The digital transformation imperative

How organisations are achieving competitiveness, resilience and sustainability.
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The digital transformation imperative

In 2022, Siemens brought together over two thousand industry, governmental and economic thought leaders at its inaugural Transform event. We collected views on progress towards digital transformation in industry, infrastructure and society, and its role in enabling sustainability and business resilience. As we now look to 2023, this paper presents the forward-thinking insights of these leaders.

Organisations in the UK and Ireland are at an inflexion point. There is no stopping for breath post-pandemic while both the public and private sectors are now facing a wave of further challenges.

The significant impact of Covid-19 on our industries, coupled with additional energy and inflationary pressures at the fore, have accelerated rapid transformation in leading organisations at an unprecedented scale. This investment is designed to enable these businesses to better cope with geopolitical uncertainty, volatile markets, environmental targets and supply chain re-organisation.

Expert delegates and commentators at Siemens' Transform 2022 event emphasised that digital technologies and platforms are playing a crucial role in enabling this transformation – introducing new capabilities, efficiencies, environmental improvements and social access.

Without digital transformation, sustainability and resilience are impossible.

As leading economist Jim O'Neill put it:

"Now is the time to invest in resilience and get serious about productivity in the UK."

- Lord Jim O'Neill, Vice Chair, Northern Powerhouse Partnership

Over 70% of firms say that new technologies have improved business resilience according to the Confederation of British Industry.[1] The same is true in Ireland.[2]

Carl Ennis, CEO, Siemens UK and Ireland

In short, whether addressing workforce challenges including Covid-19, skills shortages, decarbonisation, supply chain issues borne of geopolitical disruption or material shortages, organisational transformation will be digital.

The value of strategic investments in digital transformation has already been proven.

At our conference, Stephen Phipson, CEO of manufacturers' organisation Make UK, emphasised that digital transformation is already producing hard, measurable operational benefits: "We are looking to automation and digitalisation to help manage pressurised margins in industry...clusters need to come together to collaborate and learn more from one another about real outcomes."

Analyst reports on digitalisation confirm that new combinations of talent and technology are delivering enhanced customer experience, operational efficiency and, ultimately, the competitive edge.[3]

Digital transformation is driving positive outcomes: whether streamlining processes, harnessing data or shaping entirely new ways of doing business, and uniting every part of the enterprise in a common purpose.[4]

Cedrik Neike, Global CEO of Siemens Digital Industries, summarised the potential of transformation, saying: “Digital transformation is a big promise. You have to use the digital world to make the real world better."

Yet thought leaders are still highlighting the need for urgent wholesale investment to accelerate this trend.

In my view we must recognise that digital transformation is now a necessity for every business, not just the large market-leaders – and that requires increased collaboration between all participating organisations.

Despite these challenging times, there is a sound commercial basis for investing now – not least the emerging body of evidence such as that from McKinsey showing that digital transformation improves company revenues and profits[5], as well as making public infrastructures more efficient and effective.[6]

Digitalisation is widely seen as underpinning and enabling two associated key trends - sustainability and business resilience.

Two of the key themes at our conference were sustainability and resilience. But only through digitalisation can sustainability and resilience requirements be realised.

The World Economic Forum has neatly summarised this interdependency, highlighting the need to “prepare for future disruption through resilient business operations backed by reliable data and digital technology”.

Finally, investors are also driving change and sustainability as a mechanism for growth, and this has also been signalled by the financial markets themselves.

On the other side of the coin, ignoring your place in a sustainable economy could not only cause costly waste and inefficiencies, but also put your licence to operate at risk.

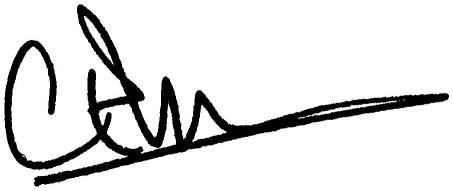
Cedrik Neike, CEO of Siemens Digital Industries

Transform was a great opportunity for Siemens, our customers and our partners to navigate the challenges presented by this maelstrom of change. In this paper we offer insights and vision from a wide collection of experts at the event in order to look forward to 2023 and beyond.

> According to the Manufacturing Digital Productivity Report from iBASEt, supported by the MTC (Manufacturing Technology Centre), many manufacturing organisations (67%) implemented Industry 4.0 and smart factory technologies in response to the pandemic and social distancing rules – with 30% doing so for the first time. More than two thirds (68%) said this made them more productive, and more than half (51%) said it made their business more agile.[7]

I hope readers can reflect on the real-world benefits already reaped from digital transformation and use the viewpoints shared here as a means to accelerate ambitions in terms of competitiveness, resilience, sustainability and a more inclusive society.

Carl Ennis, CEO, Siemens UK & Ireland



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(L-R) Justin Kelly, Director of Corporate Communications & Business Development, Siemens UK&I; Matthew Fell, UK Chief Policy Director, CBI; Ashling Cunningham, CIO, Irish Water; Mike Wilton, Director, Arup; Lord Jim O'Neill, Vice Chair, Northern Powerhouse Partnership and Carl Ennis, CEO, Siemens UK&I.

1. Building Business Resilience and Sustainability

Today's Challenges

The National Institute of Economic and Social research is predicting continued inflationary challenges for the UK.[8] The same is true in Ireland where prices rose an estimated 9.6 per cent in the year to July 2022 according to estimates from Eurostat, the statistical office of the European Union.

Growth forecasts have been subject to downgrades[9] too. All this points to a need to put increased focus on business resilience – attracting and retaining customers, de-risking supply chains, and of course optimising costs versus value.

According to research from audit, tax and consulting provider, RSM UK, more than a third (38%) of UK businesses experiencing supply chain problems said they had seen an overall decline in customer satisfaction. Meanwhile, over a quarter (28%) said they have lost one or more key customers within the past year due to unanticipated supply chain pressures. UK productivity overall remains weak[10], as does GDP.[11] All in all, UK plc is facing a cluster of challenges, which it will need to weather.

However, as renowned economist Jim O'Neill, former Commercial Secretary to the Treasury, Member of the House of Lords, and now Vice Chair of the Northern Powerhouse, points out: "Uncertainty is historically shown to be the norm. Business and public service thought-leaders have generally acknowledged the need to improve resilience to deal with shocks and challenges that uncertainty is almost bound to present in the coming decade and beyond."

