# Accelerating digital:

A win-win-win for customer experience, the environment and business growth

# Executive summary

The business landscape is constantly evolving and, with it, digital transformation. Businesses are under pressure to adapt to new competitors, increasingly from non-traditional markets, and to navigate ongoing geopolitical and economic uncertainty. At the same time, they need to become more sustainable and socially responsible, driven by government mandates and customer demands. Our new study shows that digitally driven businesses are able to embrace these rapid changes in their markets and deliver better customer experiences to drive profitable growth.

Indeed, the vast majority of firms we surveyed (99%) are leveraging new digital business models to tackle these challenges and drive greater agility, a trend that has been accelerated by covid-19. Over half (55%) of businesses expect a long-term increase in their use of digital technologies as a result of the pandemic, according to research by the European Investment Bank.[1]

Firms that are able to capture and derive value from new streams of data, and offer new products and services rooted in digital capabilities, can improve their operational efficiency, reduce their carbon footprint and boost customer satisfaction. This can translate into improvements in both revenues and profit margins, with 80% of our survey respondents stating that some form of digital transformation contributes over half of their profits today. Moreover, 95% expect some, most, or all of their revenue to be digitally enabled within five years.

However, there is often a wide gulf between the digital ambitions of firms and their ability to use data insights at scale, which would enable employees to make better real-time decisions and drive higher levels of innovation.

To better understand these trends, Economist Impact has undertaken an ambitious research programme. We have examined the state of digital transformation in businesses across five sectors in which digitalisation offers substantial opportunities for growth and competitive advantage: construction and infrastructure; manufacturing; transportation and logistics; energy; and healthcare and pharmaceuticals. Our global survey of 500 multinational firms identifies the ongoing barriers they face in executing their digital strategies. We offer cross-industry insights on how these barriers are being overcome based on economic analysis of firms that are successfully using digital business models to boost their customer satisfaction, sustainability metrics and revenues, and interviews with experts.

## Our key findings:

**Today, digital business models are not a choice but the default.** All businesses are digital in some form or another. Of the 500 firms surveyed for this report, 99% have extensively adopted at least one of four broad types of digital-first business models: digitalised processes;[2] smart products and services;[3] platform-based business models;[4] and digital ecosystems.[5] Moreover, 95% have adopted more than one of these, and 25% claim to have extensively adopted all four.

**The primary motivation for digital transformation is to enable businesses to better serve their customers.** Globally, across all five industries studied, businesses are adopting digital initiatives to improve customer experiences (57% of firms surveyed, on average). They are leveraging data to create more personalised and intuitive products and services.

In healthcare, for example, smart, sensor-enabled products are enabling a shift away from traditional provider-delivered healthcare towards greater self-monitoring and care management by patients. In the transport sector, vehicle manufacturers such as Volvo and Toyota are using telematics, sensors and the data they provide to help people drive more safely. A recent study finds that this has lengthened the average time between driving accidents by 1.8 years.[6]

**Digital transformation is also motivated by a drive for improved environmental, social and corporate governance outcomes.** Customers are increasingly factoring the values and behaviour of businesses into their buying decisions. In a recent survey by consultancy PwC, 80% of consumers acknowledged that they are more likely to buy from companies that are more environmentally and socially conscious.[7] Firms are responding: 39% of our survey respondents indicate that health and safety benefits are their primary motivation for digital transformation, and 38% are pursuing environmental benefits.

Hotel group Marriott International, for example, has captured energy savings of 15% by using automated smart meters to track and manage consumption.[8] The covid-19 pandemic has also accelerated the use of video conferencing and remote working, with knock-on environmental implications and benefits.

On the customer-facing side, firms such as John Deere, the US-based farm equipment manufacturer, have been investing heavily in technologies that minimise environmental harm. John Deere's See & Spray technology uses cameras, computer vision and machine learning (ML) to reduce its customers' use of herbicides in farming by 75%.[9] The digitally enabled equipment makes on-the-spot judgement calls to determine whether a plant is a weed and if treatment is needed based on real-time changes in the environment, adjusting the spraying of herbicides accordingly. This results in higher levels of precision, less waste and lower cost.

**Evidence shows that digitally transformed businesses see competitive gains over time.** The use of data has allowed businesses to optimise and automate functions (a key benefit for 37% of survey respondents), resulting in greater efficiency, fewer errors and faster time-to-market. According to 32% of survey respondents, data also allows businesses to better collaborate across both their value chain of suppliers and distributors and the end-to-end life cycle of their products and services. Construction contractor Skanska, for example, has achieved a 65% cost saving by using digital tools to liaise across project teams and improve construction accuracy.[10]

Cost reductions, combined with revenue growth from greater competitive advantage, contribute to higher profits in the longer term. Research by consulting firm Accenture found that the revenues of digital leaders are growing five times faster, on average, than those of other businesses since the pandemic. These firms are pulling ever-further away from their competitors—previously they were growing twice as fast as the digital laggards in their sectors.[11]

**But the biggest challenge to *successful* digital adoption is in applying the right data insights across the entire value chain and the life cycle of products and services.** The value of digital transformation is no longer in question—in our survey, only 10% of businesses still struggle with leadership buy-in. Now, the challenge is putting the business case into practice. This means an overhaul of the traditional ways of doing business, with implications for every employee and process.

When asked about the biggest challenges to digital transformation, the top responses in our survey relate to infrastructural concerns which limit the ability to generate usable data. These include: cyber-security (37% of respondents); data interoperability (29%); and legacy technology (22%). Without standards helping us share data using common languages and formats, firms cannot fully leverage the insights they offer for improving every aspect of business. According to analysis by Forrester Research, up to 73% of data firms collect today is unused for analytics purposes.[12] The challenges around data management and governance are also hindering the adoption of artificial intelligence (AI) and ML. Only 25% claim that the use of AI across their business is mature.

Kajima Corporation, one of the largest construction companies in Japan, has been at the forefront of overcoming the challenge of data interoperability in the sector through its efforts to drive the global use of open data standards. Its cloud-based Business Information Modelling (BIM) platform enables open data to be shared with partners responsible for designing, building and maintaining infrastructure, and to be integrated into the software systems these firms use to speed up time-to-market, reduce errors and operational costs, and improve sustainability.[13]

**Digitally mature firms have a first-mover advantage and can sustain success by attracting and retaining the right talent.**
Access to digital talent is one of the key differentiators between businesses that have extensively adopted digital business models and those that have not. The former group appears to have an edge in hiring digital talent—around 60% of these businesses believe that the expertise of their employees in digital technologies is mature, compared with 40% of businesses that have not extensively adopted digital business models believing this to be the case. Navneet Kapoor, chief technology & information officer at shipping company A.P. Moller-Maersk, noted: "We have incorporated 3,000 new employees in tech over the last three years, which implies a huge shift in capabilities, a critical aspect for us to be able to unleash the potential of our strategy and ensure that we can move at the speed needed to meet the ever-changing needs of our customers."

Digital transformation is by no means a once-and-done endeavour. More appropriate terminology would be to describe all businesses as "digitally transforming" on a journey with no endpoint. It is disruptive: 69% of respondents to our survey have been moderately or severely disrupted by the adoption of digital business models. But in an environment in which all firms are adopting digital technologies to meet customers' growing demands for value and social responsibility, digital transformation is the only viable way forward.

Early adopters are benefitting from the digital expertise they can build, which is enabling them to attract and retain the right talent. Businesses that can continually transform successfully will reap the gains from the disruption, while those that do not will bear the far larger cost of being left behind.

# Contents

# Introduction

Businesses today face more competition than ever before, while also having to navigate geopolitical and economic disruption. Greater competition brings greater choice for consumers. As a result, customer expectations regarding quality, performance and overall value are rising too. Meanwhile, greater disruption gives rise to greater uncertainty: witness the effect of the pandemic on global supply chains that businesses had to respond to in order to fulfil customer demand in the cheapest and most efficient manner.

Beyond the need for businesses to be able to anticipate and adapt to disruption and changes in consumer demand, they must also respond to increasing scrutiny of their ESG (environmental, social and governance) practices. In the UK, for example, large firms are now required to disclose their climate-related risks and opportunities.[14] Globally, at least 29 countries have introduced similar mandates, while many others encourage

voluntary disclosure.[15] Consumers are demanding sustainability too. In a recent survey conducted by the consultancy PwC, 80% of consumers said they are more likely to buy from companies that are more environmentally and socially conscious.[16]

Digitalisation has been proven an effective means for firms to adapt to rapid changes in their markets. It enables them to capture real-time data to monitor and manage their value chains and sustainability footprints, and to establish direct, responsive relationships with customers. During the pandemic, digital technologies were an essential enabler of business continuity amid global lockdowns. As a result, digital adoption across industries and geographies accelerated by three years, on average.[17] This acceleration has widened the competitive gap between digitally advanced firms and those firms that have been less progressive. Research by consulting firm Accenture found that while the revenues of digital leaders grew twice as fast as digital laggards before the pandemic, they are now growing five times faster.[18]

While most businesses recognise the imperative for digital transformation, many struggle to overcome the barriers created by legacy technologies and ways of operating, both internally and across ecosystems. A key emerging question is: what have those businesses that have successfully adopted digital models done differently, and what can others learn from them?

**Digitalisation has been proven an effective means for firms to adapt to rapid changes in their markets. It enables them to capture real-time data to monitor and manage their value chains and sustainability footprints, and to establish direct, responsive relationships with customers.**

This report examines the adoption and maturity of digital business models in five sectors: construction and infrastructure; manufacturing; transportation and logistics; energy; and healthcare and pharmaceuticals. It focuses on four broad categories of digital business model:

- **Smart products and services:** The use of smart, connected products (consumer or industrial goods or services) to generate and transmit data, enabling complementary, and often revenue-enhancing, offerings (such as smart contracts and predictive maintenance).

- **Digitised processes:** The use of digital technologies and data to drive improvements in operating efficiency, product/service quality, and/or customer experience.

- **Platform-based business models:** The facilitation of digital interactions at scale between different entities, such as suppliers, customers and firms in adjacent industries.

- **Digital ecosystems:** A business arrangement between two or more entities to create and share in collective value for a common set of customers, enabled by technology and data platforms.

In the report, we explore:

- The impact of the adoption of digital business models on a range of performance metrics, including revenues, profits, customer experience and sustainability measures;

- The power of data created by digital technologies, and how it is being applied across industries to create value; and

- The barriers that businesses face in digital transformation, showcasing examples of how some companies have overcome them.

# The great digital acceleration

### Key takeaways:

- Of the industries studied, the energy sector is currently leading the charge with the highest level of digital adoption, followed by transportation and logistics.

- Nearly three-quarters of our respondents (73%) say that it is "extremely likely" that they will invest more in smart products and services over the next five years, increasing to 92% for extensive adopters of technology.

- Motivation for digital transformation is typically driven by the need to create value for customers, but there are internal benefits that generate lower costs and higher profits as well.

- The vast majority of survey respondents (80%) say that some form of digital transformation contributes over half of their profits today.

## Digital by default

### The acceleration of digital

Today, virtually every company is a digital company. Of the 500 firms surveyed by Economist Impact, 94% report having adopted digital-first business models (64% to a great extent and a further 30% to some extent).

Nearly all (99%) have pursued digital transformation in at least one of four ways: the adoption of digitised processes (70%); smart, connected products and services (64%); platform-based business models (64%); and digital ecosystems (57%). One-quarter of firms have extensively pursued digitalisation in all four ways.

