exciting stuff and not the legacy and not the people side of it."

Loftus said the process of updating existing machines can be prohibitive for many. "The big issue is when you're into semi-automatic or manual, it's not just collecting the data. You have to go back and shut the machine down, add sensing, create the infrastructure to actually collect the data, write the custom software, then apply it. And sometimes the cost of doing this starts to approach the price of replacing it."

STUMBLING IN THE DARK

However companies choose to adopt IIoT, they need the skills and resources to enable and manage this adoption, and our survey suggests these might not be readily available. Twenty-eight per cent of respondents said a lack of skills is a barrier to adoption (23% said so last year).

Tidy said, "As you continue to add capabilities and requirements to what you want out of manufacturing and IIoT in particular, that integration piece gets way more complex. And that's where you need those skilled resources you probably don't have. You're looking to outside contractors or interviewing systems integrators to do that."

"When you start getting complicated and require specific tasks and techniques that you don't have within your organization, it becomes extremely difficult to make a business case for doing it," Myrick said.

One of the biggest challenges for manufacturers is the lack of standards for technology, according Corker. "There's an array of open source, proprietary, closed systems and complex components. It's Ikea in the sense that if you're a small to mid-sized company, you have to put all this stuff together. "Manufacturers are really acting as a general contractor to try and integrate all these things. That skill set doesn't exist inside manufacturing companies, so the risk, the cost and the outcome of these projects really start to escalate in terms of coming off the rails and not delivering the business outcomes people are looking for."

Dussin agreed. "A lot of managers and manufacturing companies don't have the skills or the knowledge to understand what technology is available and to understand what it's going to do for the business. The technology is changing so quickly that what you knew two years ago doesn't really matter anymore."

He said most business owners or managers are stumbling in the dark hoping they make the right decision on the right technology.

"There's something to be said for key decision makers on technology investments needing some support, education and standards."

Jean-Pierre Giroux, EMC's president and McNeil-Smith's colleague, said his organization has been focusing on training supervisors and managers "in basic problem-solving, continuous improvement, Lean 101."

He explained, "In manufacturing, about 85% of the workforce report to supervisors, so they're essential. They're critical to the future of manufacturing, so having them well-trained, having them understanding the basics of problem-solving, continuous improvement and lean will lead to [well-thought-out] projects."

Changing technology, changing culture

When it comes to managing change within organizations, 34% of our respondents described themselves as somewhat experienced, while only 9% said they had vast experience

Only 18% of manufacturers are employing sensors to capture data.

IMAGE: STOCK.ADOBE.COM

28% of respondents said a lack of skills is a barrier to technology adoption.

IMAGE: VECTORFUSIONART - STOCK.ADOBE.COM

with change management and 25% are using a formal change management strategy.

Forty-one per cent of respondents cited resistance to change, and 27% cited a lack of leadership vision as challenges in developing and implementing technology strategies.

Loftus said demographics factor into resistance to change. "We have a huge demographic of small business owners that are [close to] retirement. They're not making these investments because they're riding it out to the end. 'I'm making money, I'm doing okay. I could probably be more profitable. But I'm going to capitalize on what I've got, sell for what I can and move forward.'"

Here is how the survey's age demographics look: 41% of our respondents are between 56 and 65 years old, 28% are between 46 and 55 and only 5% are 35 and younger.

McNeil-Smith had an idea about resistance to change. He said it can be attributed to how new technologies are implemented. "People are spending more time trying to make the new system do things the way the old system did them, rather than adapting to a new way of doing things."

He said resistance to change comes from not just company culture, but a lack of skills and capacity as well. "There does need to be supports in place so you get them to a comfort level that the new way becomes adopted more quickly."

Myers said peer-to-peer networking organizations like EMC and ReMAP help manufacturers build a support network and share data, challenges and experiences.

> ***There seems to be a tendency in Canada to try to do it yourself and we're frankly too small to try to do it ourselves.***
>
> ***– Jason Dowd***

"If it's in terms of skills development, or in terms of ability to manage technology or use data or anything else, we look for individual solutions,"

Myers said manufacturers need to foster a greater culture of collaboration and work together to achieve common outcomes, especially when it comes to skills and technology adoption.