The path to greater business and organisational resilience is a new mindset, according to O'Neill. He sees 'profit with purpose' as imperative for businesses in the UK and Ireland seeking to enhance their resilience.

"Hardly any institutional investors will invest in initiatives designed to fund academic spin-outs in the United Kingdom. So we need to change the risk-return and the regulatory environments so that those that run investment companies take a more long-term view and make a shift in their own risk-return dynamic."

- Lord Jim O'Neill, Vice Chair, Northern Powerhouse Partnership

This is a vision which ensures commercial goals are always considered as part of a more strategic view of longer-term business and societal benefit, and is the key to business resilience. Carl Ennis, CEO Siemens UK&I explains: "Profit with purpose is fine.

"Whatever you think is the purpose behind your business, try as hard as you can through all of these uncertainties to stick to what it is and if that gives you the legitimacy to make a profit, be active in its pursuit."

The notion of active pursuit of business resilience relies in large part on a wave of investment in digital and automation technologies. In the words of Matthew Fell, UK Chief Policy Director, CBI: "To position for success, we have to make the running, double down, take action. A lot of the gains for resilience and sustainability are being made by investing in proven digital technology that others are already using. However, that's not yet happening enough. More collaboration is essential."

There is broad consensus that investment in digital, sustainable technology is critical to future robustness. Nevertheless, commentators highlight that there is a series of challenges which must be addressed as a strategic framework for building resilience and sustainability.

Challenge #1 – Broadening vision – the art of the possible

Businesses in the UK and Ireland have to broaden their vision of what they can achieve – especially when exploring the new world of digital technology. The stresses on UK society and business are opening minds to a new 'art of the possible'. Covid-19 showed that pace of change can be very fast – and for many, the appetite for change has grown as a result of that experience. As Matthew Fell of the CBI says: "When it comes to agility, we've changed more in the last few months than we ever thought it possible to do over five years."

Speaker Dan Watkins, Head of CAD/PLM at Oracle Red Bull Racing shared how his organisation has been testing the bounds of available technology: "Over the years we've recognised this need for digitalisation. The more change we can push through the business the better we perform. The biggest challenge of all is that people and money are not endless and so we need to fall back on technology, and technology partners, to deliver the next big thing."

The collective experience of the pandemic has opened minds to how much can be achieved when organisations are freed from operational convention. At Siemens we were at the forefront of rapid change during the pandemic. Our experts, in collaboration with partners and original equipment manufacturer Penlon, went to new efforts in 2020 to deliver a ventilator manufacturing facility at speed.

It was created, tested and enhanced first in the virtual world, then in the real world. It took production up from seven products a week to over 1,000 products a week, all achieved in the space of 100 days. Transformation is massive and rapid if we want it to be.

Yet with accelerated change comes new challenges. Modern skills development is often highlighted as a major area where more attention and investment is needed from government and business alike.

"Purpose is all about outputs and outcomes. Technology for its own sake is useless. For instance, data and AI is useful in that it produces actionable insights. Manufacturing technology has to produce efficiency and productivity."

- Carl Ennis, CEO, Siemens UK and Ireland

Matthew Fell, CBI, calls for greater alignment between education and business: "Continuous change needs to be mirrored in an adaptive skills programme – continual reskilling – as the demand for EV engines and hydrogen driven technologies grows, for instance." This is echoed by Jim O'Neill who looks abroad: "20% of Germany's education budget is paid for by companies... we need to change our broad approach to how it's done. Business leaders should create more of the narrative and pay for it and that should all happen at a devolved level around the country."

Meanwhile, according to Mike Wilton, Director at Arup, people engagement is also critical: "People assets are becoming increasingly important in achieving digital transformation. Employees having a proper feeling of involvement and ownership is the way to implement purpose and vision."

Challenge #2 – Overcoming short-termism

Investing now in organisational resilience, sustainability programmes or supply chain reorganisation will better serve your future business. According to the Organisation for Economic Co-operation and Development and the UK Government, ongoing digital transformation can enhance productivity and performance through innovation and resumed costs.[12]

Yet investment today is required for future payback. Siemens UK&I CEO Carl Ennis summarises: "Now is exactly the right time to be investing in resilience and strengthening your organisation, but some of those investments will end up being focused on strategic benefits felt over decades rather than here and now. Organisations have an important role to play in advancing society. Stable, long-term, responsible decisions can have massive positive impact on society at large while also mitigating volatility in markets, notably energy."

Forward-thinking companies already have this strategic approach to investment and payback periods. Ashling Cunningham, CIO at Irish Water, points to existing strategic investments that have demonstrated valuable payoff: "Covid-19 helped us to recognise the value of the investment we had already made in long-term resilience."

"It has shone a light on successful investments we had made which were ensuring continuity across the business, customers, partners, supply chain and cyber environment. Now we have an opportunity to build on those successes and harness infrastructure to perform even better for us over time."

Challenge #3 – Forging a culture of collaboration

Resilience in the digital age requires collaboration. The nature of the relationship between technology supplier and technology buyer has altered, becoming more of a collaborative partnership. Gregory Albertson, Equipment Digital Twin Product Owner at pharmaceutical giant Sanofi, explains: "Being able to use tools like digital twins – using technology to fit a need, solve a problem, optimise a process – is revolutionary. But we are looking for partners, not just suppliers. They need to be able to adapt and grow with us, working together to figure out the right way to address each business challenge."

Ashling Cunningham, Irish Water, expands the point to say: "Strategic partners are essential to achieve resilience. We are all having to decide what skills we want in-house, and which will be provided by those strategic partners.

"And we continually scrutinise the partner network to make sure they are successfully recruiting and retaining those skills."

Collaboration within partner networks is equally key too and knowledge of specific solutions, open APIs and transparent as-a-service price modelling can help provide the scalable solutions organisations need.

Paul Wilson, CBO, Connected Places Catapult, sees this collaborative mindset working across all partners in a project: "Working together in good stakeholder partnerships is key and this is the biggest challenge of all. We need to move beyond just working in our 'my organisation' silo and start to work in collaborative ecosystems where we partner genuinely for each other's benefit."

With all this change, government is seen as responsible for providing a stable economic environment for organisations to operate within and is a key collaborator with all organisations across public and private sectors. Carl Ennis notes: "From government we need a stable strategy that is articulated clearly and then is stuck to. We've shown as businesses that we can operate within whatever parameters are laid down. What we can't cope with is variety where the rules change every five minutes."

