Business4.0™

BUSINESS 4.0™:
THE JOURNEY BEYOND INDUSTRY

4.0

Industry Focus : **Manufacturing**

Winning in a Business 4.0™ World: a TCS study
tracks the adoption and impact of Business 4.0

CONTENTS

usiness 4.0™ is the next wave of change breaking over organizations across the world. Digital technologies such as the cloud, the internet of things (IoT), analytics, automation, robotics, and artificial intelligence (AI) are vital enablers of this transformation, but it is not enough to use these to simply mechanize existing functions.

Instead, firms are using technology as a foundation for four critical business behaviors that will help them move to the next level:

Driving mass personalization – personalizing products and services to a market of one customer, often even of one transaction, and at scale.

Creating exponential value – adopting business models that leverage value from transactions at multiple levels and address new markets.

Leveraging ecosystems – collaborating with partners inside and outside the supply chain to create new products and services.

Embracing risk – moving beyond rigid planning and operational barriers with an agile strategic approach.

TCS' global research shows the way forward by helping organizations benchmark their progress against peers.

This report delves into the findings of TCS Business 4.0 Global Study to detail the level of adoption in the manufacturing sector, the benefits industry players have seen, and their plans for the next three to five years. As manufacturing companies adopt Industry 4.0 on their path to operational efficiency and productivity, we focus on how they are adapting to the Business 4.0 behaviors that drive the very basis of competitive advantage and market strategies.

RESEARCH

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CS surveyed 1,231 respondents from firms across 11 industries and 18 countries. All firms included in the survey reported annual revenue in the range of a minimum of $500 million to upward of $5 billion. All survey respondents were either directly involved in or were aware of their firm's digital transformation plans.

The sample included 186 executives from the manufacturing sector. Nearly half of manufacturing respondents (44%) were from the C-suite, while the rest were manager-level and above.

In addition, we conducted in-depth interviews with 30 experts and business leaders from across industries.

Key
Findings

A cross the entire manufacturing sector – from aerospace to industrial manufacturing, from automotive to chemicals and continuous process industry – digitalization is changing the face of business. Factory-floor equipment may still churn out discrete and processed goods, but data and its analysis – supported by the internet of things (IoT) and cloud-based technologies – have increasingly become the driving forces of productivity.

Moreover, digitalization is about much more than just improving process efficiency. Applying state-of-the-art digital capabilities is helping manufacturers customize products to an unprecedented degree. It is enabling them to create new sources of value beyond the goods they produce, such as through servitization. And it is helping them access a wealth of information, ideas, and expertise in ecosystems.

Our findings suggest that organizations that have adopted all four Business 4.0 behaviors – driving mass personalization, creating exponential value, leveraging ecosystems, and embracing risk — which we refer to as the 'leaders', are more likely to report and anticipate strong financial performance.

Leaders, early adopters, and followers

We have identified three distinct groups in the survey, based on their adoption of Business 4.0 behaviors:

Leaders: organizations that have adopted all four behaviors

Early adopters: organizations that have adopted one, two, or three behaviors

Followers: organizations that have adopted none of the behaviors

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hile making clear progress in some areas, the manufacturing sector – which faces its fair share of specific challenges and barriers, as explored in this report – has a relatively low proportion of leaders among the seven sectors we surveyed (see Figure 1).

We ascribe this to the complexity of the manufacturing industry context. Software is not just in the enterprise but has moved into the product or asset itself, bringing with it the associated demands of performance, reliability, safety, compliance, and related liabilities, among other aspects.

But that is not a showstopper, as Susheel Vasudevan, Global Head, Manufacturing, TCS, remarks, "At the heart of change in the manufacturing industry is the software in the product. Automation in production, artificial intelligence in autonomous cars, data-based analytics in aircraft and airline ecosystems, and personalization of in-car experience, all promise to make manufacturing one of the more exciting proponents of Business 4.0 in the years to come."