Dowd noted CCRM's experience with collaborations. "If they've got a particular piece of equipment that we find interesting, that might be a prototype or late-prototype level, then I'll do an exchange for that piece of equipment to be in our labs for, say, three years, and we'll offer up our expertise to run it and generate data for that."

Dowd also had some exchanges involving technology evaluations. "They will come to us and say, 'Okay, well, we've got this interesting piece of tech, but we don't have the labs to test it and evaluate it and see if it's real or not.'"

He concluded, "There seems to be a tendency in Canada to try to do it yourself and we're frankly too small to try to do it ourselves. And we have to collaborate in-group together to be more effective."

A HELPING HAND

Regardless of what plans firms have, implementation costs loom over every decision, and government support for these endeavours can be critical for small manufacturers. However, 17% of respondents (10% last year) said that lack of support and services from the government is a reason for not investing in technology, and 25% cited a lack of financing as a barrier to investment. A further 60% (up from 46% last year) said funding challenges are impeding developing and implementing technology strategies.

Corker said the prevailing government funding paradigm in Canada per single company. "So, every manufacturing company applies on their own … There is actually no sharing on what's going on. Obviously, if it's intellectual property and it's a product innovation, that's one thing. But if it's just a process innovation, there's a high likelihood lots of companies could have similar looking process issues."

Sterian said there is a lot of confusion about government funds. "There is, number one, confusion as to where to apply. And then once you do apply, the probability of actually getting

Industry 4.0 FEEDBACK

Manufacturing executives responding to the 2021 Advanced Manufacturing Outlook survey had an opportunity to write in comments about their experiences with Industry 4.0. Here are some of their insights (edited).

DATA

- I trained staff to analyze and visualize data, optimize processes by measuring/reducing variation and develop leading indicators for maintenance and scheduling that improved asset performance and equipment capability. We improved OEE by 8% in six months and were on track to hit 11% improvement by the third quartile.
- We currently have a robust information system on the floor that tracks equipment and provides new opportunities to improve processes and the current information system that's doing the tracking.
- We have evolved a custom ERP system that's intimately related to our operations. It starts from product APQP and goes all the way to parts submission warranty and continues to consistent part repeatability.
- ERP and MRP systems are too costly for small businesses. And they are not flexible.

TECHNOLOGY

- We are currently experimenting with artificial intelligence to reduce menial jobs on our production floor.
- Automation is always helpful and reduces downtime. It helps do analysis quicker and more logically.

PERFORMANCE

- We have been able to streamline our process and take out waste.
- Our improvements have helped us better evaluate each operator's performance and benchmark so best practices can be determined from shift-to-shift and employee-to-employee.

the funding is very low."

Sterian argued governments should focus on pushing manufacturers toward economic development in their localities and pushing them to get involved in government procurement. "As we've seen now in PPE, there are gaps in our supply chain. Can we make those stronger? And those supply chains don't have to just stay in healthcare. They could be in automotive, aerospace, telecommunications, and those could all be growth industries."

Dussin provided a manufacturer's perspective.

"What I see is a kind of a hodgepodge or a patchwork of programs that companies have to access to implement these projects. If I want to buy a new piece of machinery, I can get an accelerated capital cost allowance, but that's just on the hardware. If I'm going to buy a new machine, I've got to do some process development, and maybe I can get another program to pay for some of the consulting fees.

"Maybe I have to buy some new software and one program is going to pay for the assessment of the software and the other program is going to pay for the training of the software, but it's

[On Industry 4.0 adoption] People have to be ready and they have to be educated, look for the cost benefit and then move forward.

– Steve Loftus

IoT/IIoT

- The human race is more or less already obsolete. IoT is another stepping stone to the endgame where the machines take over.

ENGAGEMENT

- We are primitive in the application of these technologies and I do not see any will from the top management in the near future.
- IoT requires a lot of investment that we don't have, but more importantly, department leaders are slow to change – they have old-school thinking.
- Limited buy-in from staff. Upper level management is technophobic – prefers "paper-based" systems.
- When a company is led by politicians and non-technical people who think they know what they're doing but aren't capable, I don't expect any change.
- Our company does not understand these new technologies, what the costs are and how they can help boost productivity.
- We are 20 years behind our peers but that's what the top people want so they can keep employing their own people with little concern about the organization's future.