Of the five industries studied in this report, energy is currently leading the charge with the highest level of digital adoption, followed by transportation and logistics (see Figure 1). Across the energy sector, 97% of firms surveyed have developed smart products and services to some or a great extent. Enel, for example, has been digitising its electricity grids and has 60% of its customer base using smart meters as of 2021.[19]
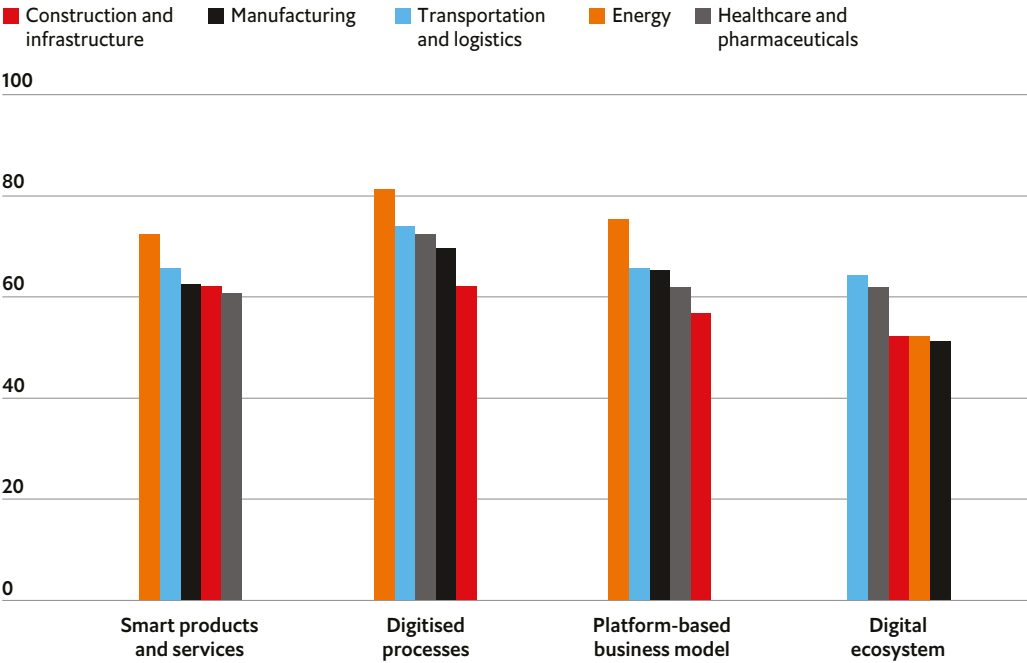
Digitalisation has enabled a shift away from the traditional energy business model of business-to-consumer (B2C) energy trading to peer-to-peer (P2P) models through interconnected platforms.[20]

Energy suppliers are leading experiments in distributed energy, developing products and services for households and businesses to help them manage consumption. Energy Management Systems (EMS), for example, automate the collection of real-time data across the chain of energy suppliers, distributors and consumers, enabling greater efficiency. A recent study found that they can reduce energy costs for consumers by almost 9%,[21] partially counteracting the rapid growth in energy prices today.[22]

**Figure 1: The energy sector is the highest adopter of all components of digital business models, except ecosystems**

% share of businesses using different components of digital business models extensively, by industry

- Construction and infrastructure
- Manufacturing
- Transportation and logistics
- Energy
- Healthcare and pharmaceuticals



Source: Economist Impact survey of business executives[i]

The growth in smart products and services is particularly strong across every sector. For example, in the automotive sector, smart, connected vehicles are helping to improve safety and minimise congestion in a global context of rapid population growth and increased urbanisation. According to the World Health Organisation (WHO), around 1.3 million people die in traffic accidents every year around the world—this is equivalent to a fatality every 24 seconds.[23] Intelligent vehicles share traffic data with each other and their surroundings to provide better vehicle awareness and a safer and more convenient driving experience. Vehicle manufacturers such as Volvo and Toyota are using telematics and sensor data to track driving patterns and increase safety by providing real-time guidance on improving driving behaviour and automating system responses—for example, by sending notifications when a collision is detected. A recent study has found that this has lengthened the average time between driving accidents by 1.8 years.[24]

Nearly three-quarters of our respondents (73%) say that it is "extremely likely" that they will invest more in smart products and services over the next five years, increasing to 92% for extensive adopters of digital technology. This corresponds with forecasts for growth in the number of connected devices from 12.3 billion today to 27 billion by 2025.[25]

The collection of real-time data through these connected devices enables firms to anticipate and adapt to rapid changes in their operating environment and make smarter, more automated decisions that reduce time-to-market and costs. Estimates of the economic impact of Internet of Things (IoT) technologies that enable smart products and services are eye-opening. McKinsey Global Institute, for instance, predicts that the IoT will deliver a total economic benefit of between US$3.9 and $11.1 trillion per year by 2025.[26] Achieving the upper end of these estimated gains will rely on overcoming business-level and regulatory hurdles.

## Opportunities for all

The benefits of digital transformation and real-time data insights span all industries.

### Construction and infrastructure

#### Opportunities

Digitalisation in construction is providing a solution to whole-life asset management, spanning the design, build and maintenance processes.

Digital platforms enable new business models, built on vertical integration and the development of ecosystems connecting partners across the value chain and total life cycle of a product or service.[27] For example, architects, engineers, environmental specialists and building and maintenance contractors can benefit from more transparent and collaborative workflows.

Data standardisation helps firms share information using common languages and formats, while AI can help to improve the planning, delivery and operation of built assets. Without data interoperability, owners and operators incur additional costs in converting or recreating the data they need to manage their built assets and asset-based services.

#### Case studies

Construction contracting firm Skanska has adopted BIM and digital engineering in its Crossrail development project in London—Europe's largest construction project, with 10,000 people working across 40 sites to build a new railway. This has reduced construction costs by 65% and saved significant time.[28]

The use of digital twins to create a virtual representation of the railway, and data, has also enabled Skanska to rehearse key phases of this complex construction project in order to improve on-site planning and decision-making and support better health and safety for its workers.[29]

### Manufacturing

#### Opportunities

Many manufacturing firms are creating digital platforms and ecosystems, enabling the development of more sophisticated products, and venturing beyond products into servitisation ("outcome-as-a-service") business models.

With servitisation, a vendor is incentivised to design and manufacture high-quality, durable and modular equipment for easy repair and replacement. These products then circulate in use for much longer, conserving the resources that are used in production.

A variety of new and emerging technologies support this transformation, including the IoT, ML, digital twins, robotics, flexible systems, numerical control systems,[30] additive manufacturing and other types of digital fabrication, rapid prototyping and 3D printing, and nanotechnology.[31]

#### Case studies

Rolls-Royce's aviation business is an archetypal case study of servitisation. Over 50 years ago, it pioneered the services model in manufacturing, selling "power by the hour" — a model in which it leases its engines to airlines and monitors their performance remotely in real time.[32]

Since then, servitisation has become increasingly widespread. In 2016, for example, Signify (formerly Philips Lighting) introduced a "lighting-as-a-service" (LaaS) business model in which it retains ownership of light fixtures while clients pay a monthly fee for contracted light levels, energy savings and uptime maintenance, including recycling and end-of-life management to support the circular economy.[33]

AI, ML and the IoT enable LaaS vendors like Signify to monitor building usage so that light is provided in response to actual need. Lighting accounts for 15% of global electricity demand and generates 5% of global greenhouse gas emissions.[34] In Schiphol Airport, LaaS reduced energy consumption by 50% compared with the previous system.[35]
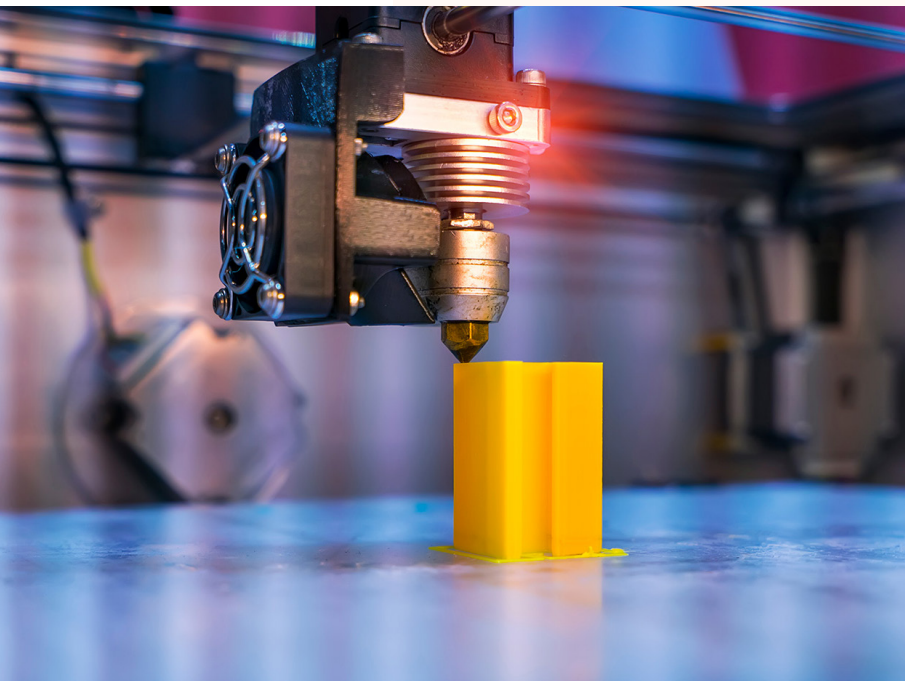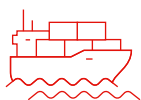
### Transportation and logistics

#### Opportunities

In the realm of transport, technologies, such as AI, the IoT, remote control, comprehensive automation, big data, real-time tracking, and 3D city and network modelling, support a variety of business models.[36]

Digitalisation is the driving force behind shared mobility in transportation, a market that already exceeds US$60 billion in China, Europe and the US.[37] In car sharing, for example, there are B2C roundtrip and one-way models, and P2P models.

Digital technologies also support vehicle telematics which uses Global Positioning System (GPS) technology to triangulate the position of vehicles, and digital cellular networks to transmit a range of data from the vehicle. This enables consumers to personalise services, such as usage-based insurance, predictive maintenance and in-car entertainment. It enables commercial logistics providers to manage services like mileage and driving style reporting and coaching, in addition to AI-enabled routing to reduce fuel consumption and $CO_2$ emissions, while improving safety. The International Data Corporation (IDC) predicts that nearly 70% of worldwide new light-duty vehicles and trucks will be shipped with embedded connectivity by 2023.[38]

The availability of real-time data is also vital to the development of autonomous vehicles.

#### Case studies

Volvo introduced its Telematics Gateway in 2013 to remotely monitor the condition of its customer-owned trucks via mobile networks and the collection of fault codes. Volvo can use this data to plan servicing based on need, reducing maintenance costs and improving vehicle availability and scheduling for logistics providers.[39]

Today, telematics is providing a wider range of benefits for a new generation of electric vehicles (EVs).[40] Volkswagen's Car-Net telematics, for example, is installed in its EV models and allows users to remotely monitor battery status and locate charging stations.[41]

## Energy

### Opportunities

Arguably the most pressing need and demand for business transformation is in the energy sector, where the triple imperatives of "decarbonisation, decentralisation, and digitalisation"[42] are driving the rapid adoption of renewable energy sources, such as solar, wind, biomass and geothermal.

AI enables energy providers to forecast demand from different communities, taking into account the weather and situational and historical data. ML enables them to monitor the success of decisions to store solar power in batteries, distribute it over a microgrid, or sell it on an electricity exchange, and thereby continuously improve their operations.

### Case studies

BluWave-ai is a Canada-based business, founded in 2017, that uses AI to transform the distribution of renewable energy. It has developed an AI-powered optimisation platform that uses historical and live data to balance the cost, availability and reliability of different sources of alternative energy. This allows for better decisions on the most efficient utilisation of renewable energy and minimises the need for fossil fuels. Using its platform, BluWave-ai's customers have reduced both their operational costs and their carbon footprint.[43]

### Healthcare and pharmaceuticals

#### Opportunities

The covid-19 pandemic has demonstrated the critical role of digitalisation in global health leadership, as well as access to healthcare for all. Digitalisation is also the driving force behind e-health, with many new startups providing virtual doctor consultations and diagnoses.

In addition, wearable technologies enable patients to continuously monitor their conditions. The application of these technologies has enabled the industry to make significant strides in understanding different diseases and how they can be best treated.

The use of the data they produce, combined with AI and ML technologies for disease identification, for example, is improving the diagnostic process and reducing the risk of life-threatening misdiagnosis.[44]

#### Case studies

In response to the increase in the prevalence of heart disease and hypertension, Omron Healthcare has made "Going for Zero™ heart attacks and strokes" its mission.[45]

In 2019, the firm launched HeartGuide—the first wearable blood pressure monitor. All readings can be transferred to a corresponding mobile app, HeartAdvisor, for review, comparison, and treatment optimisation. HeartAdvisor can store, track and share user data with healthcare professionals, while also providing users with insights into how their lifestyle affects their blood pressure.[46]

**Kajima: Transforming construction using data**

Japan's Kajima Corporation has been at the forefront of digitalisation in the construction industry. It is using digital technologies to transform its operations and reduce its carbon footprint.

In 2015, Kajima became the first company in the world to develop a cloud-based BIM platform, which it uses to manage and share data internally and with partners across all phases of the building process. The company also plays a leading role in the effort to develop global BIM standards, which are vital to ensure the data interoperability necessary to enable multi-disciplinary collaboration. Nearly one-third of the respondents to our survey identified data interoperability as one of the key challenges in implementing digital business models.