Leaders — Early adopters — Followers

Legend:
- Travel and hospitality
- Life sciences and healthcare
- Telecom
- Retail and CPG
- Manufacturing
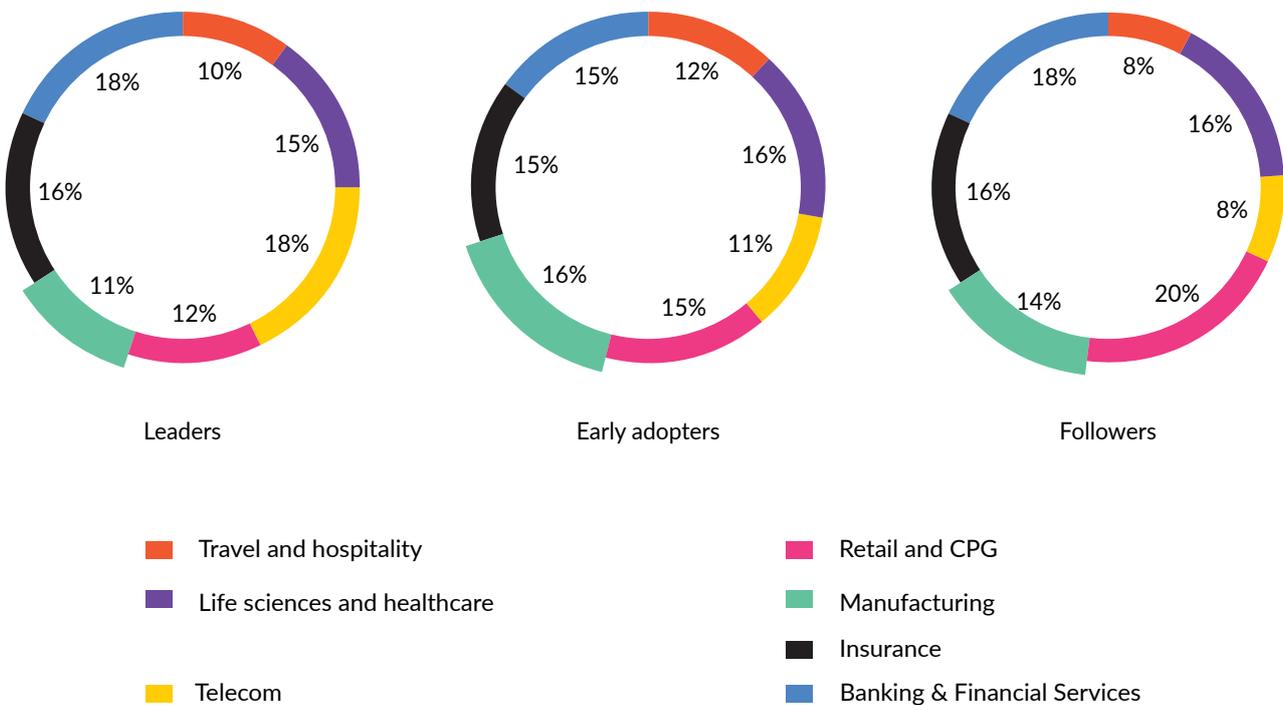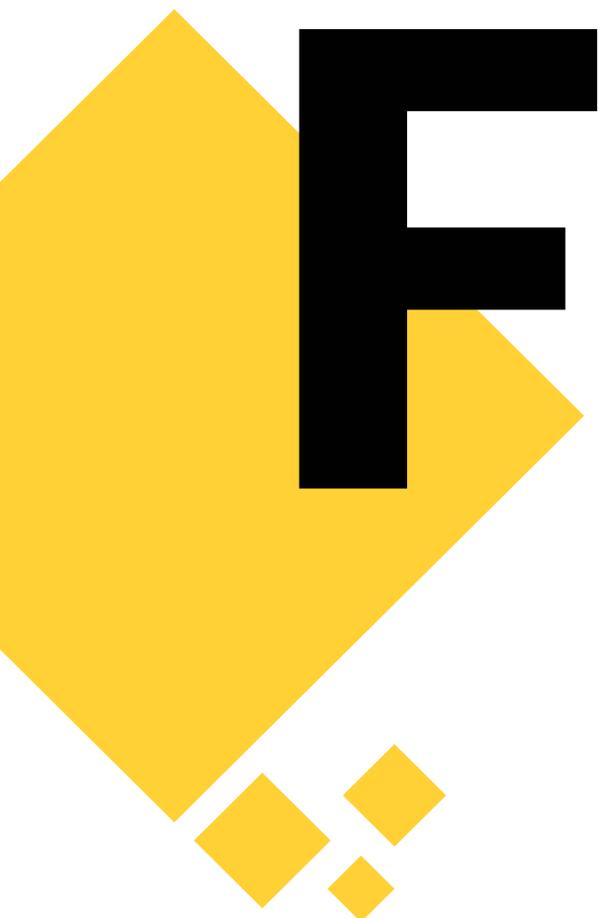- Insurance
- Banking & Financial Services

Figure 1: Industry-wise share in the leaders, early adopters, and followers groups

Following are our key findings pertaining to the manufacturing industry:

Progress toward Business 4.0 is positive. Manufacturers are at the forefront of mass personalization, ahead of organizations in most other industries in their use of digital technology to customize products to highly individualized requirements. They have been able to create exponential value and leverage ecosystems more effectively than others, however, most firms are struggling to embrace risks.

Adoption is resulting in tangible benefits. The majority pursuing personalization report higher volumes and value of customer transactions, and higher customer profitability. For the 55% that are leveraging ecosystems, improved innovation capability is the chief benefit, along with gaining access to new markets.

Strong digital foundation is a must for sustained progress. Most manufacturers today manage at least some of their IT operations in a cloud environment, recognizing the scalability and cost advantages this confers. A strong IoT base and a desire to widen the scope of automation provide further wherewithal to help manufacturers progress toward Business 4.0.

A Complex Journey

igitalization is at the heart of Business 4.0. For the manufacturing sector, which is fast adopting Industry 4.0 – that is, a focus on industrial IoT as well as the convergence of IT and data systems in operational technology – Business 4.0 represents a broader umbrella of digital transformation. We can consider Industry 4.0 to be a good stepping stone to Business 4.0.

Business 4.0 and Industry 4.0 are complementary, and both are mission-critical for manufacturers. "Like Industry 4.0, we don't see Business 4.0™ as an option; we see it as the enabler to reach the next level of value creation, increasing customer satisfaction," says Mats Högberg, IT Strategy & Innovation, Atlas Copco.

Like Atlas Copco, a notable proportion of manufacturers have embarked on the Business 4.0 journey. Figure 2 shows the industry's adoption of the four behaviors as compared with cross-industry findings.
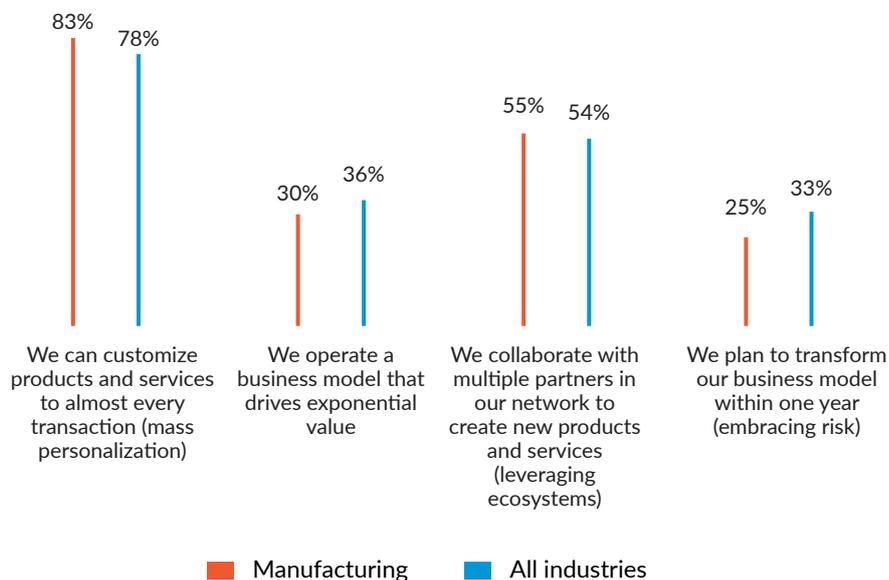