COST

- Have not made decisions. Lots of good machinery innovation offered but the question is cost and ROI – will need some practical figures from users, not manufacturers' hype.
- Significant ignorance exists regarding the benefits of IIoT because expectations are set in tangible ROI, which often materializes alongside intangible benefits that create fundamental shifts beneficial to the business.
- We expect to see improved production quality, cost improvement in machinery maintenance, and long term cost reduction in our overall operations.

INVESTMENT

- Investments will depend on government support. They are very expensive and it is tough to justify economically.
- Being a small company, we need to analyze the pros and cons of acquiring the technology to make sure it will help the company grow, not just a fancy gadget.
- We increased our spending on technology a few years ago and expect that it will remain high for the foreseeable future.
- We have no growth plans beyond what we're doing already, until we find the proper commercial partner for our project.
- We see IT/Technology as an advantage. But we will target resources that meet the greatest needs and expand as needed.

TRAINING

- The Government of Canada does not have any good programs to train younger people.

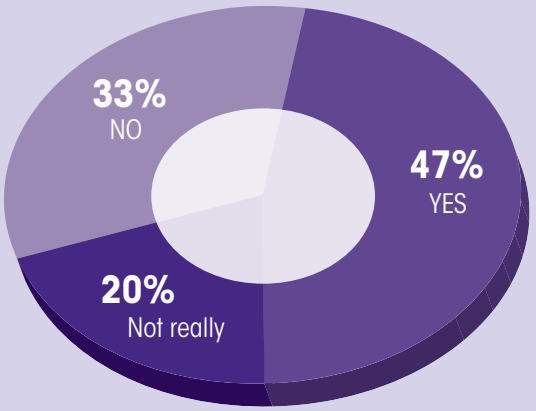
HOW DATA IS MONETIZED – 121 replies

- **62%** Improving operational efficiencies
- Leveraging supply chain/ customers **28%**
- **24%** Developing new business models
- Adding new services to existing offerings **22%**
- **18%** Developing analytics capabilities for external sale
- Partnering with similar companies **12%**
- **23%** None of the above

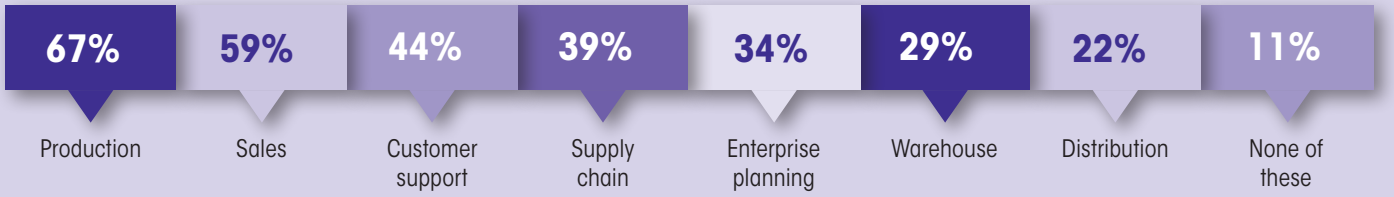
COLLECTING AND USNG DATA – 122 replies

- **69%** Spreadsheets, such as Excel
- **48%** Accounting package
- **32%** Manual paperwork
- **31%** Integrated ERP for supply chain
- **24%** MRP
- **18%** Sensors-big data

USING CLOUD SYSTEMS – 125 replies



AREAS TO IMPROVE DATA – 124 replies



going to exclude the cost of the actual software. Then I end up having to put together all these different financing pieces."

Myers agreed with the assessment that government support in Canada is patchwork, "It's up to the manufacturer to go around and shop for the right funding … It's piecemeal and it really doesn't give you the whole solution.

"What we're trying to do at NGen is take more of a syndicated funding approach. We'll also bring in co-investors into that project where it makes sense … You bring companies together and you come up with better solutions or better ways of creating value than people can achieve on their own."

Dowd said CCRM secured an NGen grant and "it took us awhile to get all the contracts. We're still figuring out the last little bits of that, but you need the business plan and you need something that's going to be sustaining."