Jim O'Neill too, stresses the importance of focusing on real outcomes rather than fiscal tools, adding: "The big thing for the future prosperity of this country is not just focusing on taxes or monetary policy. We need policies that support our productivity and performance."

"Collaboration – especially around the push for greener – can be, and is, a major enabler of levelling up. Devolved innovation is at the heart of the UK's success. In Manchester, we have set a clear path as an early adopter where we plan and act, not sit in limbo. We have one of Europe's fastest growing tech hubs, attracting and developing digital skills. Collaborative networks are springing up between academia, business, public sector and others – all fostered and encouraged by the city plan. And the societal benefit is that greener – and digital – should also be fairer, improving access, equality, skills, prosperity, the lot."

- Andy Burnham, Mayor of Greater Manchester

Challenge #4 – Associating sustainability with business benefit

Rising energy and raw materials costs make sustainability initiatives to reduce consumption an even more urgent imperative – not least given current spikes in prices that follow years of rising costs. We now have a body of evidence that shows that 'more sustainable' can also equal 'more productive', 'more efficient', 'more agile' and 'more profitable'.

According to Alberto Prado, Head of R&D Digital & Partnerships at Unilever: "Digitalisation and automation are critical enablers of sustainability and higher levels of productivity. There is no denying it. We know that by investing in automating production processes and making them more digitally capable we can reformulate our products much more effectively. By using technology like digital twin we can produce products that consume less, improve our agility and flexibility, and overall enhance our resilience as well."

Capital investment can be a considerable challenge for wholesale transformation of processes, but smart financing techniques can capture future savings and use them to fund current investment. For instance, buildings that incorporate smart controls save on energy and water costs and provide a very attractive return on investment – typically starting at 20%[13] of former costs. Smart financing arrangements can use that saving to fund the initial conversion, all without consuming the building owner's scarce capital. Equally as-a-service contract models can shift capital expenditure into day-to-day operating costs. Increasingly, financial barriers to transformation are being lowered.

Transforming through digitalisation can also provide visibility in understanding where there are additional, unforeseen benefits too. Rob Passmore, Commercial Lead, Biosphere Foundation notes that: "Software has a massive role to play in nature-based solutions to the climate emergency. It can help identify and provide the toolkit to manage project delivery to give a single-version of the truth."

Attracting talent and adopting green policies and processes are also linked issues that transformation can help address. Matthew Fell, CBI, summarises the point by saying: "Your company purpose is being put under the microscope. Not just by employees but also by the customer base. Net zero has proven operational benefits, but it is also an increasing driver from employees, customers and financial markets." Companies need to be increasingly conscious of sustainability and their employer brand as hybrid working changes the talent landscape.

Meanwhile, demonstrating solid green credentials when bidding for work or investment creates an inextricable link between sustainability and the bottom line.

Future resilience

In summary, strategic technology investments have already delivered improved resilience for some organisations. Investment in digital platforms, in particular, have shown value during the pandemic and beyond.

These early successes should act as inspiration for accelerated investment in digital transformation particularly as securing resilience becomes harder and harder. Without robust digital platforms, it is impossible to be sufficiently agile. And that agility is needed corporate-wide, sector-wide and nationwide to navigate what the future has to hold.

The following sections of this paper look in more depth at where digital transformation is happening in industry and infrastructure. They describe examples of the clear benefits experienced to date, and practical steps organisations can take, along with collective opinion on the need for accelerated deployment.

"To drive climate change, policymakers are looking to work towards climate targets through the regulatory mechanism of central banks... they are exploring the allocation of regulatory capital in terms of different risk weighting so that banks lending to various industries will find that those risk weightings change. This would constitute a slightly more directed version of carbon pricing."

- Lord Jim O'Neill, Vice Chair, Northern Powerhouse Partnership

Key Takeaways

- Business resilience will be an **ongoing challenge** as global pressures mount.
- This requires a new mindset from business: **profit with purpose** – a vision which tempers the profit motive with a more strategic view of longer-term business and societal benefit.
- **Digital technology forms the basis for** improved business resilience, sustainability and social benefit. Goals will not be met without digital transformation.
- **Four main challenges** face businesses and the public sector as they seek to achieve ambitious commercial and societal targets:

  - **broadening vision** to realise an extended 'art of the possible' through digital capabilities

  - **overcoming short-term views**, and instead investing in digital transformation now for longer-term gains

  - **forging a culture of collaboration**, enabled by digital tools, between supplier and buyer, and between industry players – all working in a single ecosystem

  - **combining sustainability goals with business targets** into a unified strategy where digital platforms deliver strategic resilience

2. Transforming Industry

Doing more with less to become more competitive, productive and sustainable

Manufacturers are currently faced with a host of serious challenges that make Industry 4.0 transformation a business imperative.

Firstly, climate change has come to the fore as a key agenda item for British and Irish manufacturing. While a few years ago only 10% of businesses said they were interested in digital transformation for decarbonisation – now 90% are, according to recent research from manufacturers' organisation Make UK.

Stephen Phipson, CEO, Make UK explains: "Even with unprecedented economic challenges, manufacturers consider decarbonising their business a priority." Meanwhile Darren Budd, Commercial Director, BASF, says: "Sustainability has always been a part of our business, but it is now front and centre in our strategy. We have to be sustainable for our employees and our customers."

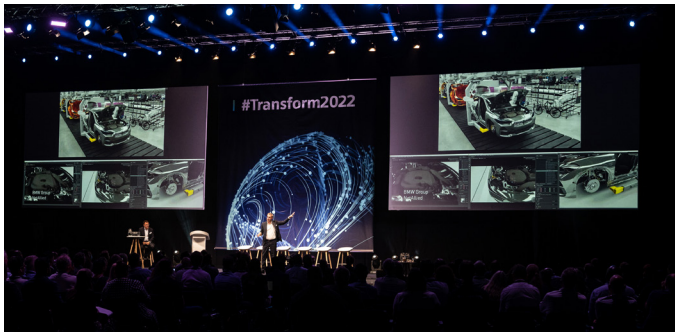
Motivations span from moral and ethical considerations to commercial cost management and shareholder returns. But if digitalisation doesn't underpin sustainability, it will fall short.