83% 78% 30% 36% 55% 54% 25% 33%

We can customize products and services to almost every transaction (mass personalization)

We operate a business model that drives exponential value

We collaborate with multiple partners in our network to create new products and services (leveraging ecosystems)

We plan to transform our business model within one year (embracing risk)
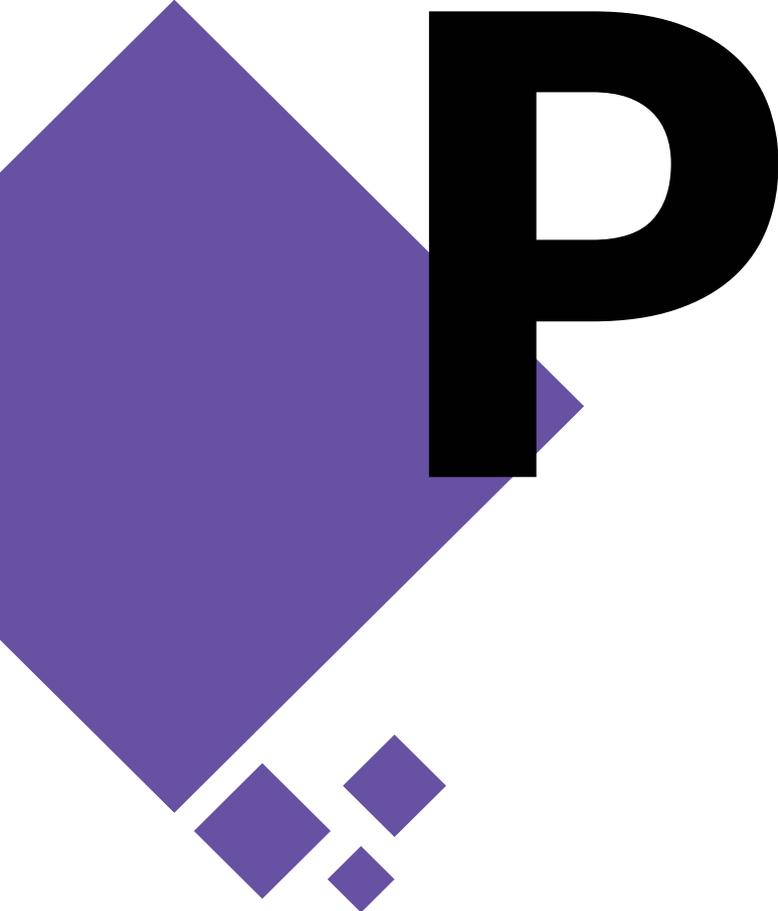
■ Manufacturing   ■ All industries

Figure 2: Manufacturers' adoption of Business 4.0 behaviors

Personalization is the name of the game

Manufacturing firms have made the most progress around mass personalization. A massive 83% of respondents say their organizations can customize products and services to individual customers nearly all of the time, which is higher than in any other sector in the survey.

Manufacturers of high-end goods – Ferrari[1] being one good example – have the experience of personalized production (often referred to as engineer-to-order) going back a decade or more. There are many examples of companies deriving exclusivity from such an approach. If we fast-forward to the present time, manufacturers are leveraging the power of digitalization to give their customers the ability to configure products to a high degree in almost all price brackets, effectively democratizing the exclusivity of the engineer-to-order approach.

Examples range well beyond engineered goods, including apparel, processed food, packaging, and other types of products.[2,3] Even the highly commoditized chemical and continuous process industry is moving toward personalization, with companies utilizing personalized business information in the supply chain to build closer relationships with customers.

[1] Ferrari, The Project Ferrari Tailor Made, accessed May 7, 2019, https://auto.ferrari.com/en_EN/sports-cars-models/personalization/tailor-made/

[2] Gear & Style Cheat Sheet, 5 Sites That Let You Design Your Own Sneakers (October 2017) accessed May 7, 2019, https://www.cheatsheet.com/gear-style/sites-design-sneakers.html/

[3] Packaging Distributors of America, Why You Should Be Using Personalized Packaging (April 2017), accessed May 7, 2019, https://www.pdachain.com/2017/04/26/why-you-should-be-using-personalized-packaging/

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anufacturers' ability to offer personalized products at scale is a growing driver of revenue. Those in the survey that are pursuing personalization see it enabling a higher volume of customer transactions, as well as a higher average value of transaction (see Figure 3). As cloud-based technologies enable cost-efficient ways to configure products and drive other forms of personalization, manufacturers are also seeing customer profitability rise significantly.

Increased volume of customer transactions	63%
Increased value of customer transactions	60%
Higher customer profitability	54%
Reduced customer churn	30%
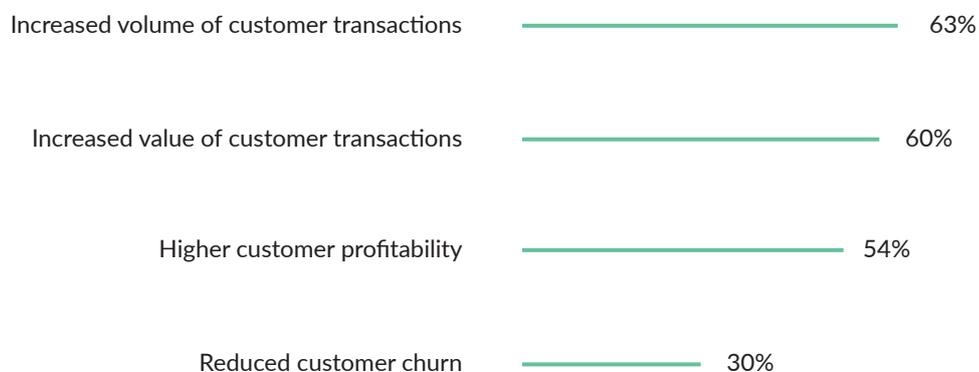
**Figure 3:** Benefits manufacturers are realizing from driving personalization

New value: From products to services, and data monetization

Manufacturers are embracing servitization – the augmentation or replacement of the sale of goods with the provision of services – to create additional value for their businesses. Philips Lighting provides an example, offering 'lighting-as-a-service' to commercial customers, whereby the Dutch firm installs, maintains, and manages the lighting at facilities on a recurring-fee basis.[4]

In the industrial manufacturing industry, we have observed that up to 25% of revenues already come from services. For bigger firms, this figure exceeds 40%. Further, we expect services to drive the next wave of growth for many established businesses. By embedding sensors into elevators, for instance, elevator companies can analyze and predict demand patterns so as to reduce waiting times, creating new value for customers. At the same time, in aerospace, we see engine manufacturers use sensors and IoT-powered connected equipment to offer a range of maintenance services.