McNeil-Smith agreed firms need to approach funding opportunities with a solid business case. "We've seen, for example, in Ontario, FedDev [a federally-administered economic support program for southern Ontario] will get behind the acquisition of new equipment where there's jobs involved or job creation, or sustaining jobs."

But he said reliance on the funding can be detrimental

long-term. "Providing the appropriate incentives is key, but to making sure companies are acting proactively on their own is also important."

EMC's Giroux added, "I still see there's a bit of a gap when it comes to making the next move for a project. There probably needs to be more help on that side."

Loftus said government funding has been a mixed bag of success for Innovative Automation.

"We've had great success in certain areas and other areas we cannot get any traction. A lot of it has to do with how you communicate what you're doing on those documents that you have to fill out for government funding."

Loftus said one way governments could help is by providing educational tools for navigating funding forms, and to standardize the help that is available across different levels of government.

Oh Canada?

The challenges inherent in technology adoption are many, but one that doesn't show up on a balance sheet is a lack of confidence in Canada as a tech leader. Only half of our respondents think Canada is a world leader in adopting new technology, and almost two thirds (62%) believe Canadian culture is risk-averse.

Myers believes this might be a misconception. "If you look at a rate of investment in new machinery equipment and technology in Canada versus the United States – not in terms of the amount of investment, but as a proportion of cash flow – Canadian manufacturers on average, over the last 20 years, have actually invested more of their cash flow in new technology than American manufacturers.

"We only have something like 250 manufacturers in the country that employ over 500 people. There are 37,000 in the United States, that's why their rate of investment in technology is so high."

Myers said more focus is needed on the factors that can help smaller companies grow. "We have a pretty strong presence and huge capabilities, but we've got to do more to figure out how we can leverage all those capabilities."

Trade Comissioner Picareillo agreed that size works against Canadian companies on the world stage. "The majority of the companies are too small to have achieved the level of technology we see around the world."

He believes Canada's recent free trade deal with Europe and other treaties could be a recipe for growth. Exporting allows companies "to be more competitive, to be able to move out of their natural environment."

He has seen Italian companies competing abroad for business that have thrived, while those just covering the domestic market struggle.

"Canada really has to widen the approach," Picareillo concluded.

> ***A lot of companies manufacture, they don't design their own products. We need to link manufacturing a lot closer to design.***
>
> ***– Irene Sterian***

Dussin sees Canadian manufacturing (mostly in southern Ontario), as on par with other manufacturing centres in the world (Japan, Germany, Italy, South Korea). "We punch in that league and yet we are not proud of it. Politically, I don't think there's been enough emphasis placed on the importance of manufacturing strategically as a sector. And that permeates through the whole culture. You ask people in your regular, everyday life what do they buy that's made in Canada, they probably don't even know."

Weathering the COVID storm

One of the more surprising statistics in our survey is that 50% of respondents said they haven't changed their technology spending plans in light of the pandemic.

Myrick said, "As COVID comes into play, people are reassessing their business strategies and I think some would be investing more and some would be pulling back, depending on the health of their overall organization."