When asked about the centricity of the latest digitalisation and automation in achieving net zero, Alberto Prado, Unilever stated: "It's the only way to get there because the net zero targets are super ambitious. We see digitalisation, sustainability and productivity going hand in hand."

Brian Holliday, Managing Director, Siemens Digital Industries, UK&I agrees that the challenge isn't going anywhere and technology has to be core to the long-term solution: "Transformation needs to accelerate at pace if we are to meet national carbon targets. Technology adoption, supportive government policy and ambitious decision-making will help create a resilient and productive sector that is ready for the future."

"This idea of Industry 4.0 is over 10 years old. The pandemic has accelerated us towards the use of digital technology and now, post-pandemic, we've got to do more on sustainability. It's essential that we have the skills, the technology and the partners needed for this, to save the planet one factory at a time."

- Brian Holliday, Managing Director, Siemens Digital Industries UK&I



Coronavirus, energy crisis, sustainability, competitiveness

The second set of disruptions comes from the aftereffects of Covid-19, which have altered ways of working and disrupting global supply chains. During the pandemic it was clear that many digitally robust businesses gained a competitive edge and historical evidence suggests that companies which invest wisely during a downturn will gain a long-term competitive advantage that their rivals struggle to match.[14]

That same logic can also now apply to the energy crisis, which is an additional area of concern for manufacturers around the world.

"In terms of decarbonisation, digitalisation can enable the chemical industry by looking at our processes - using digital twins or augmented reality or even AI. AI looks at the products we develop and machine learning helps us understand the processes we go through to produce our chemicals. It helps us work with our suppliers, using tools like blockchain to make sure we have transparency along the value chain."

- Darren Budd, Commercial Director, BASF

And much like the impact of coronavirus on business, Cedrik Neike, CEO Siemens Digital Industries, argues: "These amazingly high energy prices will do the same. If you do not use technology to reduce your energy consumption it will wipe out your profits. So managing this is necessary for survival."

But there are tangible gains to be made by adapting your business during challenging times too. Speaking about the need to transform in the face of the electric vehicle (EV) transition in the automotive sector, Frank Ludwig, Chief Transformation Officer at Jaguar Land Rover explained: "It caused an extreme period of disruption not just in supply but in customer demand. That said, I cannot remember a time more agile than now."

Ludwig's words speak to the heart of the issue. Digital, sustainable technologies help manufacturers to retain business agility and respond swiftly to market, economic and regulatory issues. As Neike summarises: "These challenges mean we as manufacturers need to be able to react faster. In order to do this, we need to become more sustainable, more digital and more resilient. It's not enough to do the same things you've done in the past. To cope you have to accelerate digital transformation."

(L-R) Brian Holliday, Managing Director, Siemens Digital Industries UK&I; Frank Ludwig, Chief Transformation Officer, Jaguar Land Rover; Cedrik Neike, CEO, Siemens Digital Industries, Stephen Phipson CBE, CEO, Make UK; Alberto Prado, Head of R&D Digital & Partnerships at Unilever; Darren Budd, Commercial Director, BASF; Sarah Black-Smith, General Manager, Motion Control Business, Siemens UK&I.

Adoption rates

So how far along is UK manufacturing on its digital transformation journey? According to data from Make UK, 70% of UK Manufacturing is making world class achievements. But as Chief Executive Stephen Phipson points out: "the national average is being held back by 30% who are way behind".

In global terms, British industry is in a leading space in terms of digital transformation according to analysis by BloombergNEF, ranking fourth behind South Korea, Singapore and Germany. Better still, when it comes to decarbonisation efforts the UK is "leading the world, with nearly half of manufacturers already implementing their plans to decarbonise operations, according to the research.[15]

Industry 4.0 is empowering manufacturers to make processes more efficient and increasingly productive, and it is also helping them to reduce waste and ensure sustainability targets are intelligently defined and met.

However, as Phipson notes: "The challenge isn't so much the technology, it's getting companies to make the adoption leap, to have management curiosity and try it in their factories. This is particularly a hurdle for SMEs."

General Manager for Motion Control at Siemens UK&I, Sarah Black-Smith agrees adding: "Having leadership onboard and the ability to grasp concepts and make changes is as important as having the right technology in place."

What, then, is the technology that is helping industry transform and how is it being applied to generate hard business benefits? There are many examples already in production across the world. Here we focus on two key elements of industrial transformation as defined by the Transform panellists and audience.

Autonomous factory - measurable benefits

Comprehensive, end-to-end automation helps manufacturers shorten time-to-market and ensure maximum plant availability while also increasing quality, flexibility and sustainability. Unsurprisingly then, automation and robotics are touted as the most important skills for manufacturing engineers over the next decade.[16]

That is because while automated processes are essential to remain competitive, they cannot totally replace human input. Nor should they. Sarah Black-Smith explains: “It’s all about communicating with people, being open about what you’re doing, and why you’re doing it. Involve them in your plans.”

Black-Smith's own experience of adopting automation on the factory floor at Siemens' carbon neutral Congleton factory informs her views: “When we were introducing automation, we put the first robot on the shop floor and explained what we were doing. We wanted to engage people on that journey. It helped them understand their own place in transformation and how it would keep us competitive in the long-term.”

Automation in action

Investing in a connected and automated plant helped paint manufacturer AkzoNobel to deliver the highest quality of customised product consistently, faster than ever before and with flexibility that allows agile market responsiveness. From the moment raw materials come on site, to the finished product leaving, every process is automated.

The company’s Ashington plant can now turn the production wheel of 3,500 paint varieties in only two weeks.

As well as meeting the ever-increasing needs of its customers, the automation technology has helped AkzoNobel increase productivity, reach sustainability goals (reducing carbon emissions by up to 50%) and manage the minefield of safety legislation.

The same processes and technology can be scaled and applied to brownfield and greenfield sites alike, enabling existing plants to be efficiently modernised. "I feel like we’ve advanced 20 or 30 years ahead... But the most important thing to recognise...is that to keep us efficient, you have to embrace the very latest technologies" - ***Jeff Hope, Head of Ashington Manufacturing Unit, AkzoNobel***

Digital twins – business results

Digital twins – which provide a connected virtual version of a real world entity – are gaining significant traction in manufacturing. The technology allows design, adjustment, testing, optimisation configurations, to be developed faster and at lower cost. A report by Deloitte into the growth of digital twins explains: “We expect to see digital twins deployed broadly across industries for multiple use cases.