Other manufacturers create new value by monetizing the data they are collecting. Some tire producers, for example, have created revenue streams by selling the data they collect on tire pressure to fleet managers and insurers. A business model change of this nature would not be possible without IoT and advanced data analytics capabilities.

[4] SmartCitiesWorld, Philips' light-as-a-service offering (November 2016), accessed May 7, 2019, https://www.smartcitiesworld.net/news/news/philips-light-as-a-service-offering-1137
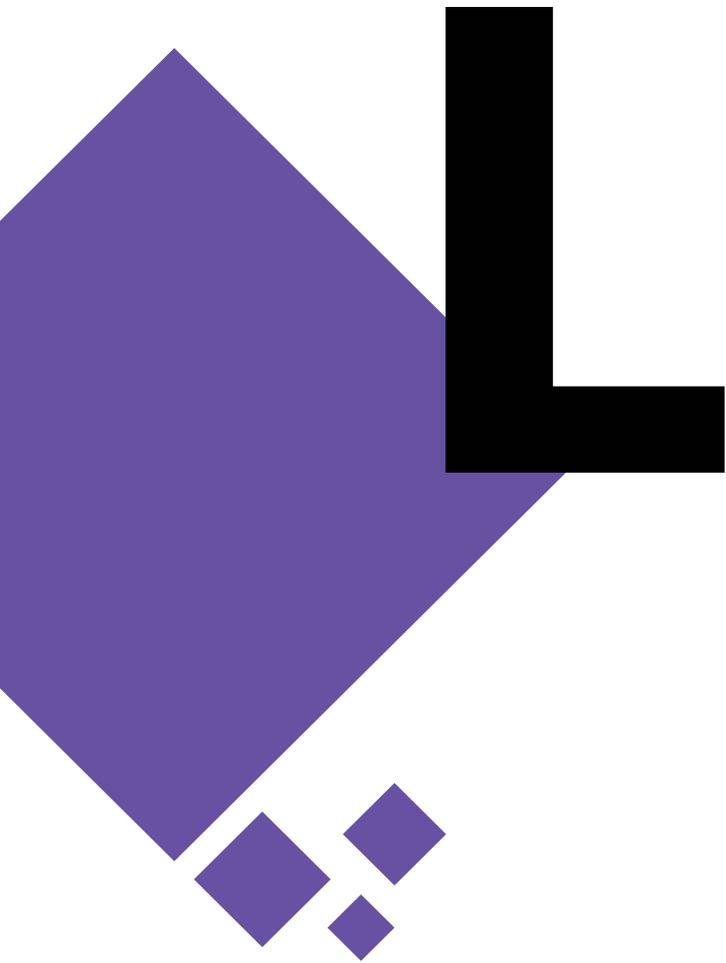
ess than one-third of surveyed manufacturers claim to be driving exponential growth in value in this or other ways, which is testament to the stiff challenges companies face in doing so. Those that do, however, point to measurable benefits. Nearly two-third report higher profits, and half say revenues have improved considerably (see Figure 4). The latter is almost certainly a result of manufacturers' success in expanding their addressable markets.

Take the case of Lexmark, a traditional imaging solutions company that has successfully forayed into the services business. The company offers Managed Print Services to help its customers gain a better view of their entire document environment. Going beyond reducing printing and paper usage, this model helps Lexmark's customers unify their print and digital information. Through a three-step process – infrastructure optimization, proactive management, and streamlined business processes – Lexmark provides its customers greater control over costs and inventory.[5]

Higher profitability	64%
An expanded geographical marketplace	63%
Ability to target a wider range of potential customers	54%
Higher revenues	52%

Figure 4: Top benefits from operating on an exponential business model

[5] Lexmark, See what's possible with Lexmark Managed Print Services, accessed May 8, 2019, https://www.lexmark.com/en_in/services/managed-print-services.html

C A S E   S T U D Y
## From products to services at Lexmark International

"We're in an industry that's being commoditized," says Brad Clay, Chief Information and Compliance Officer at Lexmark International, the US manufacturer of laser printers and imaging products. "We're increasingly focused on how we can drive additional value and differentiation."

A major direction for the company in recent years has been developing solutions that help customers bridge the gap between paper and digital information, driving greater visibility into operations. The IT function itself is involved in this effort.

Clay cites the example of a Latin American customer for whom Lexmark provides document-reporting capabilities. Lexmark developed a cloud-based application for the customer that, leveraging cloud's vast resources, has much greater reporting capabilities than if it had been developed in a traditional server environment, and can be run at a substantially lower cost.