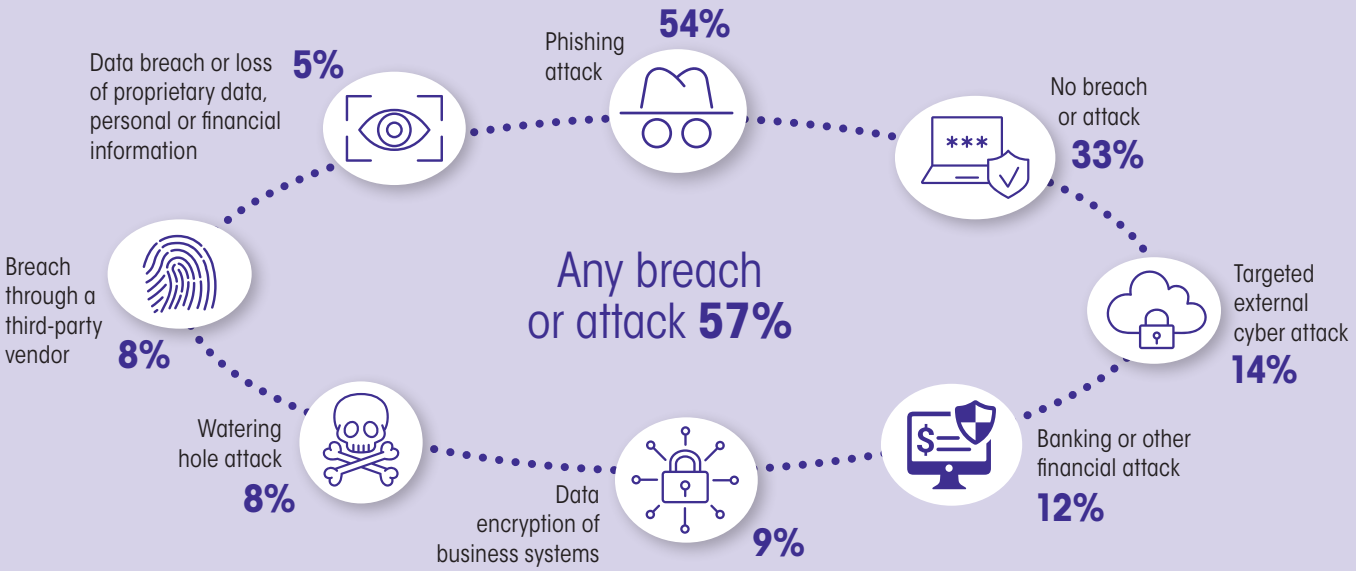
He believes visionary individuals – or companies – would actually be pushing forward with more investment in some type of platform that may help make their businesses less people/body centric.

McNeil-Smith said for EMC member companies, "we're hearing cautious optimism. All the underlying issues and opportunities are still there. It's just how companies can navigate them with their current constraints."

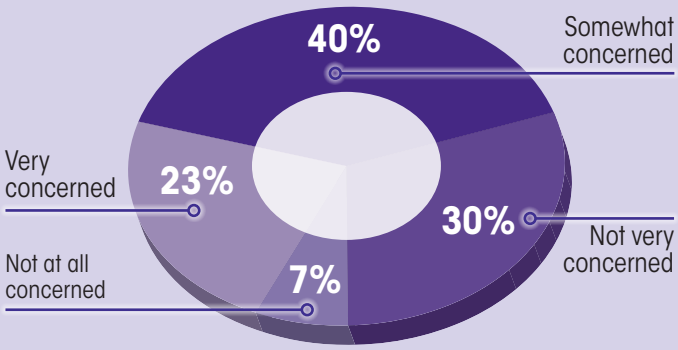
Loftus said of Innovative Automation's pandemic reaction, "The plan might get modified or slowed down a bit, but the plan really doesn't change. If you had sound business plans before the pandemic, they should be sound business plans afterward.

CYBERSECURITY

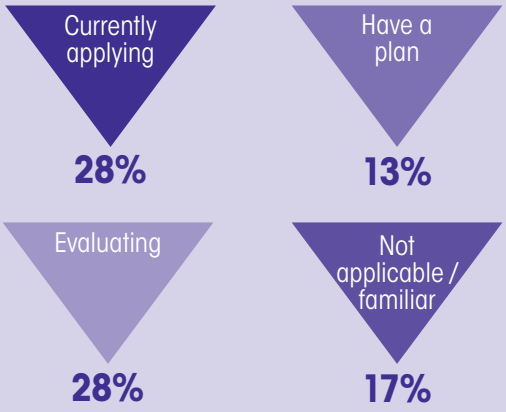
ATTACKS OR BREACHES – 120 replies



CONCERN ABOUT CYBER RISKS – 119 replies



GOVERNANCE POLICY IN PLACE – 120 replies



SECURITY MEASURES TAKEN – 120 replies

68% of respondents reported being the victim of a cyber-attack.

IMAGE: NICOELNINO - STOCK.ADOBE.COM

The other thing is, most business plans were queuing up or should have queued up for some kind of a slowdown in the economy anyhow."