With its advanced approach to data governance and management, Kajima is also making great progress in the adoption of AI and ML. For example, the firm is using AI to automate some of the processes involved in creating technical drawings[47] and planning construction schedules, including the use of scenarios to identify how it should respond to potential changes or delays. This is helping to keep projects on time and on budget.[48]

Analysis of the company's performance pre- and post- the implementation of its BIM platform suggests positive impacts on its bottom line. Since 2011, Kajima's carbon production has been increasing at a rate of over 11% annually. However, after implementing its digitalisation efforts, its carbon production has been in sharp decline in recent years, now *decreasing* at a rate of 3.5% annually.[ii] By reducing defects and problems before beginning the construction process, BIM has allowed the business to speed up processes and minimise waste from replication.[49]

In addition to the adoption of BIM, Kajima is using digital technologies in other ways that reduce its own and its customers' carbon footprints. For example, Kajima Europe launched a renewable energy platform to develop solar and battery storage projects to decarbonise the grid and property sectors.[50]

While Kajima's revenue growth has slowed, its digital transformation has been accompanied by a significant increase in profits. Profits have grown at an average annual rate of nearly 6% since 2015 (exceeding the 5% industry average in Japan), compared with 2.6% before the launch of Global BIM 2.0. While not entirely attributable to the digital transformation, this suggests that there has been some reduction in operating costs.

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ii.   Based on Economist Impact analysis using data published in the company's latest Integrated Reports.

**Figure 2. Kajima Corporation has seen a rapid growth in profits post-transformation compared with its historical performance**
Estimated impact of digital transformation on gross profits, Yen million
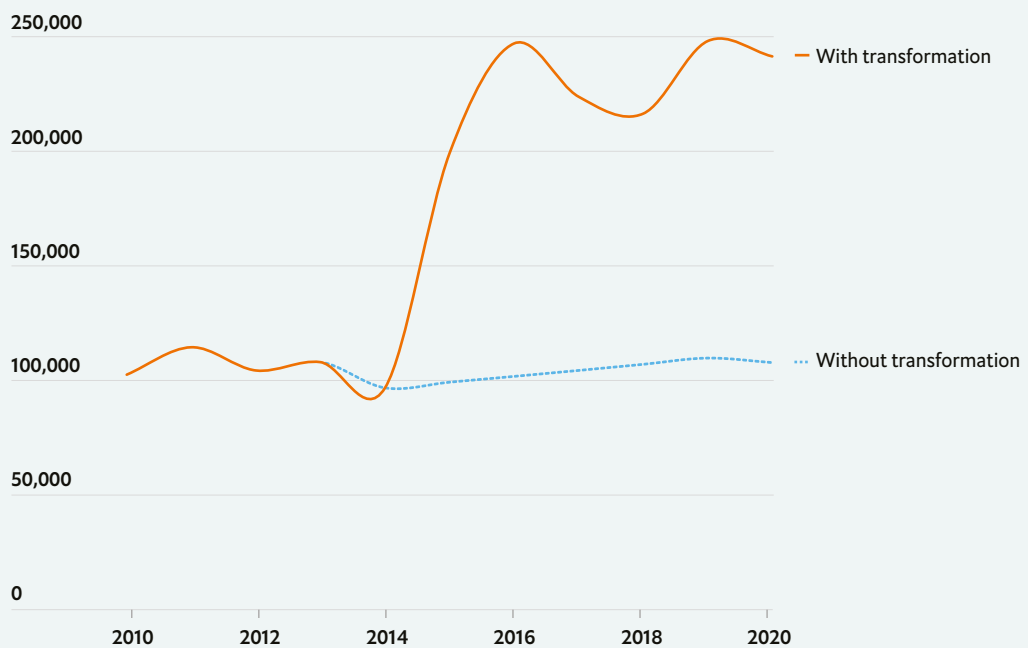


Source: Economist Impact (see Appendix 2 for detailed methodology)

## Profits and purpose

Business growth is driven by profits and purpose. Digital transformation plays an instrumental role in achieving both. While our survey results indicate that the motivation for digital transformation is typically aimed at creating value for customers, the benefits can be felt internally as well, and are reflected in lower costs and higher profits.

## Profits

Data—and the digitally derived insights it contains—drives corporate profitability. It allows businesses to identify new revenue-generating opportunities aligned to the overarching business strategy. Thijs Broekhuizen, associate professor of innovation management and strategy at the University of Groningen

notes: "In order to become a successful digital platform, all parts of your business strategy should be aligned. The more digital a product is, the higher the profit margins. The difference between winners and losers when it comes to digital transformation is that the winners use technology to serve new segments of the market that have not been served."

A recent study by IDC found that, within the next year, 40% of revenues will be digitally derived for one in two firms.[51] Our survey suggests that this could be a low estimate. The vast majority of survey respondents (80%) told us that some form of digital transformation contributes over half of their profits today. Moreover, 95% expect some, most, or all of their revenue to be digitally enabled in five years.
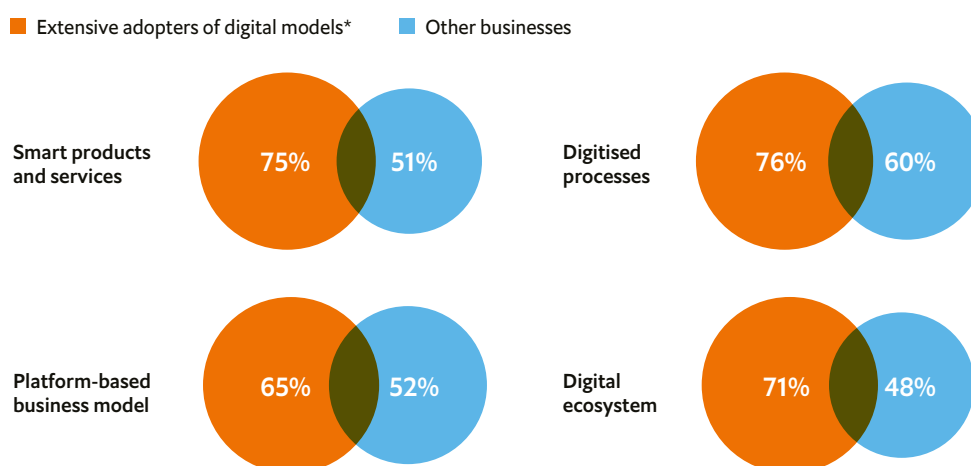
> ## "The difference between winners and losers when it comes to digital transformation is that the winners use technology to serve new segments of the market that have not been served."

Thijs Broekhuizen, associate professor of innovation management and strategy, University of Groningen

**Figure 3. Businesses that are extensive adopters of digital models derive a greater share of their revenues from digital components.**
% share of businesses deriving over 50% of their revenue from digital models

■ Extensive adopters of digital models*   ■ Other businesses

**Smart products and services** 75% 51%

**Digitised processes** 76% 60%

**Platform-based business model** 65% 52%

**Digital ecosystem** 71% 48%

*Note: "Extensive adopters of digital models" include survey respondents that have extensively adopted all four types of digital business models assessed

Source: Economist Impact survey of business executives[iii]

Digital transformation spurs profit growth in several ways.

**Cost reduction, driven by increased efficiency:** The use of digital technologies, such as data analytics and AI, can make business processes 40–50% more efficient according to the Everest Group, a research firm.[52] Among our survey respondents, 37% state that digital technologies reduce their costs.

**Enhanced customer value:** More than half (57%) of survey respondents said that digital technologies allow them to provide a better customer experience, which in turn enhances the value proposition they can offer customers as well as their competitiveness in the market. McKinsey estimates that digital transformation focused on customer experience can increase customer satisfaction by 30%, and revenues by up to 50%.[53]

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iii.  Based on the number of businesses responding "to a great extent" to the following question: "To what extent is your organisation currently using the following components of a digital business model to generate value for customers?"

**New revenue streams:** Servitisation models enabled by digital technologies can be a rich source of new revenue—yielding as much as twice the revenue of product sales, according to Laure Ambroise, a professor at France's IAE network of business schools.[54] She also finds that servitisation mitigates commoditisation risks and price sensitivities, delivering higher margins and rates of return than on products alone.

**Greater agility and resilience:** Digital technologies help companies shore up revenues and profits in the face of change. This was confirmed by the Subscription Economy Index which tracked the performance of subscription models in the manufacturing sector through the covid-19 lockdowns.[55] It found that firms with subscription-based digital services "outperformed their S&P counterparts as they rebuilt after shutdowns". It also found that these digital services enabled 7% revenue growth in the second quarter of 2020, compared with an 8.1% revenue decline for non-servitised S&P counterparts. Part of the rebound for servitised businesses was driven by their recurring-revenue models during a time when consumer spending was in decline. These businesses were also able to offer free trials to attract new customers once spending was revived.[56]
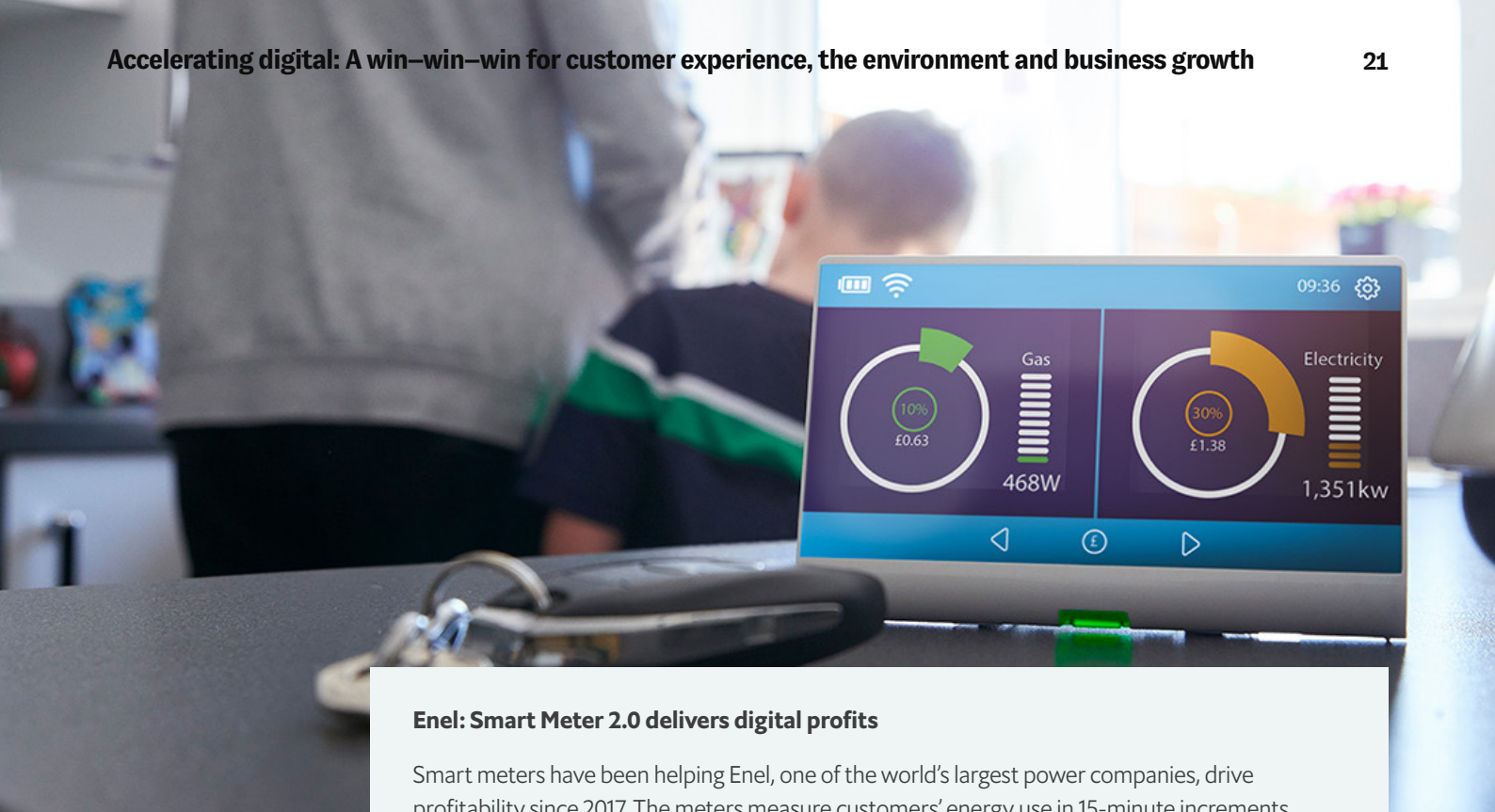
### Enel: Smart Meter 2.0 delivers digital profits

Smart meters have been helping Enel, one of the world's largest power companies, drive profitability since 2017. The meters measure customers' energy use in 15-minute increments, generating a near real-time picture of power use and consumption behaviours. According to Antonio Cammisecra, Head of Global Infrastructure and Networks at Enel, "In only a few years the benefits both for the company and for the customers were so evident that smart metering systems became mandatory for all the other national distribution companies."