"The ability to create exponential value isn't in the commoditized piece of it, it isn't in the infrastructure, servers, network, or storage," says Clay. "It's in that platform in the middle that makes possible instantaneous delivery at an incredible price point."
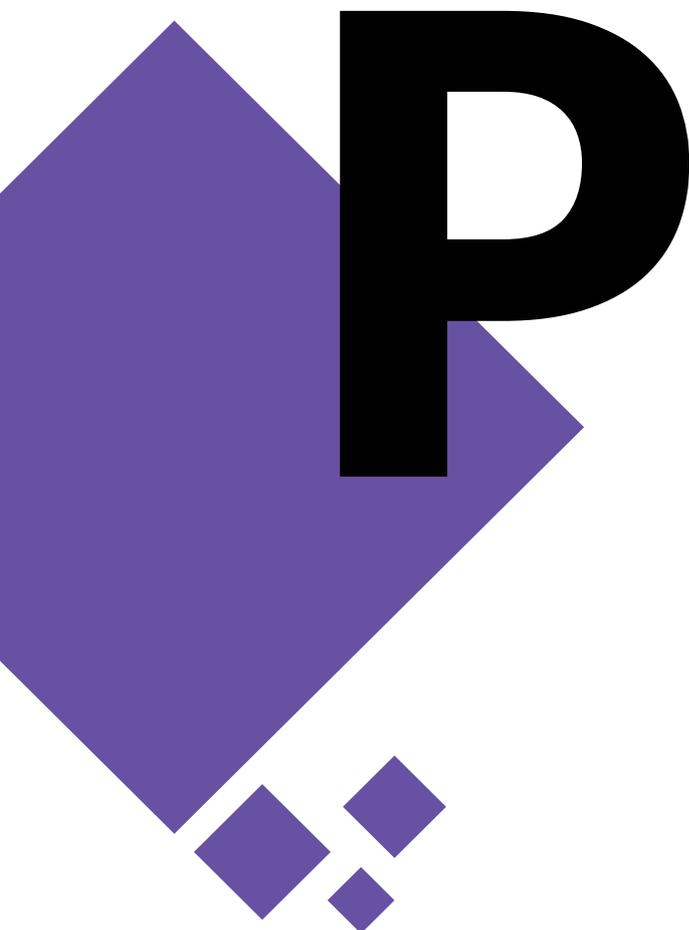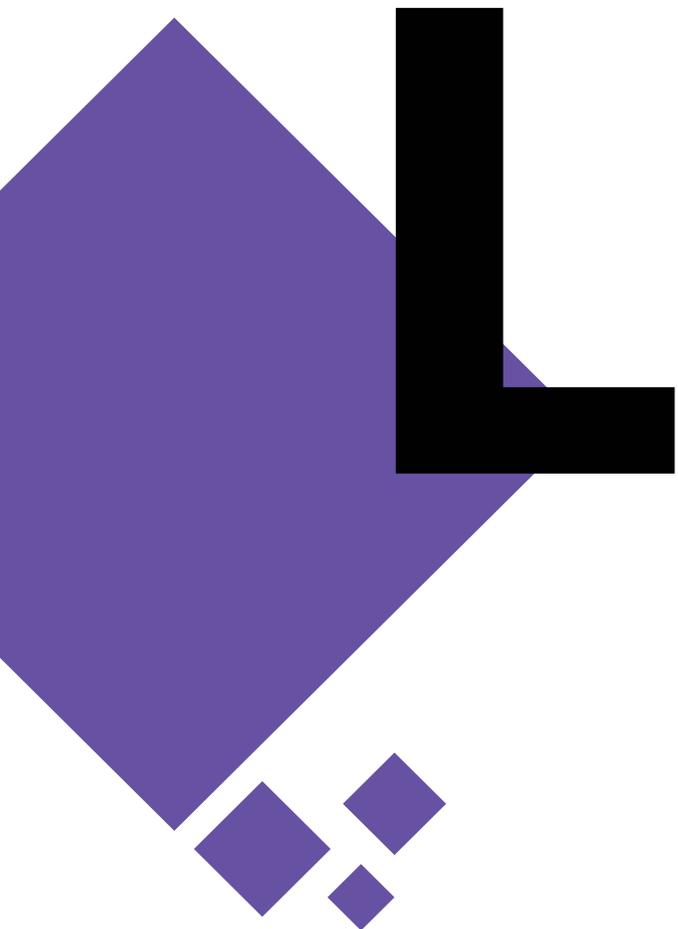
Platforms of product innovation

Manufacturers are no strangers to working with partners in extended supply chains. Many producers today, however, are part of ecosystems that are more collaborative than traditional supply chains. Over half of those surveyed say they work in collaborative networks for the purpose of creating new products and services (see Figure 5).

In the automotive industry, ecosystems may take the form of technology platforms that connect original equipment manufacturers (OEMs) with the developers of API microservices, entertainment firms, telecom companies, and many other types of service providers. Some automotive OEMs are not part of such networks. Some – such as Ford, BMW, Volkswagen, and Fiat Chrysler – regard ecosystem play as the main driver of connected car platforms.

Manufacturers are clear on the benefits that such ecosystems have afforded them: the ability to develop more innovative products and services than if they had gone at it alone. In automotive, this could include the roll-out of new software-based services, to the development of a 'mobility-as-a-service' offering. It is also worth noting that there are mutual benefits to be realized, as ecosystem partners can tap into new markets through collaboration. Interestingly, these very same platforms also strengthen the ability of OEMs to personalize the experience they deliver to each vehicle owner or user. This is rapidly becoming the new basis of competition in the automotive business.

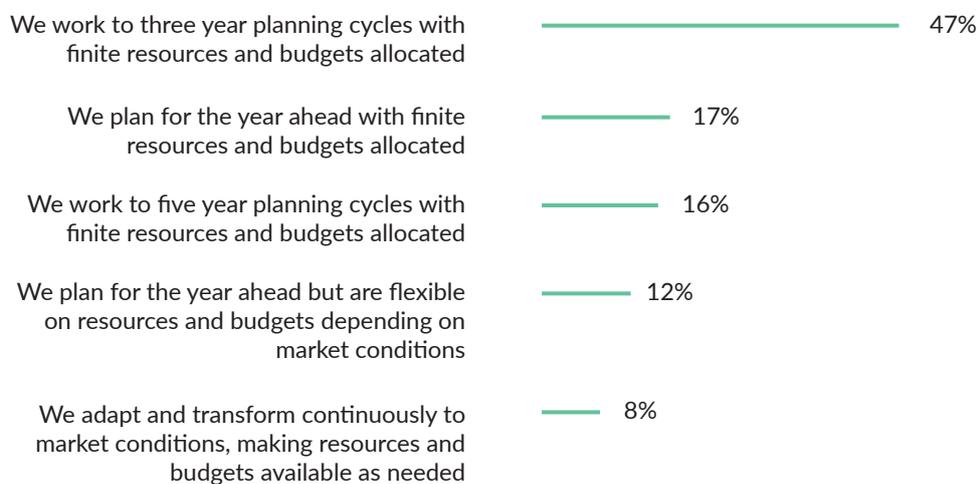|	
Ability to develop innovative products and services	52%
Access to new markets	42%
Higher revenues	41%
Ability to act faster to satisfy customer demand or perceived appetite for new products or services	39%
Trialling new products and services in partnership with a third party	35%