For many manufacturers there are more questions than answers, Fung said. "Do you need to be investing now so that you're ready, that you don't get disrupted later, or worse, another pandemic comes? Who knows what's coming down the pipe, right?"

Sterian said the City of Toronto and the Toronto Region Board of Trade are focusing COVID recovery efforts on acceleration of investment in and adoption of digital manufacturing, so there are opportunities amidst the crisis.

Myers said he believes companies will still invest in technology, but given the cash crunch COVID has created, those investments will be lower than they were in the past.

Dowd said now that the initial noise of the pandemic shock has died down, there's going to be some rebalancing. "There's certainly going to be some industries where it's questionable what you're going to do, but at least in the healthcare sector, COVID is an increase in production. There's a lot more interest in the science and the treatments."

FINAL THOUGHTS

To cap off our roundtable discussion, panelists provided final thoughts on the present and future of Industry 4.0 in Canada and the potential of Canadian manufacturing.

Dowd observed COVID has up-ended a lot of industries in different sectors, but he believes this challenging and strange year will be an outlier in the grand outlook for manufacturing in Canada.

Sterian put it simply, "I think every company is a tech company and every company has automation, but it's really the companies that can best connect these islands of automation and these islands of tech. They can leverage the data that will be successful in the future."

Myers looked back at how far manufacturing has come. "It was only a few years ago where the adoption of Industry 4.0 and advanced digital technologies was less than 10% of companies. We're seeing more companies adopt this, or looking to adopt it." But he cautioned, "It's a journey and it doesn't happen overnight."

Myrick touched on the international picture. "Every organization now is a global organization, whether they want to be, or not, because we're competing on a global level. Whether you have presence – say a brick and mortar presence – in another region, you're competing in those regions."

Canada is abound with opportunity, according to Corker. "There are so many opportunities in Canada for manufacturers with all the trade agreements and the educational institutions, it's a great country to produce goods in. It's a great country to be a technology provider."

"There's a lot of great manufacturing happening here, and it's high tech," Fung said. "But there's a lot of work to be done terms of changing perceptions about what manufacturing is."

Loftus said examining the Outlook report data "forces me to not just read the numbers, but think about them and how they apply. It allows me to benchmark my own business to say, where am I, and what should I be thinking about?"

Tidy mused on how remote work will fuel future innovations. "It's not just that people aren't going into the office or may not be on the floor, but that one person who's in Malaysia, who's a real expert on your process may not be available to fly to Canada anymore to actually fix that machine. So, how are you using data and remote technology

[On Canadian manufacturers] The majority of the companies are too small in order to have achieved the level of technology we see around the world.

– Matteo Picariello

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 keeping up with the tools people want and request.

– Dennis Dussin

to help that person who used to be on the plane all the time?"

Picariello also stressed that Industry 4.0 technologies bypass distance. "I don't know if – for countries or industries – the proximity to the provider of digitalization technology, the robot manufacturers or the system integrators can be a winning factor or not."

For Dussin, Industry 4.0 has changed the way businesses look at technology on a fundamental level. "It used to be that if you were adopting technology, you might have some kind of competitive advantage and you might do better than your competitors. I think that's changing. The adoption of technology isn't necessarily a matter of doing better. I think it's a matter of just being in the game."

"In my view, we need to make sure we're emphasizing the focus on internal capacity development," said McNeil-Smith. "And as that continues to grow within each manufacturer, the resistance to change, the resistance to adopting the technologies and the kind of the pace of adoption will all improve over time."

Giroux said technology adoption can't be successful without a shift in culture. "There is a cultural shift that is needed for a more relevant workplace, more competitive, more productive and more skill in appealing the younger generation. We're desperately looking for people, so let's put manufacturing on the radar!"

As manufacturers look to make it through the rest of 2020 and turn the page on a year to forget, it's worth reflecting on just how transformative this time of crisis has been. The shift to remote work, the necessities of social distancing, the strain on supply chains and the increasing impetus to accomplish more with fewer resources are all funneling manufacturers toward increased adoption of advanced technologies. It is said that necessity is the mother of invention, and as companies meet adversity with ingenuity at every turn, that is a hard sentiment to argue with. The future defined by Industry 4.0 is inevitable, and we are heading there a lot faster than we were just a few months ago.