"For logistics, manufacturing, and supply chains, digital twins combined with machine learning and advanced network connectivity such as 5G will increasingly track, monitor, route, and optimise the flow of goods throughout factories and around the world.”[17]

Implementation rates are not yet fully mainstream, with Gartner predicting that adoption will ‘cross the chasm’ in 2026.[18] Yet adoption is certainly strengthening very fast, with various analysts reporting annual growth rates of more than 30%[19] to the end of the decade.

Manufacturers are increasingly looking into what a digital twin can deliver, how it can be deployed, and what impact it could have on the factory floor. However, the benefits are already well-known.

Cedrik Neike offers a simple breakdown: “In essence, you virtually plan production lines and complete factories, simulating and testing product flows, and optimising at every step before a single piece of the plant is even built.”

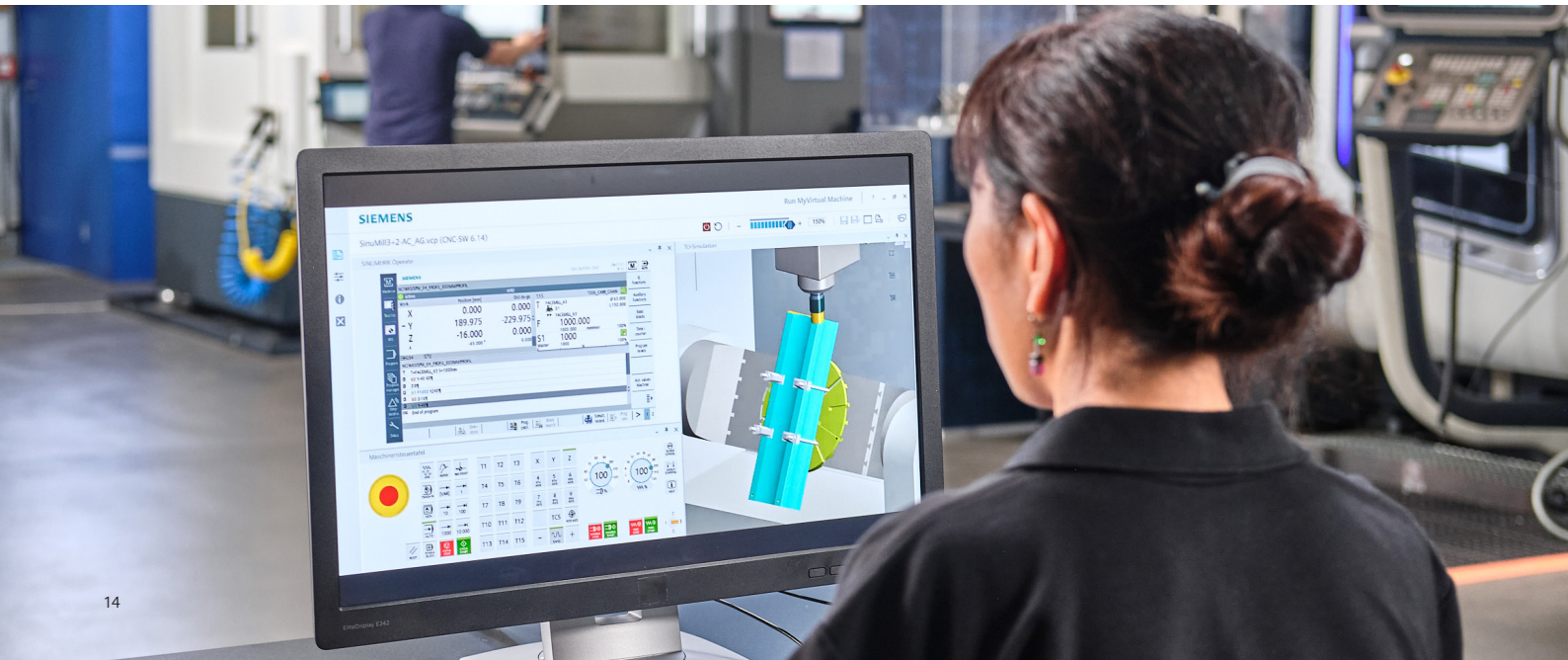
"It can take weeks to program a robot in the real world. The industrial metaverse and the use of technologies such as artificial intelligence can help speed up this process by having robots training in the virtual space, while factory processes are being designed. This can translate to automation being ready in hours rather than weeks.

Neike continues: “With the insights you gain through the industrial metaverse and the use of AI, you can tremendously speed up the programming of your robot, which also optimises the time it takes to change an entire production process. The metaverse is a complete game changer in this respect.”

In simple terms what does "Digital Twin" mean in the context of Industrial Transformation?

- Audience Question

Given its many applications as well as its relevance to achieving net zero targets, it’s no surprise that the market for Digital Twins is expected to grow tenfold this decade, a trend that is led by the manufacturing, automotive and aerospace sectors.[21] As will be explored in the next section of this report, the same technology is also being used in city planning to improve sustainability and encourage low-carbon living.[22]



People, partnerships & skills – more than technology

The combination of people and technology will drive change in the sector. As Alberto Prado, Unilever, asserts: “People are a pillar of digital transformation that is often forgotten. We assume that if you throw in the technology, people will embrace it and operate digitally but the reality is that there’s a lot of explanation that needs to happen even before training.

"My experience, is that if people understand the rationale behind what we’re trying to achieve and where they fit in, they want to learn, grow and acquire new skills.

"There’s an enormous amount of corporate knowledge that exists in the talent pool you already have. So, equipping them with digital skills can be a quick and effective way to deliver value.”

This question of “why transform?” is also central to defining goals and getting the right people onside. Sarah Black-Smith explains how Siemens has achieved this in its own site in Congleton, which is on track to hit carbon neutral targets eight years ahead of its goal: “Our sustainability journey at Congleton was driven by an understanding of ‘what’ we wanted to do and ‘why’ we were doing it. This is deeply reliant on having the right team together to push the initiative.”