Figure 5: Top benefits from leveraging ecosystems

Learning to embrace risk

While some manufacturers are willing to adopt new ways of working to drive newer ways of value creation, such acceptance of risk is not widespread among those we surveyed. When it comes to changing business models, manufacturing appears the most risk-averse of industries. No more than a quarter of manufacturing respondents say their firm is likely to transform its business model within the next year (see Figure 2). Moreover, just about 8% respondents say they adapt and transform continuously to market conditions (see Figure 6). At a deeper level, we see the willingness and ability to embrace risk much higher in industrial or automotive companies as opposed to chemical or continuous process industries.

We work to three year planning cycles with finite resources and budgets allocated	47%
We plan for the year ahead with finite resources and budgets allocated	17%
We work to five year planning cycles with finite resources and budgets allocated	16%
We plan for the year ahead but are flexible on resources and budgets depending on market conditions	12%
We adapt and transform continuously to market conditions, making resources and budgets available as needed	8%

Figure 6: Manufacturers' appetite for risk when planning ahead

As manufacturing becomes more digitalized and software-driven, managing risk becomes easier because the resources and time required to deliver products and services are reduced. The adoption of agile principles of operation, not just in software development where the concept originated, but also in product development and on the shop floor, is important in this context. Half of the manufacturers have adopted agile in some parts of their operations, but so far no more than one-quarter have applied it enterprise-wide. This is largely explained by the industry's reliance on high-cost physical infrastructure – utilizing heavy engineering technology across the assembly line – which presents operational challenges for firms looking to embrace agile methodology.

"Embracing risk is about having a continuous process of looking at the road in front of you," says Mats Högberg of Atlas Copco "It's not a one-time effort to say, 'Now that we have Business 4.0 working well, we can relax for four years.'"

Overcoming the Obstacles on the Road to Business 4.0
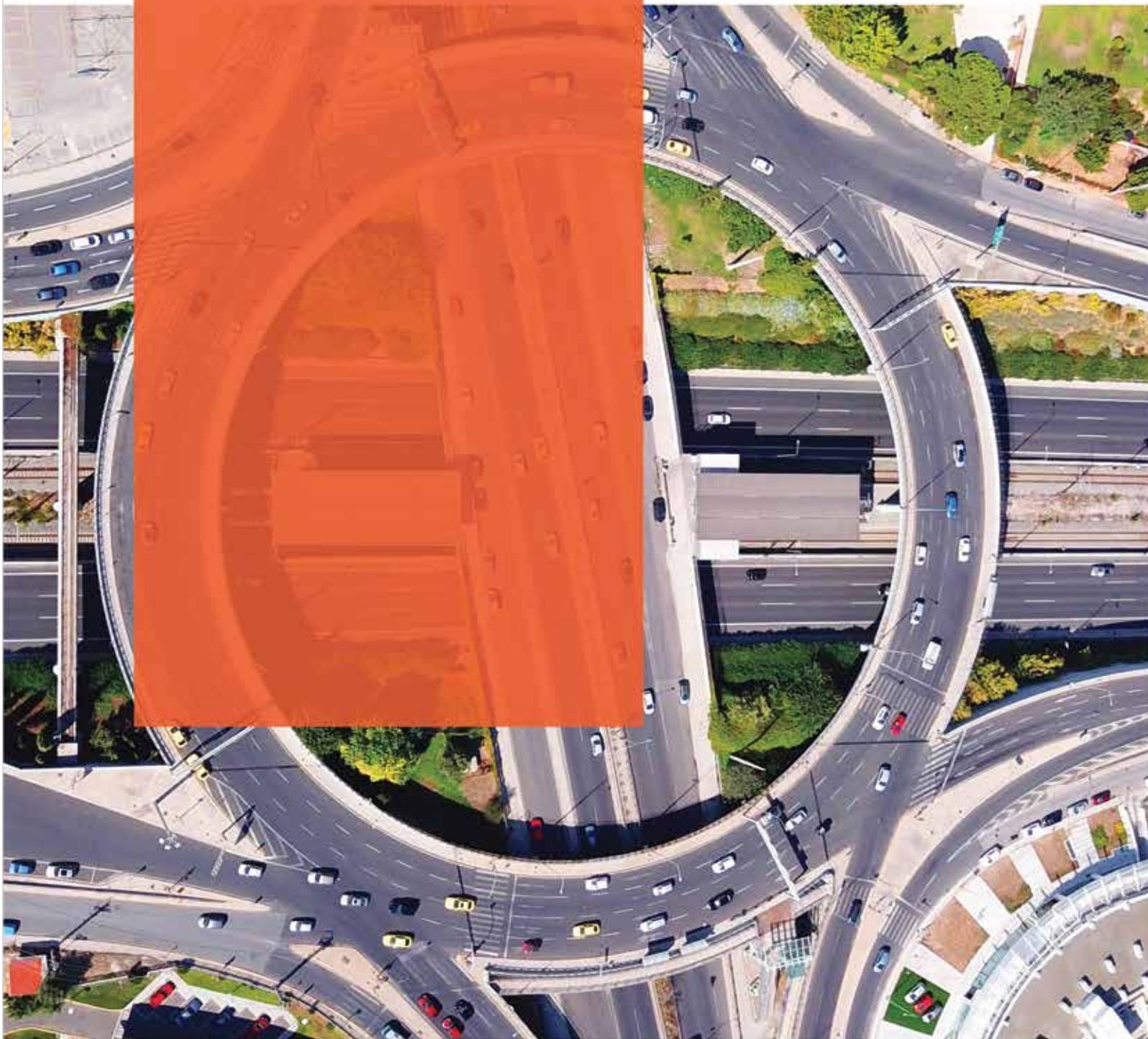
As factory-floor equipment, smart products, and IT systems become more deeply interconnected, a wider range of security vulnerabilities is getting exposed. This is certainly true for connected cars, according to the former CIO of a global automotive brand, who we spoke to as part of this research: "The more technology is onboarded to a vehicle and the more connected it is, the more exposed it is to cybersecurity risks."