2020 has been a transformative year for manufacturing, facilitating the shift to remote work and pushing technology adoption.

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

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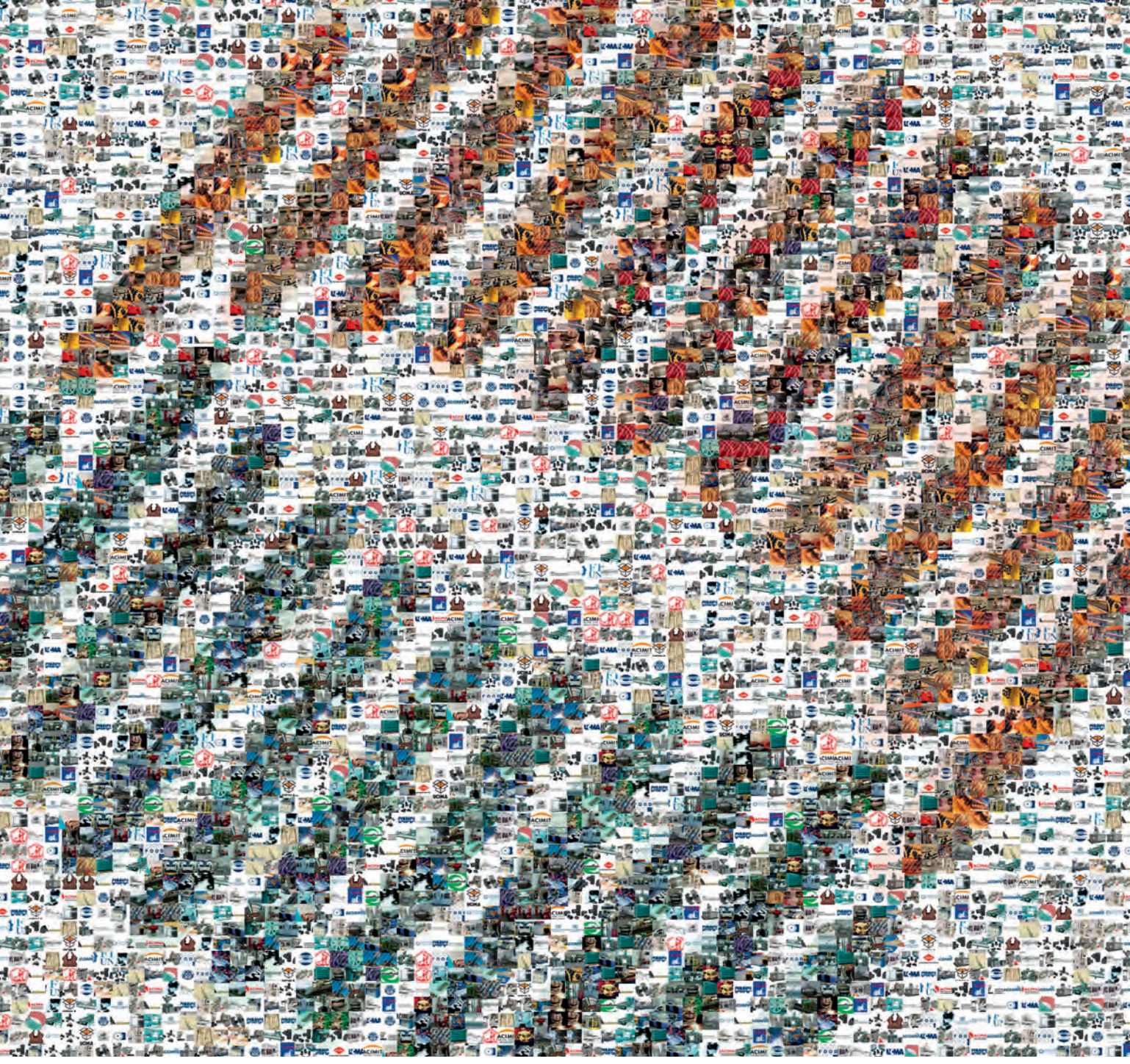

IT'S TIME TO TAKE A CLOSER LOOK AT ITALIAN MACHINERY

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