Leadership must also lead the charge on these changes, which requires a shift in mindset at senior level. As Frank Ludwig, Jaguar Land Rover acknowledges: “Engineers are focused on balancing quality, costs and time. Adding sustainability into that mix can blow that out of the water. We as leaders need to be able to explain the rationale in clear terms.” In agreement with this, Stephen Phipson, Make UK, highlights: “The first steps to transformation aren’t about technology but people. For SMEs this needs to be driven by leadership and investment in training for staff to be able to cope with the change.”

Developing skills and partnerships

Though a key concern for the sector is skill shortages.[23] Cedrik Neike warns: "This will not go away, so we need to make technology simpler for people to use and easier to integrate. It should be an open ecosystem so that everyone involved on the shop floor who know their processes can continuously optimise through technological platforms." In the automotive sector, Ludwig's experience is similar. He suggests: "Give people the tools to do their own reporting and modelling and they will implement and develop naturally."

Having the right partner is also essential – one that will help you first work out what to do, before recommending which solution will help you get there.

As Alberto Prado summarises: "This is a team sport – in our industry these big challenges can only be tackled if different functions get together and optimise end-to-end and not just internally, but teaming up with external partners that can help us get there. Without this collaboration we couldn't digitalise at scale."

These partnerships range from big technology companies and start-ups to collaborating with local clusters to learn from one another. BASF's Darren Budd says: "Collaboration is key – we've come a long way but we've realised, particularly in the chemical industry, we can't do this alone. We have to work with partners and we can only achieve net zero if we work in partnership."

The effort to push a digital transformation in manufacturing is encouraging, but can it fully take place when there is a skills shortage?

- Audience Question

Digitise, simplify, focus... and never forget your people

Through recent economic uncertainty and emerging crises, manufacturing has proved itself to be resilient. But given the ambitious targets set for UK industry, manufacturers of all sizes will be reliant on digital technologies to achieve competitive positioning in volatile markets, and meet their net zero targets. Innovative systems such as factory automation and digital twins are unlocking more efficient operations and lower costs while also reducing waste and emissions.

And at the heart of this transition are the people who make up this industry. Through collaboration, partnerships and training, manufacturers are empowering their teams to drive change. While upskilling will be key, the most successful businesses will be those that incorporate people into the digital transformation and drive their initiatives 'with purpose'.

Key Takeaways

- **Competitiveness and sustainability** now form a combined vision for leading manufacturers.
- Digital leaders made significant gains during the pandemic crisis and are **better prepared for challenges** like rising energy prices.
- **Digital capabilities** have been seen as the key to managing past, present and future market economic and regulatory challenges.
- Industrial adoption of digital tech such as autonomous factories or digital twins is advancing, but **needs to accelerate** to keep pace with the scale of challenges faced by UK and Irish manufacturers.
- **An equal investment needs** to be made in people skills to manage the new digital world.
- Digital technology suppliers are becoming **collaborative**, **consultative partners**, and group partnerships are springing up within sectors and regions to share best digital practice.

3. Transforming Infrastructure

Inclusive digitalisation

Innovation in manufacturing runs parallel to development in infrastructure in the UK and Ireland and each has a significant role in achieving a net-zero economy.

The lessons factories are learning in the fields of automation and sustainability must be applied in cities and communities too. Just as people are at the heart of digital transformation in industry, the transformation of our infrastructure must be for the benefit of all, incentivising communities to participate in both digitalisation and decarbonisation.

Climate change, coupled with the energy crisis, presents us with a serious challenge, but also the opportunity to innovate.

Optimising infrastructure will support every facet of society, from factories to schools, and facilitate the path to net zero. However, there are significant barriers to smart city adoption, including a lack of technical skills, local authority funding, regulatory hurdles for large-scale projects, and low public trust in digital initiatives. This chapter delves deeper into those challenges, but also presents ideas – some proven and some in development – for future-proofing our cities.

What good urbanisation looks like

In 1980, 40% of the world's 4.4 billion people lived in cities.[25] In 2100, it is estimated that 85% of the population (around 11 billion people by then) will be living in a city.[26]

This mass urbanisation is predicted to generate 79 cities with a population over 5 million by 2025, growing to 122 such cities by 2050, and 181 by 2100.

Professor Greg Clark, Chair of Connected Places Catapult, the UK's innovation accelerator for cities, transport and place leadership, stresses that if we do not prepare, we face a future of "bad urbanisation" characterised by overcrowding, overheating, congestion, flooding, and much more. On the other hand, good urbanisation is connected, intelligent, data-driven, coordinated, well-led, and it has people and nature at its core.

The forecast for growth in city dwellers is quite dramatic. Are city leaders prepared for 50 years of sustained investment to cope with impending infrastructure pressures?

- Audience Question

Leadership to unlock sustainability

Place leadership is becoming more important with this in mind, and decisions at local level are pivotal in delivering better, cleaner, and greener infrastructure.

"We need to attend to transport, heat and city infrastructure to make a significant impact, since concentrated, large, centralised generation only accounts for about 30% of emissions", as Carl Ennis, CEO at Siemens UK&I, points out.

This comes at a cost. Research by Connected Places Catapult estimates that between £300 billion and £500 billion will be needed to fund net-zero transformation, significantly higher than the £90 billion of private investment the government is hoping to secure by 2030, as part of its Net Zero Strategy.

The organisation's Chief Business Officer, Paul Wilson, puts this into perspective, reminding us that government measures during the Covid-19 pandemic cost the country a similar amount, with current estimates ranging between £310 billion to £410 billion.[28]

Moreover, there is an appetite from investors – including traditionally cautious financial institutions – for green infrastructure projects, which are in short supply. To address this lack of suitable projects, Connected Places Catapult, London Councils, Core Cities UK and other organisations, such as the UK Infrastructure Bank, came together during COP26, forming the 3Ci Cities Commission for Climate Investment.

The commission is aiming to deliver a pipeline of investable projects, by bundling multiple city initiatives into large bonds for investment – a clear example of the powerful role community leaders can play in enabling change.

Open APIs for greater connectivity

Digitalisation plays a key part in meeting the sustainability challenge, as we have explored in previous chapters on business resilience and industry transformation. As Wilson puts it: "The answer to everything has become digital."

"What is missing and what is coming," he says, "is shared open APIs, that enable content to come from different models."

Currently, this is often blocked by a lack of alignment between stakeholders. Wilson cites one successful example: NHSX (now part of the NHS Transformation Directorate), which used an open API for medical technologies, mandating that certain APIs must be used.