The risk of attackers gaining access to a manufacturer's networks and systems through connected assets may also be heightened. IoT has been a cause for concern for manufacturers in this context, as unified security standards have yet to be agreed among chipmakers.

This explains why data and systems security loom large as a barrier to manufacturers' adoption of Business 4.0 behaviors. Potential security risks are cited more frequently than any other factor as an obstacle to utilizing ecosystems, and to creating exponential value for their businesses (see Figure 7). Related concerns are also voiced, such as opening up APIs to third parties and customer data protection requirements, not to mention inflexible technologies.

Our survey results show that moving to the cloud should help manufacturers address some of their security concerns, even as it allows them to scale. IT executives in many industries once saw cloud environments as concealing sources of vulnerability, but that does not appear to be the case among manufacturers today. In fact, over half of the survey respondents (52%) believe data security will improve as they step up cloud migration.
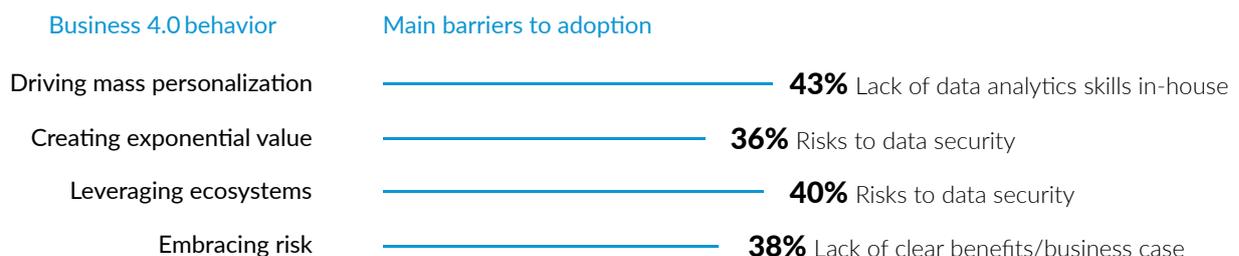
Business 4.0 behavior	Main barriers to adoption
Driving mass personalization	**43%** Lack of data analytics skills in-house
Creating exponential value	**36%** Risks to data security
Leveraging ecosystems	**40%** Risks to data security
Embracing risk	**38%** Lack of clear benefits/business case

Figure 7: Top barriers to adopting Business 4.0 behaviors

ne ingredient of successful transformation is having the right talent on board to exploit advanced technology such as data analytics. Manufacturers cite the absence of such specialists as the leading obstacle to personalization. The increasing personal data privacy concerns are not making matters easier.

Another success factor is the ability to change established attitudes and practices. But traditional corporate culture is one of the toughest barriers to break down. "The greatest challenge for us going forward is human nature," says Brad Clay of Lexmark. "I regularly have people working in development, R&D, and other areas asking, 'When are we going to stop all these changes?' Because we're literally changing everything."

Digitalizing
Production
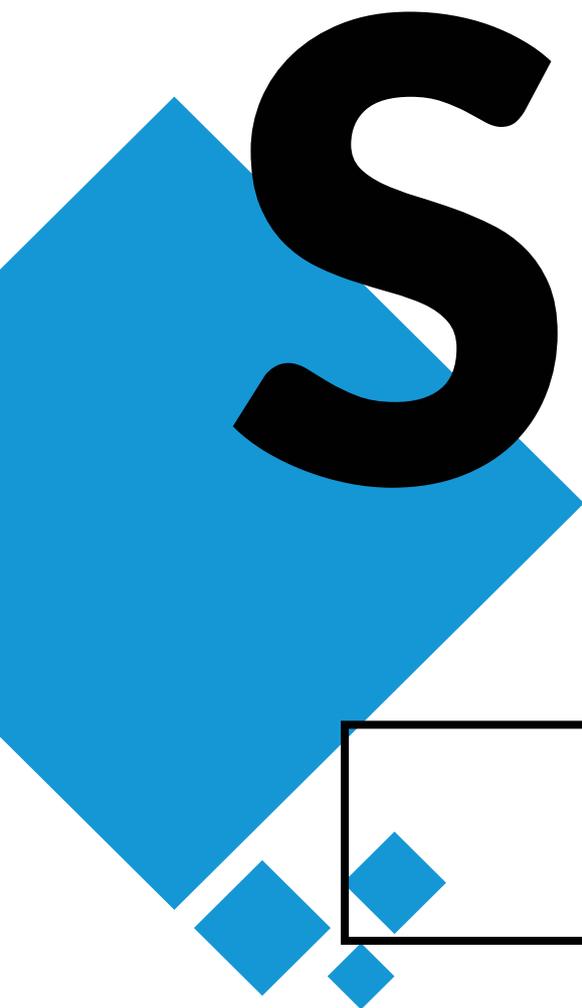
Some manufacturers are yet to be convinced of the need to digitalize all aspects of their operations. When asked about the most important elements of their business strategy for the next three years, the leading response of those surveyed (cited by 46%) is to "adopt more digital technologies such as cloud, analytics, robotics, and IoT." In several areas of digital adoption, the surveyed manufacturers appear to be keeping pace or are ahead of firms in other industries (see Figure 8).

Two-thirds of the survey respondents report that their firms access cloud-based IT services today, and all expect to be doing so within three years.

Cost is one reason, according to Lexmark's Brad Clay, who remarks that, "Thanks to cloud, the cost of infrastructure is dropping to almost nothing. Especially if you can get into a server-less environment."