Enel uses the vast amount of data it collects to improve service quality and operational efficiency in its networks through predictive maintenance, load balancing and revenue protection. The second-generation meters also empower customers. A dedicated communications channel in the meter, "Chain 2", allows Enel to deliver energy management and home automation services, along with a broad range of information that raises customer awareness and understanding of their personal energy consumption. For example, the system can trigger the start of a washing machine cycle when an off-peak tariff is detected, or control the power available to recharge EVs based on data on the energy consumption of other household appliances.[57]

Enel's Smart Meter 2.0 and Chain 2 provide an example of how firms can overcome the problems associated with leveraging data to create new customer value. Research has found that 60–73% of all data that firms collect goes unused.[58]

Two years after the introduction of Smart Meter 2.0, Enel's revenue was 11% higher than in a hypothetical scenario in which the business did not undergo digital transformation and historical growth trends persisted.[iv] This far outstripped the 5% profit growth in Europe's energy sector. The company's carbon production—which had been rising annually by 1.2%—has also changed trajectory and has been on a declining path since the launch of its smart meters. While many factors may contribute to these improvements, digitalisation is expected to have played a role.

Although Enel's revenues and profits have declined recently, this has largely been driven by external factors, including the covid-19 pandemic, the devaluation of currencies and bad customer debt.[59]

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iv. Based on Economist Impact analysis using data published in the company's latest Integrated Reports.

**Figure 4. Post-transformation Enel's revenues have seen growth following a long period of decline.**

Estimated impact of digital transformation on revenue, EUR millions



— With transformation
··· Without transformation
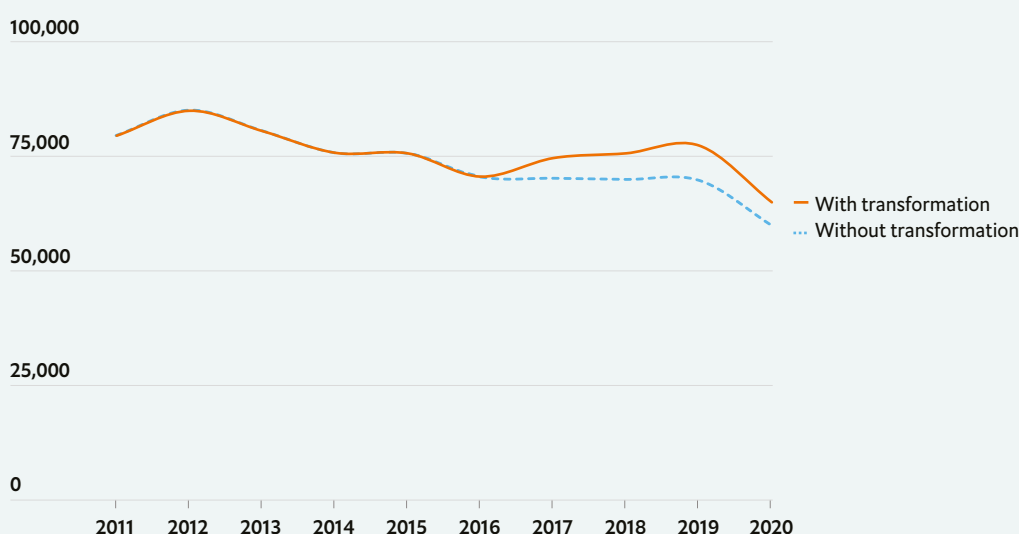
Source: Economist Impact (see Appendix 2 for detailed methodology)
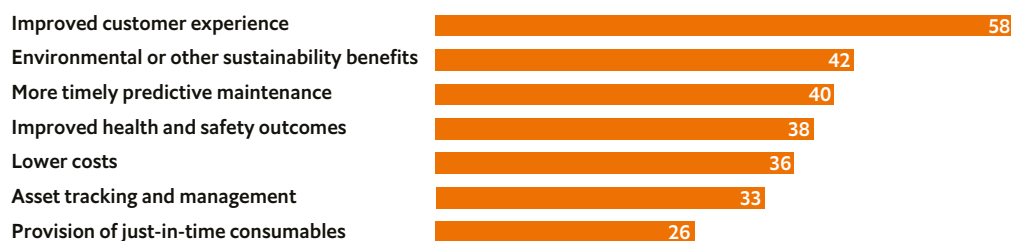
## Purpose

Digital transformation helps firms define their purpose and to pursue it with greater intensity. It can support a more customer-centric strategic focus, as well as the attainment of ambitious ESG targets that serve a broad range of stakeholders.

**Customer-centricity:** Given the success that companies such as Amazon and Uber have realised by placing customers at the centre of their business, it is clear why our survey respondents identify an enhanced customer experience as their primary motivation behind digital transformation (see Figure 5). It also explains why digital initiatives are often focused on customer-facing activities, such as ordering, fulfilment, monitoring and diagnostics, and repair and resell.

"The most successful digital businesses are constantly running experiments to understand their customers' needs", says Vallabh Sambamurthy, Albert O. Nicholas dean of the Wisconsin School of Business of the University of Wisconsin. He adds: "Today, most innovative businesses run thousands of market and customer experiments a year. They include Intuit, P&G, Google, Amazon, and Netflix. These experiments include discovering customers' latent needs, new market opportunities, or opportunities for enriching customer experiences. While most experiments may fail, the successful ones spawn breakthrough business gains. For example, Amazon's outstanding success with Amazon Web Services, Prime, Echo, and Kindle were all born out of market experiments. According to Bezos, the founder of Amazon, big winners pay off for the volume and velocity of experiments".

**Figure 5. Improved customer experience is the strongest motivator for businesses to invest in digital transformation.**

%, Business motivation for digital transformation

| | |
|---|---|
| Improved customer experience | 58 |
| Environmental or other sustainability benefits | 42 |
| More timely predictive maintenance | 40 |
| Improved health and safety outcomes | 38 |
| Lower costs | 36 |
| Asset tracking and management | 33 |
| Provision of just-in-time consumables | 26 |

Source: Economist Impact survey of business executives[v]

To enhance customer experience, eBay recently launched a new virtual reality (VR) technology that allows Australian customers to browse more than 12,500 products using its new gaze recognition technology, Sight Search. The VR technology connects to the existing eBay site via an app on users' smartphones.[60]

**"The most successful digital businesses are constantly running experiments to understand their customers' needs."**

Vallabh Sambamurthy, Albert O. Nicholas dean of the Wisconsin School of Business of the University of Wisconsin

**ESG enhancement:** The pursuit of ESG goals is a key target for digital initiatives. A recent joint study by the Global e-Sustainability Initiative and Boston Consulting Group estimates that IoT-enabled solutions aimed at increasing the efficiency of the transmission, distribution and use of power could reduce greenhouse gas emissions by 17% of projected emissions each year.[61] It is no wonder that our survey respondents identified health and safety benefits and environmental benefits in almost equal measure (39% and 38%, respectively); 14% cited both.

"From a business perspective, digitalisation is breaking down silos and providing a unified, real-time view of the entire organisation," explains Olivier Blum, Executive Vice President of Schneider Electric's Energy Management business. "It enables smarter working practices, more efficient use of space, and optimised energy demand." Kelly Becker, zone president for Schneider Electric UK and Ireland, adds: " IoT-enabled sensors have made it possible to identify and analyse at a granular level where and when energy is being consumed within a building, enabling decisions about heating and ventilation to boost energy efficiency". Marriott International, for example, has made energy savings of up to 15% using automated smart meter readings to track and manage consumption.[62]

Beyond the use of digital technologies to drive internal environmental benefits in their own operations, businesses are also leveraging these technologies from an external-facing perspective. US manufacturer John Deere, for example, is capturing broad-based environmental benefits while enhancing the value it delivers to farmers with smart, connected tractors and agricultural machinery. Its See & Spray technology reduces the use of certain herbicides by 75%.[63]

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v.  Based on survey responses to the following question: "Which of the following elements of your digital business model generate the greatest benefit for your customers today?"

In industries involving significant physical labour—such as manufacturing and construction—the use of digital technologies can also generate substantial health and safety benefits. Wearable devices can help detect dangerous conditions, while the use of AI can predict outcomes and emerging safety risks.[64] Smart helmets, for example, are being developed and used in the construction industry for increased safety. They use sensors to monitor the wearer's vital signs and the external environment and to warn workers about potential risks.[65]

**"A plethora of effective, scalable, and cost-effective technology is available to make a huge impact on lower emissions. Existing buildings can be upgraded and retrofitted with physical and digital technologies that drive the behavioural changes needed to make efficiencies, while anyone involved in designing a brand-new building has a fantastic opportunity to build in technology and create a net-zero building right from the start."**

Kelly Becker, zone president for Schneider Electric UK and Ireland

# The power of data



**Key takeaways:**

- Of the businesses surveyed for this research, 70% are currently using digitised processes to automate their functions to a great extent, while 72% believe their investment is "extremely likely" to increase in the next five years (85% in the transport industry).

- Data enables firms to automate and orchestrate complex business processes. In healthcare, for instance, data supports the automation of high-volume, repetitive tasks, such as patient registration processes, and claims processing and reconciliation.

- Data sharing is an important element in the collaborative effort needed to create vibrant and productive digital ecosystems. The primary benefit of sharing data with ecosystem partners is to produce solutions that would otherwise be beyond the reach of individual firms.

- Data and digital technologies create myriad opportunities to engage with customers and enhance their overall experience. Accordingly, 48% of our survey respondents say that data can improve their understanding of customer needs, and 57% believe it allows them to personalise the customer experience in numerous ways.

Data enables evidence-based decision-making by tracking and analysing all aspects of human life. The process of generating insights from data is becoming increasingly automated and more effectively leveraged through digitalisation. While most businesses understand the power of data, and many collect it, fully harnessing it using digital technologies is where many businesses struggle.

**"The times are changing quickly, even for laggard industries. Harnessing the power of data will be the driver of future growth."**

Andrew Maher, group managing principal, Eminence, Digital & Innovation, Aurecon

Digital technologies and business models produce data at a scale previously unimaginable. Sensors are transforming previously discrete products—such as elevators, thermostats and asthma inhalers—into data-generation engines. Digital platforms also generate an astonishing range of activity data. Manufacturing companies, for instance, are creating what Boston College Strategy Professor Mohan Subramaniam calls "production ecosystems"—digital platforms that collect data from suppliers, research and development (R&D), manufacturing, assembly and distribution channels.[66]

In turn, data enables companies to improve every aspect of their value chains. The data from production ecosystems can enhance effectiveness and efficiency across internal functions, as well as enable external collaboration with suppliers and other business partners. More importantly, data can be used to drive up the value that firms deliver to their customers—increasing engagement, loyalty and profit growth.

In this section, we explore the opportunities offered by data created using digital technologies, and in the following section we identify the barriers that businesses face in leveraging these opportunities.

## Data across internal business functions

Data is being used extensively to optimise and automate business functions. Of the businesses surveyed for this research, 70% are currently using digitised processes to automate their functions to a great extent (the highest share compared with other forms of digital transformation), while 72% believe their investment is "extremely likely" to increase in the next five years (85% in the transport industry).