The Digital Twin Hub – a platform supporting collaboration, interoperability and adoption – has the same aim of using a mandated open API to bring together roads, rail, air and buildings. He envisages, for instance, bringing together digital twins of intermodal transport systems through a city.

In leading cities, planning goes beyond local authorities, with governance extending to businesses, universities, the third sector and citizens too. Digital twins are already making an impact in city planning. Singapore, for instance, is one of the most advanced users of digital twins, with its 3D virtual model made up of millions of images taken at street level and from the air, allowing new developments or plans to be modelled with great precision.[29]

The electricity transition

Electricity networks are another area where broader collaboration is taking place to support transformation, as distribution network operators (DNOs) transition to become distribution system operators (DSOs), a key element of creating smarter energy systems and more efficient flexibility markets.[30] Liam O'Sullivan, Licence Director at SP Energy Networks, which distributes electricity across Cheshire, Merseyside, Shropshire, Scotland and North Wales, shares how the company is adjusting to a new way of working.

Traditionally, its responsibility was to "keep the lights on, make sure people can connect, and maintain and invest in assets." Now, the company must transform how it thinks about the energy system to maximise the potential benefits of a DSO. Flexibility is essential, as well as conversations with a wider range of partners, including: "commercial discussions with large consumers, and charge point installers or owners".

It is even more important to get the balance of demand and generation right. O'Sullivan expects DSOs to be tried and tested in cities first, but that they will be equally beneficial to villages or industrial parks once they are fully developed.

The DSO strategy of some providers is aligned with local political leaders: "responding to the desire of the population to go further and faster than the national target of net zero emissions by 2050 by committing to delivering net zero much sooner."[31] And financial probity is being ensured by the regulator, Ofgem, which has begun a review into the effectiveness of institutional and governance arrangements at a sub-national level to support delivery of net zero at minimal cost.[32]

What should cities invest in first to be greener and cleaner?

- Audience Question

Keeping up with EV demand

A further challenge for the grid, according to O'Sullivan, is matching investment with the pace of demand for electric vehicles. Asif Ghafoor, CEO at Iduna, which runs an EV charging network called Be.EV, agrees, saying we are missing the infrastructure needed to give people the confidence to switch from combustion engines to electric vehicles. He explains the dual challenge of finding sites and finding power, with an electrification system that was not built for today's purposes.

Is the charging network rollout timeline fast enough and what are the barriers to accelerating?

- Audience Question

Ghafoor believes the transition may take up to a decade, and that no one organisation should be responsible for solving the challenges. There is a broader conversation needed, since many people and organisations will be affected by increasing electrification, as part of decarbonisation measures. The Government's Net Zero Strategy[33] relies overtly on private investment and innovation driving down costs, so the success of the initiative in driving decarbonisation is a truly collaborative affair.

Transformation in Infrastructure #1 – Westminster

Westminster City Council working in partnership with Siemens, has installed over 1,500 EV charging points.

The charging points range from 3kW to 50kW and have been installed at key residential and commercial locations across the city. The charging points are available to all users, making it easier for residents to switch to environmentally friendly transport solutions. Users are able to park their vehicles in dedicated EV bays and can charge for up to four hours between 8.30am and 6.30pm every day.

Research from Siemens found that 40% of motorists said a lack of access to charging points had prevented them from switching to an electric vehicle sooner. To address this, Westminster City Council has enabled residents to request for an EV charging point to be installed near their home using an online form. The Council will use this information to guide the installation of new chargers to ensure the programme is targeted at the areas with the greatest demand.

The City of Westminster suffers with some of the worst air quality in the UK and the City Council declared a climate emergency in 2019. The Council's City for All vision outlines plans for Westminster to become a carbon neutral council by 2030 and a carbon neutral city by 2040.

Councillor Melvyn Caplan, Deputy Leader and Cabinet Member for City Management, said: "Poor air quality is a major concern among our residents and the council is embracing new technology to improve air quality and meet our net zero goals. By working with Siemens, Westminster is leading the way on electric vehicle infrastructure and making it easier for residents to switch to cleaner and greener transport."

Transformation in Infrastructure #2 – EV Charging Management

Parisa Akaber, a Knowledge Transfer Associate working on a joint project between Newcastle University and Siemens, has developed an artificial intelligence (AI) algorithm as a multi-stage optimisation solution for scheduling and load management of electric fleet charging.

The solution enables the complex management of when and for how long vehicles, like buses and trucks, are recharged in large depots to take advantage of lowest cost to charge, matching charging levels of batteries to route requirements and ensure buses are ready to depart on time. Using the solution reduces the total E-fleet charging cost by up to 27% and a total reduction in maximum power peak of up to 50%, compared to unmanaged charging.

Transformation in Infrastructure #3 - University of Birmingham

The University of Birmingham (UoB) and Siemens have a long-standing partnership that began in 2010, culminating in this latest ambitious project to create the world's smartest net zero campuses.

Siemens built a digital twin of the campuses to simulate different ideas, allowing the university to gain a better understanding of use cases and to make informed decisions.

Anonymous data from campus users was collected to create a 'nervous system' that sends signals and shares important insights, on building use, heating, and power consumption, for instance. Fragmented data sources were brought together to create a campus performance overview, including a trend analysis, such as seasonal changes.

The university's energy bill was approximately £10 million, with a third of this spent on lighting alone.

Through the rollout of LED lighting devices, combined with automatic light level adjustments using Enlighted sensors, the university can take advantage of ambient daylight and significantly reduce energy requirements.

The transition to net zero needed to be commercially and technically viable, with minimal cost. Siemens Financial Services helped to create a Building Efficiency as a Service (BEaaS) arrangement, where the reduction in energy costs is harnessed to effectively fund the cost of conversion.

Over the next 10 years, the University of Birmingham will train up to 1,000 graduates and over 200 people to doctoral level in energy sector disciplines that are essential for the transition to net zero. The UoB transformation is creating a dynamic living laboratory for power generation, energy systems management, social behaviour, and big data. The university is now in a position to share its learnings with other organisations, and is already collaborating with Birmingham City Council.

Communities of all sizes

Vision, collaboration and knowledge sharing are just as important as scale in successful transformation. Wilson also points outs that: "smaller towns and cities have the advantage of easier decision-making." The University of Birmingham (UoB) is an excellent example of the transformation that can be achieved in a small community. Professor Martin Freer, Director of the Birmingham Energy institute, notes that there are wider benefits from becoming a centre of excellence.