Cloud is also integral to the platform-based ecosystems that many manufacturers are building or joining today.
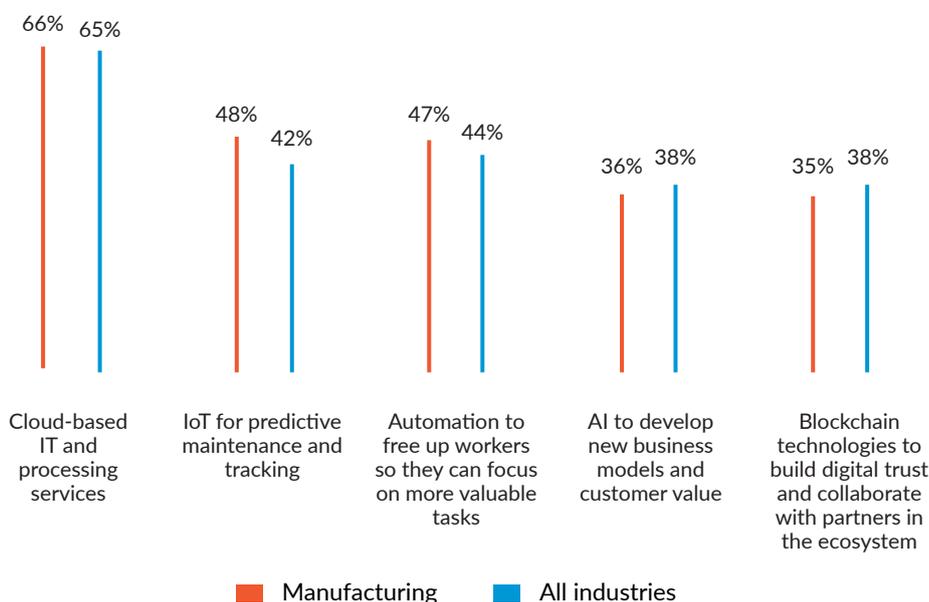

	66%	65%	48%	42%	47%	44%	36%	38%	35%	38%

Cloud-based IT and processing services

IoT for predictive maintenance and tracking

Automation to free up workers so they can focus on more valuable tasks

AI to develop new business models and customer value

Blockchain technologies to build digital trust and collaborate with partners in the ecosystem

■ Manufacturing   ■ All industries

Figure 8: Technology adoption for manufacturers today

early half of the surveyed manufacturers also utilize IoT and automation technologies, including robotics. IoT sensors are also core components of auto manufacturers' connected car platforms, as discussed above, as well as connected platforms in other subsectors.

Taking a granular view on technology adoption in the manufacturing industry, we observe that cloud is clearly the current priority (as is the case with the other industries we surveyed), with AI, blockchain, IoT, and automation expected to see increased investments over the next three years (see Figure 9).
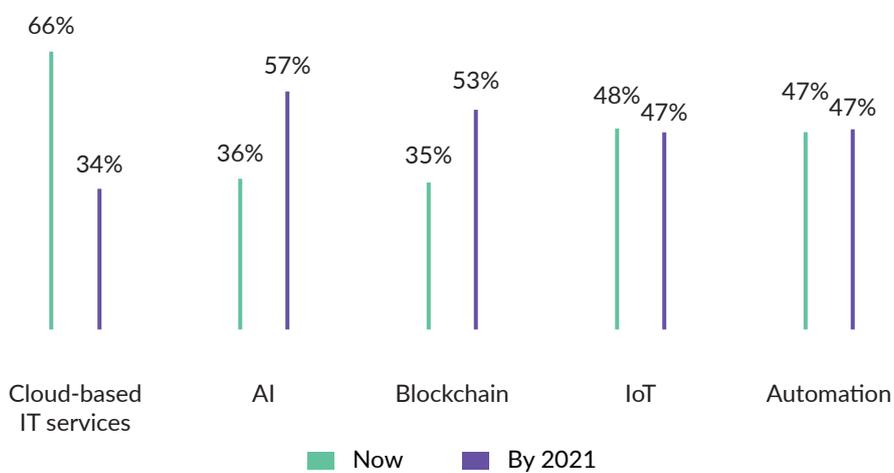
	Now	By 2021
Cloud-based IT services	66%	34%
AI	36%	57%
Blockchain	35%	53%
IoT	48%	47%
Automation	47%	47%

Figure 9: Technology priorities for the next three years

Conclusion

anufacturers who have adopted Business 4.0 behaviors assert that their top and bottom lines have seen a direct benefit. They are also finding that inculcating such practices in their corporate cultures sets them on the path to delivering higher business growth, and not just greater efficiency. The barriers to progress can be formidable, particularly where they involve people and culture, but the industry's strengthening digital foundations give hope that they can be surmounted.

Our research brings forth a few lessons to guide manufacturers as they progress on their Business 4.0 journey:

New businesses and business models mean everything.
It is no exaggeration to say that the rise of digital technologies threatens traditional manufacturers with extinction. Many established brands – including Delphi, Cummins, General Motors, and CAT – have embraced digital transformation and updated their business models to stay relevant. Others must prepare to follow suit.

Strong leadership is key to Business 4.0.
To adopt the Business 4.0 behaviors vital for transformation, and for success in the digital world more broadly, strong and consistent messages from the top are required. Without this, entrenched risk aversion can defeat ambitions to develop new revenue streams or to share data and germinate ideas in platform-based ecosystems.

Agile should guide businesses from the factory floor up.
Agile practices benefit manufacturers across the business, not just in the IT department. Accelerated development and fail-fast approaches make it easier for managers to experiment with new product and service ideas.

For process redesign, think Machine First™.
Business 4.0 demands that automation technologies, already prominent on the product development and shop floor, become the default for all process execution in the business. Many processes should eventually be given over to AI for decision-making, and to robotics for manufacturing.

NOTES

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A part of the Tata group, India's largest multinational business group, TCS has over 424,000 of the world's best-trained consultants in 46 countries. The company generated consolidated revenues of US $20.9 billion in the fiscal year ended March 31, 2019, and is listed on the BSE (formerly Bombay Stock Exchange) and the NSE (National Stock Exchange) in India. TCS' proactive stance on climate change and award winning work with communities across the world have earned it a place on leading sustainability indices such as the Dow Jones Sustainability Index (DJSI), MSCI Global Sustainability Index and the FTSE4Good Emerging Index.

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