Data enables firms to automate and orchestrate complex business processes. In healthcare, for instance, data supports the automation of high-volume, repetitive tasks, such as patient registration processes, and claims processing and reconciliation.
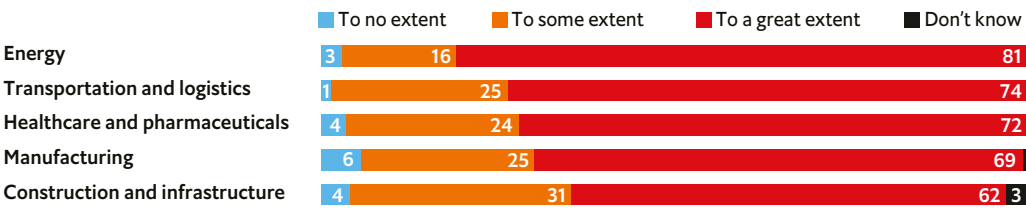
Data is also the fuel required to exploit the revolutionary advances in decision automation and support enabled by AI and ML. This is already producing many improvements in the provision of healthcare—from the fast and increasingly accurate analysis of mammograms and other tests to the prediction of relapse and remission rates for cancers, such as acute myelogenous leukaemia.[67]

**"Data drives value and solutions. Businesses that can capitalise on the data they have access to are those that will be the most successful. This is the disruption that is taking place across all industries."**

Michael Lenox, professor of business administration, University of Virginia

**Figure 6. All industries use data to digitise internal processes to a great extent.**

%, The use of data to digitise internal processes, by industry

■ To no extent　■ To some extent　■ To a great extent　■ Don't know

| Industry | To no extent | To some extent | To a great extent | Don't know |
|---|---|---|---|---|
| **Energy** | 3 | 16 | 81 | |
| **Transportation and logistics** | 1 | 25 | 74 | |
| **Healthcare and pharmaceuticals** | 4 | 24 | 72 | |
| **Manufacturing** | 6 | 25 | 69 | |
| **Construction and infrastructure** | 4 | 31 | 62 | 3 |

Source: Economist Impact survey of business executives[vi]

## Use cases by industry

### Construction and infrastructure

**Use case**

Data is powering a step change in internal construction practices. Autonomous rovers and drones enable civil engineers to capture measurements from numerous locations that they could not access before. Distributed sensor networks deliver field data over weeks, months and years, enabling real-time, remote monitoring, and rapid response.[68] The use of these technologies is reducing the time from design to construction, minimising errors and improving health and safety conditions for construction workers.

**Case studies**

The French government has partnered with software company Autodesk to apply digital construction processes in the restoration of the Notre Dame Cathedral after the severe damage caused by the fire of 2019. Digital twin technology is being used to create 3D models to compare scans of the cathedral pre- and post-fire. This is helping to replicate the original structure while increasing its resilience to potential future damage.[69]
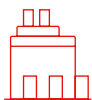
### Manufacturing

**Use case**

Data generated from sensors and analytics is enhancing every aspect of manufacturing. It is enabling industrial companies to design and build ever more versatile and tailored products at scale.

**Case studies**

In 2018, General Motors (GM) partnered with Autodesk to capitalise on a new technology called generative design. This uses machine learning and algorithmic methods to create optimised designs based on a set of performance objectives and constraints. The technology enables engineers to produce hundreds of design variations from basic parameters, such as materials needed, strength requirements, weight constraints, and the intended method of manufacture. GM was able to reduce seat bracket weight by 40% while increasing strength by 20%.[70]
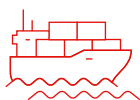
### Transportation and logistics

**Use case**

Data generated by IoT-enabled connectivity, real-time condition monitoring, and predictive analytics is transforming operations in the transportation sector.

**Case studies**

In the rail industry, GE Transportation and Wabtec offer solutions like "intelligent cruise control" to help optimise train lengths, improve handling, and reduce fuel consumption.[71] The cruise control system uses AI to calculate the most efficient speed profile for the train based on factors such as terrain, carriage make-up, speed restrictions and operating conditions.[72]

### Energy

**Use case**

Data generated by sensors is optimising consumption and increasing efficiency throughout the energy industry. This data informs smart energy management systems, enables real-time energy optimisation, and facilitates new approaches to energy load management.[73]

**Case studies**

ABB, the Swiss power and automation company, uses AI to analyse images from pipelines and machinery to detect faults and flaws before they become critical, saving its customers money and minimising downtime. A pilot project conducted with one of the world's largest hydroelectric utilities delivered a 10% reduction in routine maintenance and a 2% increase in output. "These measures translate into millions of dollars in cost savings," claims ABB Chief Digital Officer Guido Jouret.[74]

### Healthcare and pharmaceuticals

**Use case**

The diversity and volume of healthcare data are growing in lockstep with the use of smart, connected devices and the explosion in research engendered by digital technology. When combined with analytical tools such as AI and ML, this data is instrumental in drug discovery, disease diagnosis and care provision.[75]

**Case studies**

In 2015, during the West African Ebola virus outbreak, Atomwise partnered with IBM and the University of Toronto to screen compounds capable of binding to a glycoprotein that prevents Ebola virus penetration into cells. The use of AI analysis allowed a process that would previously have taken months or years to be completed within a day, enabling the timely development of a treatment for the Ebola virus.[76]

**Pfizer: Transforming processes with big data and analytics**

In 2016, Pfizer collaborated with IBM Watson to create a cloud-based cognitive tool that analyses data to overcome long-standing inefficiencies in the drug discovery and development process. Bringing a new drug to market takes about 14 years and costs over US$1.5 billion on average, with about 40% of the cost associated with initial lead selection.[77]

Watson for Drug Discovery helps reduce time and costs by accessing 25 million Medline abstracts, over 1 million full-text medical journal articles, and 4 million patents. It uses ML to sift and analyse this massive amount of data, revealing correlations between certain drug characteristics and disease states.

While Pfizer's revenues and profits had been in decline prior to the launch of Watson for Drug Discovery, the company has recorded an increase in both profits and revenues since 2017, with revenues growing at a rate of 2% per year and profits growing by 30%.

**Figure 7. Pfizer's revenues have grown by 2% per year since implementing a new digital model, following a period of declining revenues.**
Estimated impact of digital transformation on revenues, USD million
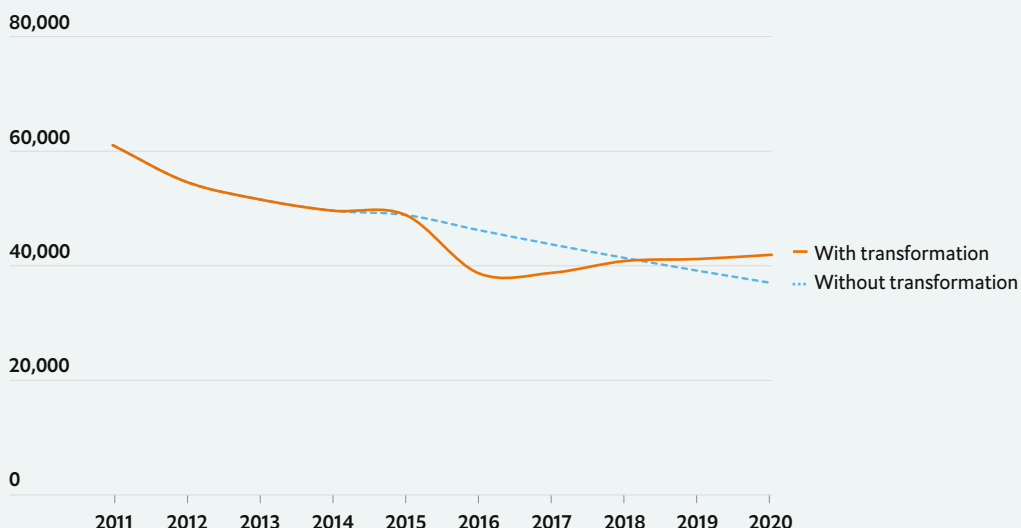


Source: Economist Impact (see Appendix 2 for detailed methodology)

## Data for external collaboration

Data is the currency of digital ecosystems. It supports collaboration and knowledge sharing among a variety of participants, including businesses and their suppliers, as well as producers of complementary products and services, logistics providers, outsourcers and financiers. Data-driven digital ecosystems can deliver greater value to the end-customer at speed and scale by enhancing the customer experience, while still delivering it in a controlled and seamless way.

Currently, digital ecosystems are the least adopted form of digital transformation across industries, requiring significant collaboration across multiple stakeholders: 57% of our survey respondents use them to a "great extent", most commonly in the energy industry. Nevertheless, there are significant opportunities and existing use cases that highlight their benefits, and 70% of our respondents believe it is "extremely likely" that their companies will be investing in ecosystems over the next five years.
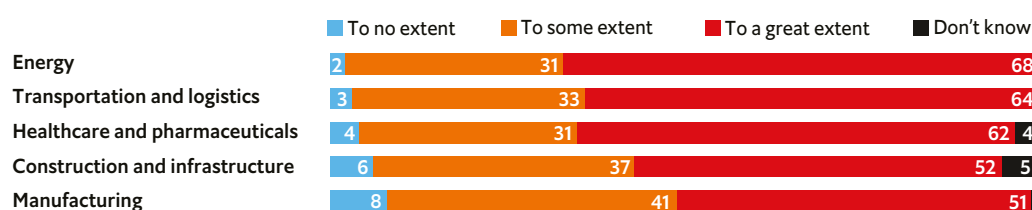
Data sharing is an important element in the collaborative effort needed to create vibrant

and productive digital ecosystems. The primary benefit of sharing data with ecosystem partners is to produce solutions that would otherwise be beyond the reach of individual firms.

Climate, a subsidiary of pharmaceutical giant Bayer, achieved this with its FieldView platform, which was launched in 2015. FieldView is a cloud-based data visualisation platform, designed to address the many challenges that farmers face in planning their operations—from increasing climate variability, to changing consumer habits and new emerging regulations.[78] Making decisions regarding the utilisation of land requires data covering all seasons. To build out the platform's offerings, Climate partnered with a diverse group of farm imagery, sensor, grain, soil, and equipment companies to capture and share data that firms need insight on. As a result, FieldView has been able to offer its customers a comprehensive service that has made Climate a leader in digital agricultural services. "From a provider or company standpoint, let the data flow," declared Thomas Nesbitt, a senior product manager for FieldView.[79]

**Figure 8. The energy sector uses data to create digital ecosystems to the greatest extent.**
%, the use of data to create digital ecosystems, by industry



| | To no extent | To some extent | To a great extent | Don't know |
|---|---|---|---|---|
| Energy | 2 | 31 | 68 | |
| Transportation and logistics | 3 | 33 | 64 | |
| Healthcare and pharmaceuticals | 4 | 31 | 62 | 4 |
| Construction and infrastructure | 6 | 37 | 52 | 5 |
| Manufacturing | 8 | 41 | 51 | |

Source: Economist Impact survey of business executives[vii]

**Use cases by industry**

### Construction and infrastructure

**Use case**

Digital ecosystems, composed of architects, engineers, construction, sustainability and facilities contractors working together are emerging across the construction sector. Enabled by data and delivered by smart, connected products, they are improving liveability, environmental footprint and building lifespan, while reducing construction and operational costs.

**Case studies**

BIM has enabled large ecosystems to be developed across the construction sector, connecting different stakeholders working on mega projects. The technology was deployed in the construction of Shanghai Tower, China's tallest building, in 2015. Over 30 consulting companies were involved in the project, along with subcontractors and design teams. BIM enabled coordination across multiple stakeholders and a large number of moving parts.[80]

### Manufacturing

**Use case**

Data is enabling new ecosystems that transform products into platforms. For instance, seed/agrochemical suppliers, agricultural equipment providers, farmers and regulators are coming together, enabled by data.

**Case studies**

In 2012, US farm machinery manufacturer, John Deere, equipped its machinery with sensors that gather intelligence from various stakeholders, including suppliers, agriculture retailers, local agronomists and software companies. This information, combined with historical data on weather, soil conditions and crop features, is sent to the farmers to help them manage their fleet, reduce downtime inefficiencies and save on fuel costs.[81]
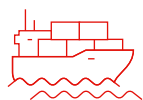
### Transportation and logistics

**Use case**

In transportation, data is enabling the convergence of the energy and automotive sectors into digital ecosystems that are built on the ability of vehicles to produce and store electricity. This is powering vehicle-to-grid business models. Data-driven ecosystems also engender new relationships with consumers around shared mobility and multi-modal transport (car sharing, eBikes, trains, buses, ride-hailing, etc.).

In logistics, data is enabling ecosystems that offer integrated logistics processes spanning transport modalities (i.e., land, air, sea) from source to destination.

**Case studies**

Jedlix, a provider of smart charging services in Europe, operates a vehicle-to-grid energy-transfer platform. Car manufacturers and energy providers are collaborating to enable consumers to store and discharge in their EVs electricity generated from renewable energy sources, such as solar and wind, where output fluctuates depending on weather and time of day. This is reducing the cost and increasing the reliability of electricity generation. At the same time, it can reduce the cost of EV ownership by enabling consumers to recharge at the cheapest rate and earn revenue from topping up the grid.[82]

### Energy

**Use case**

The data generated by smart, connected electricity meters and grids is bringing together diverse players across the industry in digital ecosystems. The makers of solar panels and wind turbines are partnering with the owners of residential and commercial buildings. Energy production, boiler manufacturer and maintenance firms are teaming up to offer "packaged" energy-optimisation solutions.

**Case studies**

In 2019, Schneider Electric launched Schneider Electric Exchange–a cross-industry ecosystem designed to bring together energy market players to solve issues related to energy efficiency and sustainability.[83] Using the exchange, one smart meter developer was able to directly connect with energy providers and companies constructing smart homes.[84]

### Healthcare and pharmaceuticals

**Use case**

Data from the Internet of Medical Things (IoMT) and other sources supports the development of healthcare ecosystems, in which pharmaceutical companies, healthcare providers and consumers work together to improve patient recovery times and outcomes.

**Case studies**

Neurotech, an Australia-based medical device company, is a leader in the IoMT. It has developed an at-home electroencephalographic (EEG) device which helps children with an autism spectrum disorder. The device provides physical comfort to patients, helping to relax their minds, while also providing real-time data and communication with hospital staff. Neurotech can share the EEG results directly with hospitals to identify seizures as well as baseline changes that may not be physically noticeable.[85]

**DB Schenker: Using data to drive collaboration**

In 2016, logistics company DB Schenker launched Drive4Schenker (D4S), an online platform using the firm's uShip software to match 25,000 Schenker-approved truckers with cargo dispatchers along their routes, in real time. The result is a P2P marketplace for partial and empty truckloads that reduces costs by up to 30% and increases overall efficiency.[86]

On the dispatcher side, the key features of the platform are the posting of loads and their respective assignment to carriers (either by preferred transporter or auction). This is supported by carrier reviews, pricing, quote comparisons and complete transport monitoring and processing.

On the carrier side, the platform offers two types of interface: a web-based site and a mobile driver app, which allows carriers to locate and bid for shipments. After a load is assigned, D4S can be used to access all relevant information related to the shipment, supporting the delivery of the goods. Truck drivers can use the app to communicate the shipment status and digitalise important documents.

Up until 2020, Schenker's digital transformation appears to have increased the company's revenue, profits and employment more rapidly than previous trends. Its average annual revenue growth nearly doubled after launching D4S, from 1.6% to over 3%.[viii] Meanwhile, the rate of growth in the transport and logistics industry overall across Europe has remained constant.[ix] Although Schenker's revenue and profits declined as the covid-19 pandemic impacted the transportation and logistics industry across the EU, Schenker's declines were slightly less than the sector average (10% and 11%, respectively).

**Figure 9. After digital transformation, DB Schenker's profit growth nearly doubled from 1.6% to 3%.**
Estimated impact of digital transformation on revenues, EUR millions
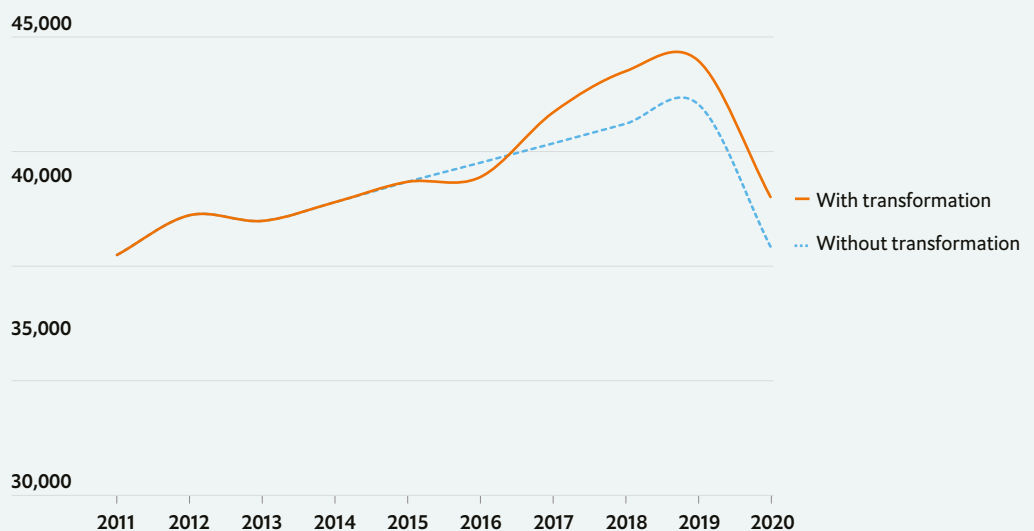


Source: Economist Impact (see Appendix 2 for detailed methodology)

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viii.   Based on Economist Impact analysis using annual report data.
ix.    Based on Economist Impact analysis using Eurostat data.

## Data for customer engagement

In an era of hyper-competition and market disruption, data provides firms with valuable insights into the hearts and minds of existing and new customers. These insights can help companies incrementally enhance solutions in ways that add value for existing customers. They can also guide the development of innovative, new solutions that can attract new customers and drive tomorrow's revenues.
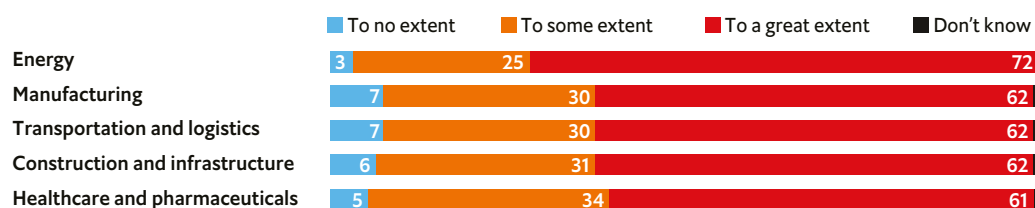
Data and digital technologies create myriad opportunities to engage with customers and enhance their overall experience. Accordingly, 48% of our survey respondents say that data can improve their understanding of customer needs, and 57% believe it allows them to personalise the customer experience in numerous ways. Speaking about how the desire to enhance the customer experience has guided automobile manufacturer NIO's digital strategy, global chief innovation officer Ganesh Iyer notes: "It is critical that brands like ours amass and analyse data at every customer touchpoint. All of our innovations are driven by deep insights into the lifestyles of our customers and how they use their vehicles. We are first and foremost a user enterprise, integrating technology and design to support premium experiences as our guiding principle".

One aspect of the use of data to create value for customers is through the development of smart products and services. **Smart, connected products** address core customer needs through the data and the insights they generate. They make products more personal. They enable closed product loops that bolster sustainability and profitability, and facilitate new revenue streams through usage-based pricing. **Smart services** are digital services that act on data and that can be bundled with a complementary smart product or delivered discretely, usually at a very low cost after the initial investment.

A majority of the survey respondents (64%) say that smart products and services have been integrated to "a great extent" in their organisations, with only 5% saying that their companies have not implemented them at all. Many of the non-implementers are smaller businesses with annual revenue between US$500million and $1 billion. Over 7% of these companies have not implemented smart products and services, compared with 0% of businesses with revenue over US$5 billion. The use of smart, connected products and services is particularly widespread in the energy sector, where 97% of respondents are using them to some or a great extent.

**Figure 10. Data is used to deliver smart products and services to a great extent across all industries, with the highest rate of adoption in the energy sector.**

%, the use of data to deliver smart products and services, by industry



Legend: ■ To no extent   ■ To some extent   ■ To a great extent   ■ Don't know

| Industry | To no extent | To some extent | To a great extent |
|---|---|---|---|
| Energy | 3 | 25 | 72 |
| Manufacturing | 7 | 30 | 62 |
| Transportation and logistics | 7 | 30 | 62 |
| Construction and infrastructure | 6 | 31 | 62 |
| Healthcare and pharmaceuticals | 5 | 34 | 61 |

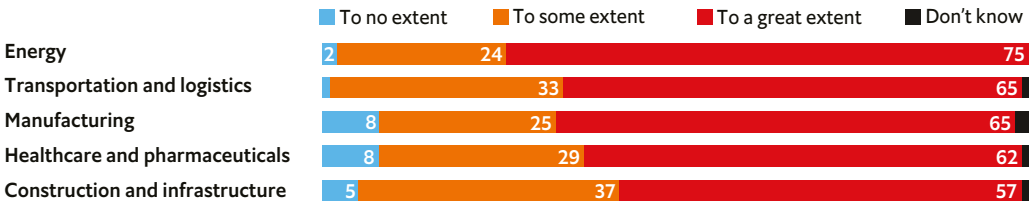Source: Economist Impact survey of business executives[x]

x.   Based on survey responses to the following question: "To what extent is your organisation currently using the following components of a digital business model to generate value for customers?"

As firms use data and digital technologies in more sophisticated ways, they can begin to create new business models that drive growth and profitability. These can be "anything-as-a-service" (XaaS) models that transform product businesses into service businesses—a strategy that Microsoft followed when it turned its Office software suite into a subscription service. They also can be platform business models, which can deliver bundles of products and services, such as the D4S online platform. The vast majority of survey respondents (93%) indicated that their firms have leveraged platform-based models to some or a great extent.

In addition to creating value for customers, data centres of this kind can bring environmental benefits. While data centres are significant consumers of electricity—currently responsible for 1% of total global electricity consumption, and expected to grow—the American Council for an Energy-Efficient Economy (ACEEE) estimates that for every 1 kilowatt (kW) of energy used by the IT sector, 10kw are saved as a result of increased energy efficiency in other sectors.[87] By doing things digitally we reduce the need for physical buildings and travel, and are better able to monitor and manage our energy usage, helping to save energy despite the additional energy required to maintain digital systems.

**Figure 11. Data is used to create digital platforms for customers to a great extent across all industries; however, the energy sector is leading in its adoption.**
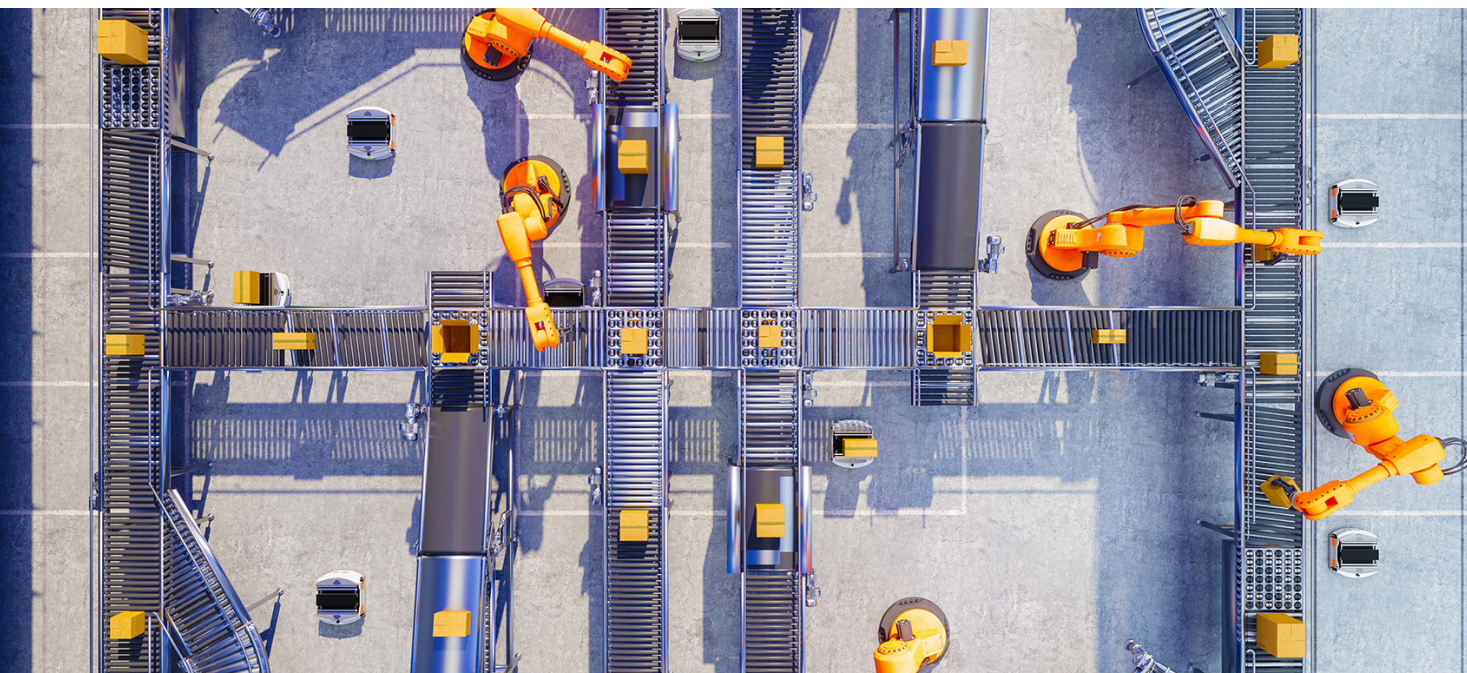
%, the use of data to create digital platforms for customers, by industry

| | To no extent | To some extent | To a great extent | Don't know |
|---|---|---|---|---|
| Energy | 2 | 24 | 75 | |
| Transportation and logistics | | 33 | 65 | |
| Manufacturing | 8 | 25 | 65 | |
| Healthcare and pharmaceuticals | 8 | 29 | 62 | |
| Construction and infrastructure | 5 | 37 | 57 | |

Source: Economist Impact survey of business executives[xi]

**Use cases by industry**

### Construction and infrastructure

**Use case**

Construction companies are servitising their business models through partnerships and mergers and acquisitions in neighbouring sectors. For example, companies are partnering with sectors such as real estate management, facilities and IT, as well as fashion, hospitality, digital, water and waste management, energy systems and asset management.[88]

The construction industry is also rapidly moving towards integrated digital platforms, designed to better serve customer needs.

**Case studies**

British multinational construction firm, Balfour Beatty, uses digital technologies such as augmented reality, VR and digital twins to enhance engagement with its clients. The company aims to create a digital twin for each projects, which is hosted on a digital platform for clients and project teams to engage and interact with.[89]

### Manufacturing

**Use case**

The emergence of the IoT and the ubiquity of sensors are enabling manufacturers to create not only smart, connected products, but also end-to-end suites of smart, connected products, services and data analytics that are delivered on a single platform.

**Case studies**

Car manufacturer Toyota is leading the servitisation of the industry. It partnered with Xevo to equip its 2018 Camry model with a smart platform to enhance the driving experience. The suite of apps available through the software allows consumers to personalise their preferences, such as setting automatic door lock options and customising map views, and offers a seamless connection to the content.[90]
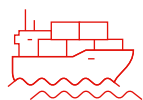
### Transportation and logistics

**Use case**

Digital technology has enabled platform business models that have disrupted entire sectors of the transportation industry, with Uber being perhaps the most notable example. This business model is now being adopted in other sub-sectors of transportation, such as freight, where integrated mobility service platforms are appearing.

**Case studies**

Maersk's shipping operations exemplify technology-enabled customer servitisation in the transportation industry. In 2016, the shipper launched an app that allows customers to track their cargo, make quick online bookings and check schedules. In the shipping industry, cargos are usually booked via a broker, but this model generates profits by eliminating the middleman, and working directly with the customer.

### Energy

**Use case**

More energy companies are investing in platform business models, such as P2P platforms that allow consumers and producers to trade electricity directly, without the need for an intermediary.[91] Smart meters provide consumers with the information they need to gain more control over their energy use and comfort levels, allowing them to save money while helping utilities balance demand across the grid. In addition, automated services enable consumers to schedule usage, such as charging an EV overnight when prices are cheaper or storing cheaper, renewable energy in a battery and using it to keep the home warm during pricier peak periods.[92]

**Case studies**

SolarCity, acquired by Tesla in 2016, provides an example of a company that has adopted an energy-as-a-service model and applied it to the expansion of access to solar energy. It offers low-cost options for solar panels in North America, integrated with 24/7 mobile monitoring that allows customers to optimise their energy consumption to reduce their carbon footprint and costs.[93]

### Healthcare and pharmaceuticals

**Use case**

Smart medicine (enabled by IoT-connected sensors and wearable devices) is providing a wealth of data to healthcare companies. This has enabled telemedicine. It has also transformed patients into more proactive consumers of healthcare, who are sharing more data with their healthcare providers and exerting more choice in care decisions.

**Case studies**

Sensors are being used to help diabetic patients to monitor their glucose levels. For example, FreeStyle Libre is a sensor-based Continuous Glucose Monitoring (CGM) system that comes with a reader and a sensor. The sensor is applied to the back of the upper arm and can be worn for up to 14 days. Studies have found that diabetic patients using CGM systems experience hypoglycaemia (phases of low glucose levels) for 38% less time compared with a control group of non-users.[94]

# Jumping the hurdles

**Key takeaways:**

- The key question firms are asking themselves is how to organise their teams and technology platforms to exploit the "data dividend".

- Wholescale changes in the team, organisational and technological infrastructure topologies are required to take advantage of the data that digitalisation generates at scale.

- Technical concerns regarding cyber-security and maximising the use of data insights are the most cited challenges in digitalisation.

- Businesses must change the ingrained ways in which they work and make decisions. This requires teaching employees how to make decisions more analytically and relying less on intuition or past experience.

Digital transformation can drive revenues and profits, and create new sources of value for customers. But it is not easy. A 2020 study of digital business transformations, conducted by consulting firm Boston Consulting Group (BCG), found that only 30% are successful in meeting their objectives and creating long-term value.[95]

The key question firms are asking themselves is how to organise their teams and technology platforms to exploit the "data dividend"— that is, the vast amounts of data generated by digitalisation and smart, connected products, and the insights it can yield.

The answer is clear, but the execution is less so: wholescale changes in the team, organisational and technological infrastructure topologies are required to take advantage of the data that digitalisation generates at scale. According to Navneet Kapoor, chief technology and information officer at A.P. Moller-Maersk, "Transformations are a marathon and require a vision to be brought to life by a clear strategy and strong execution over a sustained period. However, organisational inertia or gravity can pull back a transformation, and hence one needs to run sprints within this marathon to fight this gravity. Appropriate investments in leadership behaviours, culture, ways of working, technology capabilities and talent are a must."

As Mr Kapoor highlights, digital transformation also requires a cultural transformation in many businesses. Thus, it is no surprise that the majority of respondents to our survey (69%) report that their firms have been moderately or severely disrupted by the adoption of digital business models. And it is also no surprise that those that have most extensively adopted these models have been the most severely disrupted (20% claiming severe disruption, compared with 10% of all other businesses).

The value of digital transformation is no longer in question, but many challenges remain. Interestingly, human factors, such as tech talent and leadership, are not the principal challenges although they may have been in earlier stages of digitalisation. This is evidenced by the fact that our respondents that are at later stages of their digital journeys, and that have most extensively adopted digital models, see access to talent as a much smaller hurdle than other businesses—a concern for

**"Appropriate investments in leadership behaviours, culture, ways of working, technology capabilities and talent are a must (for successful digital transformation)."**
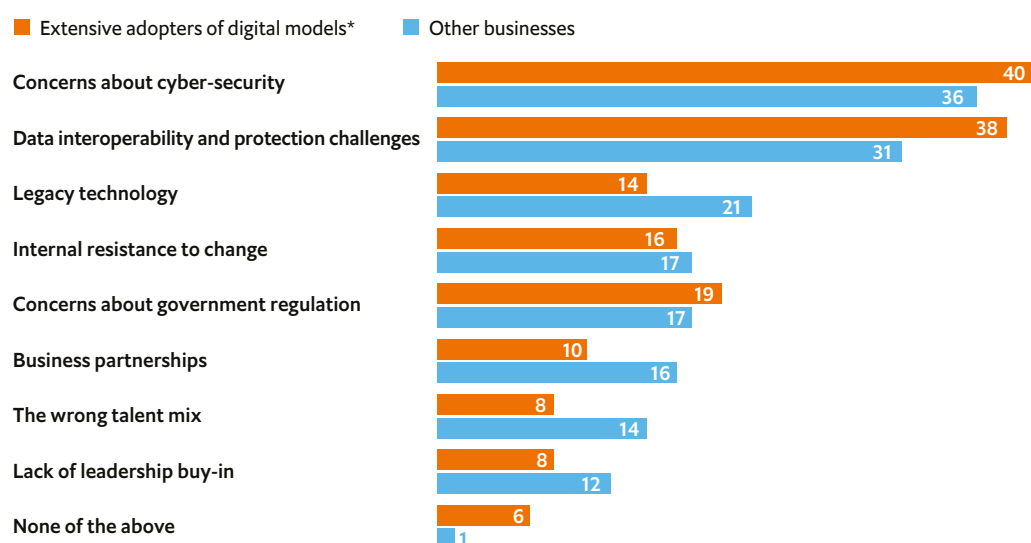
Navneet Kapoor, chief technology & information officer at A.P. Moller-Maersk

only 7% of these businesses, compared with 14% of slower adopters (see Figure 12).

Today, Technical concerns regarding cyber-security and maximising the use of data insights are the most cited challenges in digitalisation. Legacy technologies also present a hurdle, particularly for businesses that have been slower to adopt a full suite of digital models.

**Figure 12. Cyber-security concerns are the most cited barrier to implementing digital business models.**
%, challenges to implementing digital business models

■ Extensive adopters of digital models*    ■ Other businesses

| Challenge | Extensive adopters | Other businesses |
|---|---|---|
| Concerns about cyber-security | 40 | 36 |
| Data interoperability and protection challenges | 38 | 31 |
| Legacy technology | 14 | 21 |
| Internal resistance to change | 16 | 17 |
| Concerns about government regulation | 19 | 17 |
| Business partnerships | 10 | 16 |
| The wrong talent mix | 8 | 14 |
| Lack of leadership buy-in | 8 | 12 |
| None of the above | 6 | 1 |

*Note: "Extensive adopters of digital models" include survey respondents that have extensively adopted all four types of digital business models assessed

Source: Economist Impact survey of business executives[xii]

## Cyber-security

Our respondents are most concerned about cyber-security (37%)—heightened by the rising incidence and severity of cyber-attacks—and regard it as the highest hurdle to digital transformation. Their concern is warranted: experts claim that companies should consider cyber-attacks inevitable.[96] The number of cyber-attacks has been increasing at a dramatic rate each year—50% more attacks on company networks were reported in 2021 compared with 2020.[97] Yet, almost 50% of our survey respondents say that their businesses are immature or only somewhat mature in their use of cyber-security controls.

Meeting this challenge, like managing any other kind of crisis, requires putting the appropriate defences in place. "Intelligence-led" security is vital, which means continuously observing the security landscape and being able to respond to new threats. Enterprises need to understand their attack surface, including identifying critical assets and data, and accepting that controls will be breached. It is vital to build a solid plan for crisis management, including comprehensive detection abilities across networks, the cloud, applications and all devices. Today, businesses are spending over 10% of their IT budgets on cyber-security alone.[98]

## Data interoperability and protection

While data is the key enabler of digital transformation, the ability to put it to use is the second most common concern for 29% of our survey respondents. This rises to 40% for businesses that have extensively adopted digital models and are, therefore, generating significant amounts of data. Moreover, 56% of all firms say they are immature or only fairly mature with regard to data interoperability.

One barrier to maximising the potential of data is the lack of maturity when it comes to the adoption and use of digital tools powered by data, such as AI. Across our survey, of the respondents that are extensive adopters of digital models, 50% say that they are mature in their adoption of AI. But this drops to less than 25% for other businesses.

For those that have adopted digital tools to gather and leverage data, another barrier is the prevalence of piecemeal implementation approaches. Companies often adopt digital technologies and tools, such as predictive systems and AI-driven automation, in an ad hoc way that leaves the data they generate stranded. This may explain why Forrester Research found that up to 73% of the data generated by firms goes unused.[99]

A more holistic and expansive approach to data is needed, so employees throughout a business can use it as a tool in their day-to-day work. One way to achieve this is to collect a wide variety of structured and unstructured data from internal, external and market sources and collate it in "data lakes", underpinned by middleware. Data lakes can be accessed in a focused way using filters and frames. Frames help identify patterns in the data, and filters act like sieves—helping to locate the relevant data.[100]
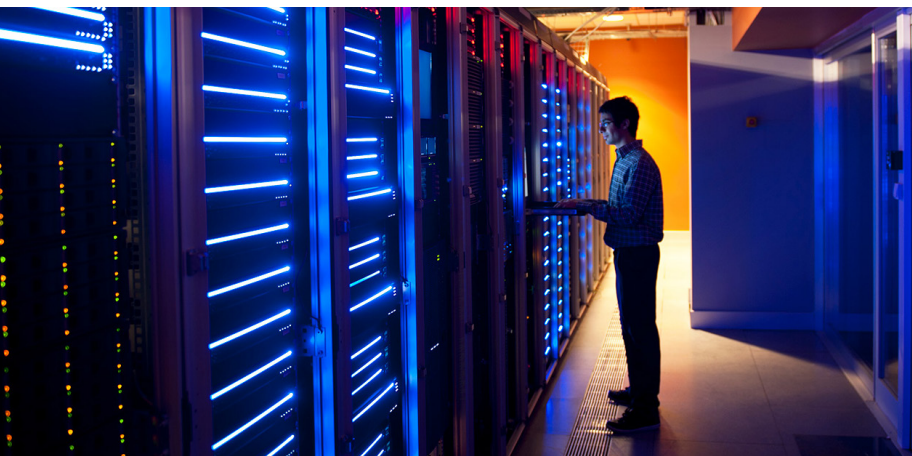
Many enterprises are also now investing in a next-generation data lake to enable access to data at scale by employees from any business function to provide business insights and ultimately make automated intelligent decisions.[101] This includes a move towards the use of more distributed data sources, including data lakes, and the ability to support real-time data streaming from smart, connected products and edge devices.[102]

### Legacy technology

Legacy IT systems can often complicate the task of adopting new technologies such as cloud computing, the IoT and ML. Their design may not allow companies to easily bolt on new technologies. They can be essential to day-to-day operations and thus not easily replaceable. Furthermore, they can represent sunk costs that leaders may feel reluctant to abandon. Understandably, 22% of survey respondents cited legacy systems as a barrier to digital transformation. Also not surprisingly, legacy systems are a bigger challenge for slower adopters of digital business models—a concern for 25% of these businesses, compared with only 14% of businesses that have already extensively adopted digital models.

### Change resistance

While there is a relative lack of concern about having the right talent for digital transformation among the survey respondents (12%), more of them cite change resistance as a barrier to successful digitalisation (18%). Many firms are not yet reaping the full benefits of their investments in data and digital analytics because of cultural barriers: 90% of C-suite executives—representing more than 70 Fortune 1000 companies—reported that people and process issues were the principal obstacle that they faced in becoming data-driven organisations in a 2020 NewVantage Partners survey.[103]

Digital skills are not enough to overcome these barriers. People must change the ingrained ways in which they work and make decisions. This means making decisions more analytically, based on real-time data insights, rather than just intuition or past experience.

### Regulation

The regulation of digital technologies and the collection and use of data is complex at best, which explains why 18% of survey respondents identify it as a challenge to digital transformation. The regulatory landscape varies widely by jurisdiction, and it seems likely that more, not less, rigorous regulatory regimes are on the horizon. The International Telecommunication Union's regulatory tracker monitors developments in the regulatory environment for digital technologies and highlights both the wide disparities across countries, and the rapid progress within countries.[104]

> **"Digital implementation is only one step in the complex process of digital transformation. Successful transformation requires a digital mindset and a culture of digital innovation and change that is much harder to achieve than the implementation itself."**

Vallabh Sambamurthy, Albert O. Nicholas dean of the Wisconsin School of Business of the University of Wisconsin

Managing this patchwork of regulation is particularly hard for multinationals. As Satish Nambisan and Yadong Luo explain in their book, *Digital Multinationals*, such companies need "to read and adapt their digital strategies to the prevailing geopolitical realities, including regulatory barriers, conflicting labour laws and institutional practices, and conditions favouring home-grown competitors".[105]

To overcome this challenge, many large multinationals are pursuing a strategy of "digital globalisation". They are transforming their models in a way that can transcend national borders while maintaining a degree of flexibility to work within local regulatory frameworks. In the healthcare industry, for example, data-flow policies across borders can create a barrier to innovation. Navigating this challenge, Philips Healthcare has created a digital partnership model in which it has collaborated with global partners to connect medical devices and collect electronic health data securely. Its approach has been tailored and localised to markets such as China where different regulations apply and different ecosystems exist.[106]

**Business partnerships**

Finding the right partners for digital platforms and ecosystems is a concern for 15% of the survey's respondents. Indeed, this is a critical factor in the success of digital business models that depend on groups of firms to deliver customer solutions.

The orchestrators of such models need to offer an attractive value proposition to the contributors on which they will depend, and establish a governance system that is fair and transparent. A BCG analysis of 110 failed ecosystems found that poor governance was the most common cause of failure.[107] The key to avoiding this fate, according to BCG consultants, is balancing open elements—those that attract partners, stimulate growth and enable innovation—and closed elements, which support quality and alignment.

Establishing trust in the data that is shared within a business ecosystem is vital. Solutions like blockchain can help. Blockchain is designed to store information in a way that makes it virtually impossible to add, remove or change data without being detected by other users. Blockchain applications replace centralised verification systems for the movement of money, goods or secure data—for example, through a government or a credit card clearinghouse—with decentralised systems, where verification comes from the consensus of multiple users.[108]

### Talent and leadership

Few of the respondents are concerned about not having the right talent mix (12%) or leadership buy-in (10%). When it comes to tech skills, 46% of businesses believe that the expertise of their employees is mature, and another 46% believe it is fairly mature.

The relatively low level of concern regarding talent notwithstanding, the market for people with digital skills is becoming increasingly competitive. Many companies, especially those in established industries outside of the high-tech arena, are finding it difficult to hire qualified candidates. Our survey also reveals that a key differentiator between those businesses that have extensively adopted digital business models and those that have not is access to talent—while a concern for only 7% of the former, having the wrong talent mix is a concern for almost 15% of the latter.

**"One area we have had to double down upon is the modernisation of our technology and building a strong internal talent base of technologists… a critical aspect for us to be able to unleash the potential of our strategy."**

Navneet Kapoor, chief technology & information officer at A.P. Moller-Maersk

Mr Kapoor from A.P. Moller-Maersk reflects on the importance of access to talent in delivering on the business' digital strategy, noting: "At Maersk, one area we have had to double down upon is the modernisation of our technology and building a strong internal talent base of technologists. We have incorporated 3,000 new employees in tech over the last three years, which implies a huge shift in capabilities, a critical aspect for us to be able to unleash the potential of our strategy and ensure that we can move at the speed needed to meet the ever-changing needs of our customers."

Some firms are turning to creative tactics to attract tech talent. But it may be that an appealing employee value proposition that is anchored in a positive work environment is the most effective talent acquisition and retention strategy. A Bain & Company analysis of Glassdoor data found that tech talent is looking for an organisational commitment to diversity and inclusion, transparent and accountable senior management, and a culture of coaching and development.[109]

Leadership buy-in is the least of the concerns cited by the survey respondents. This may be because the respondents themselves are leaders. But it is also a logical reflection of the now ubiquitous understanding of the value that digital transformation can deliver. Today, leaders are convinced that digitalisation is a business imperative, and their concerns—as enumerated above—have turned to how to make it pay.

# Conclusion

Digital transformation is imperative for businesses. Boards and CEOs today are much more willing to invest in technology that offers a clear tie to business outcomes. US-based consulting firm Gartner forecasts a 9% expansion in global IT spending between 2020 and 2021. An additional 5% growth year-on-year is anticipated through to 2023 by when spending is expected to total US$ 4.7 trillion—equivalent to over 5% of global GDP.[110]

Digital transformation enables firms to enhance customer value propositions, collaborate with business partners to bring innovative and hitherto unobtainable solutions to market, and streamline operations. It can also drive revenue and lower costs—delivering profitable growth. It is no wonder that of the 500 firms included in our survey, nearly all are actively pursuing some combination of digitalised processes, smart products and services, platform-based business models and digital ecosystems.

Unfortunately, the benefits of digital transformation are not as easy to capture as they are to describe. A variety of hurdles stand in the way of successful digital transformation and they tend to get higher as the ambitions of the initiatives rise. Without standards that help us share information using common languages and formats, the planning, delivery and operation of built assets in the construction industry, for example, remain inefficient and wasteful. The legacy of this poor interoperability is that owners and operators incur additional costs in converting or recreating the data they need to manage their built assets and asset-based services.

Our research shows that the hurdles can be surmounted, however, and that the potential rewards make the effort worthwhile. It also finds that access to digital talent is one of the key differentiators between businesses that have extensively adopted digital business models and those that have not.

But don't think that digital transformation is a once-and-done endeavour. In the words of Amit Zavery, Vice President, General Manager and Head of Platform at Google Cloud, organisations must "think of digital transformation less as a technology project to be finished than as a state of perpetual agility, always ready to evolve for whatever customers want next". Ultimately, the goal of digitalisation should be a company that is fit for continuous transformation.

# Appendix 1. Acknowledgements

# Appendix 2. Methodology

The research presented in this report is based on an extensive literature review, interviews with experts, a survey of business executives, and data collection and analysis on selected case studies. This appendix outlines the methodology used in conducting the survey and data analysis on selected business case studies.

**A. Survey methodology**

The Economist Impact team designed and fielded a survey of senior business executives across industries to understand how their organisations are using digital technology to create value for customers today - and in the future.

Survey results were collected from 500 respondents at director and above seniority levels within their organisations. Respondents were drawn from across five industries: construction and infrastructure; manufacturing; transportation and logistics; energy; and healthcare and pharmaceuticals. The survey sample was selected to allow for global representation: 250 respondents from Europe (50 each from France, Germany, Russia, Spain and the UK); 150 from APAC (50 each from Australia, China and India); and 100 from the US. The survey was conducted online and via phone.

Screener questions were used in the survey to ensure that all respondents were involved to some extent in setting the strategies for the businesses or business units, and that all businesses surveyed were of a medium–large size, eliminating all respondents representing businesses with an annual revenue of less than US$500 million.

The results from the survey were analysed across different industries and regions to assess the usage of digital models, the value created for the business and its ecosystem, and the challenges related to execution.

**B. Case study methodology**

Throughout this report, we use real-life examples to demonstrate the value and opportunities enabled by digital technology. For some examples, these have been developed into longer case studies in which we have delved deeper into the transformation process and the challenges the technology has sought to address. We have supplemented this with analysis based on company financial data from annual reports to understand how businesses have fared post-transformation and how the technology might have contributed to this. In this section, we provide an overview of the methodology used to conduct this analysis.

The first stage of the analysis involved collecting company-level data for each selected company across a range of indicators including (based on the availability of data):

- Revenue

- Profit (gross)

- R&D spending

- Company stock price

- Number of employees and employee retention

- Carbon production

- Sales

- Operating costs

Data was collected predominantly from company annual reports and supplemented with publicly available data. The data collected allowed the company baseline to be established - in other words, it provided the post-transformation outcomes for each company. These outcomes are the result of the transformation, but also several business-related factors.

To assess and isolate the impacts of the transformation, we then created a hypothetical "no transformation" scenario to understand how the company might have performed in the absence of the digital transformation. For this scenario, we developed a projection for each indicator for the businesses from the year of implementation, assuming no transformation. The projections were developed accounting for several factors:

- **Historical company trends:** The hypothetical scenario assumed that the pre-transformation trends for each company would have persisted if the transformation had not been undertaken. For example, if profits for company X were growing by 3% pre-transformation, it was assumed that they would have continued to grow at the same rate in the absence of the digital implementation.

- **Current industry trends:** Accounting only for historical company trends may have led to misleading projections in the "no transformation" scenario if there were significant shifts across the industry which meant that all companies experienced an increase or decrease in their growth rate. To account for this, we adjusted the historical company trends according to industry trends. For example, if the industry as a whole had grown at a more rapid rate in recent years than previously, historical company growth rates were uplifted to account for this trend (and similarly in the event of the industry witnessing a decline in activity).

- **Covid-19 industry impacts:** To account for the impacts of covid-19 on businesses in 2020, we adjusted the hypothetical 2020 projections for each company based on the industry-wide impacts of the pandemic.

After accounting for these factors and developing the hypothetical scenario for each company, we compared the hypothetical values of each indicator to the actual values to provide an estimate of the impact of the digital transformation.

It should be noted that while the analysis accounts for other external factors that may have impacted each business in order to isolate the impact of the digital transformation, there are always several factors that contribute to annual variation in business performance that cannot be controlled for. Therefore, the analysis should be treated as illustrative of the potential impacts of the transformation on each business, while bearing in mind that the estimated impact may not be fully driven by the transformation but also by other initiatives and actions taken by the business over the same period, as well as other exogenous factors beyond its control.

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3.  Defined for the purposes of this research as: The use of smart, connected products (consumer or industrial goods or services) to generate and transmit data, enabling complementary, and often revenue-enhancing, offerings (such as smart contracts and predictive maintenance).

4.  Defined for the purposes of this research as: The facilitation of digital interactions at scale between different entities, such as suppliers, customers and firms in adjacent industries.

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