He says: "The reason that the faculty and the students want to be involved in the university's decarbonisation and digital transformation project is because not only do they care about net zero, they also care about the campus. This is a great opportunity for us to create new areas of research, develop new technologies, test those technologies in our own environment, a sort of living laboratory." From a financial perspective, more intelligent use of the estate generates significant energy cost savings.

(L-R) Justin Kelly, Director of Corporate Communications & Business Development, Siemens UK&I; Andy Burnham, Mayor of Greater Manchester and Carl Ennis, CEO Siemens UK&I.

An inclusive transition

Creating more efficient, sustainable cities cannot be achieved without buy-in from all sectors of society. No community must be left behind in sustainable and digital transformation. Andy Burnham, Mayor of Greater Manchester, stresses that greener must mean fairer, and that net zero should be achieved through incentives, not charges.

He cites Manchester's plans for a Clean Air Zone, which were drafted before the pandemic and could not have accounted for the pressures people would be experiencing. As a result, the city decided the original plan had become unworkable and has delayed implementation of the first phase, which was due to take place in May 2022.[34]

Every individual should be able to access the benefits of transformation.

"We need to see digital connectivity as a basic human right."

- Andy Burnham, Mayor of Greater Manchester

The UN[35] and the World Economic Forum[36] among others, emphasise that this is a moral and economic imperative. On digitalisation, Burnham argues that: "we need to see digital connectivity as a basic human right. Without it, people will be shut out of the conversation, lose access to essential services, and miss out on a whole range of opportunities."

Greater Manchester has accordingly created a new Digital Inclusion Action Network to work with its wider Digital Inclusion Taskforce, which will lend its strength to fix the digital divide across Greater Manchester. Referring to the EV transition, Ghafoor stresses the importance of thinking about accessibility factors now, to avoid leaving people behind. Electric vehicle infrastructure rollout should be equally spread across privileged and less privileged areas.

Prioritising data protection

A failure to properly protect our data, and to protect ourselves from cybersecurity threats, could jeopardise valuable digitalisation efforts, taking attention away from the many benefits outlined in this paper.

How can we find a balance between gaining useful data insights and protecting individual rights? Freer suggests it is likely "we will develop a system where data is aggregated, so that the individual cannot be identified, but still has access to their own information." O'Sullivan highlights the need for clear and regular assessment of data usage, stressing that: "we need to understand exactly what is being captured, why we're capturing it and what uses it has". Wilson agrees that, "we need a more mature understanding of shared data and collective good. That is the big conundrum for smart city projects – the blurring of 'my' data and shared data".

As well as protecting personal data, the UK must also be primed to defend itself from cyber-attack. The UK's National Cyber Security Centre acknowledges the threat to critical infrastructure, from espionage and targeted attacks from malicious actors, through to accidental data loss. However, the organisation also outlines measures we can take to limit both the likelihood and impact of these threats by: "safeguarding our networks, considering the way they are technically structured and who has access to them; knowing the threats we face and how to counter them; and ensuring organisations have incident response mechanisms in place."[37]

How do we ensure that smart city data isn't used as a form of surveillance?

- Audience Question

Optimising existing assets

Cities are set to grow at an overwhelming pace. Leaders speaking at Transform did not downplay the scale of the challenge we are facing, but they are hopeful about the possibilities for innovation, and what is being/can be achieved. The University of Birmingham case illustrates how organisations and communities can decarbonise at scale and at pace, and how we can optimise the assets we already have in a viable and sustainable way. Once we have an accurate understanding of how our infrastructure is being used, we begin to see where space and energy are not being used efficiently, and can pivot accordingly.

Siemens UK&I Head of Energy & Performance Services, Faye Bowser believes we can draw from current projects to develop standardised, scalable models: "In the future only 20% of any given project would need tailoring according to the types of building, organisation and user. We can shift from complexity to simplicity through the value of data, bringing together siloed data and teams of people to create connected infrastructure that is transparently managed, and proofed for the future. Data is the most valuable resource on our journey to Net Zero in order to get scalability and action."

Key Takeaways

- Even though digital transformation of the public infrastructure delivers measurable benefits, **there remain barriers to smart city adoption,** including a lack of technical skills, local authority funding, regulatory hurdles for large-scale projects, and low public trust in digital initiatives.
- **"Good urbanisation" is seen as the goal,** enabled by digital platforms. It is connected, intelligent, data-driven, coordinated, well-led, and has people and nature at its core.
- **Devolved decision making,** combined with strong local leadership, is seen as the key driver of change, along with smart financing techniques.
- Open APIs will enable increased connectivity across city, regional and national infrastructure.
- Digitalisation will enhance the electrification of society, enabling our networks to **better manage green energy sources** on the grid.
- Green infrastructure has to **develop in step with green technologies** - the rollout of electric vehicle charging infrastructure will usher in the transition to electric vehicles.
- And care must be taken to ensure that digitalisation brings benefits to communities large and small, it must be truly **inclusive and secure.**

4. What's Next in Tech?

The pace of innovation

There is no question that the pace of innovation continues to accelerate. As Siemens' Chief Technology Officer, Peter Koerte says: "Transformation and innovation are happening all the time. We will never be done." A record 277,500 international patents were filed in 2021, marking a 0.9 percent increase from the previous year.

However, digitalisation is the main driver of innovation today. In its annual overview, the UN's World Intellectual Property Organisation tells us that patents in digital technologies have grown 172%, with the specific areas of cloud computing up 122%, autonomous systems up 109%, big data up 699% and AI up 718%.[39]

Wider deployment of today's tech

Despite this constant innovation flow, it is Koerte's contention that we are not sitting around waiting for the 'next big thing'. He says: "Much is changing around us, but we already have the technology in hand to forge a bright and prosperous future. Phase change technology breakthrough is not the issue. It is more about better deployment of what we have already."

Dan Watkins of Oracle Red Bull Racing agrees, noting that operating in integrated virtual and real -world environments is the company's 'lifeblood'.

He says: "Accuracy of simulation is critical to our success. We've pushed really hard to digitalise our design, analysis, simulation, manufacturing and operational processes to achieve control without adding administrative burden for our engineers.

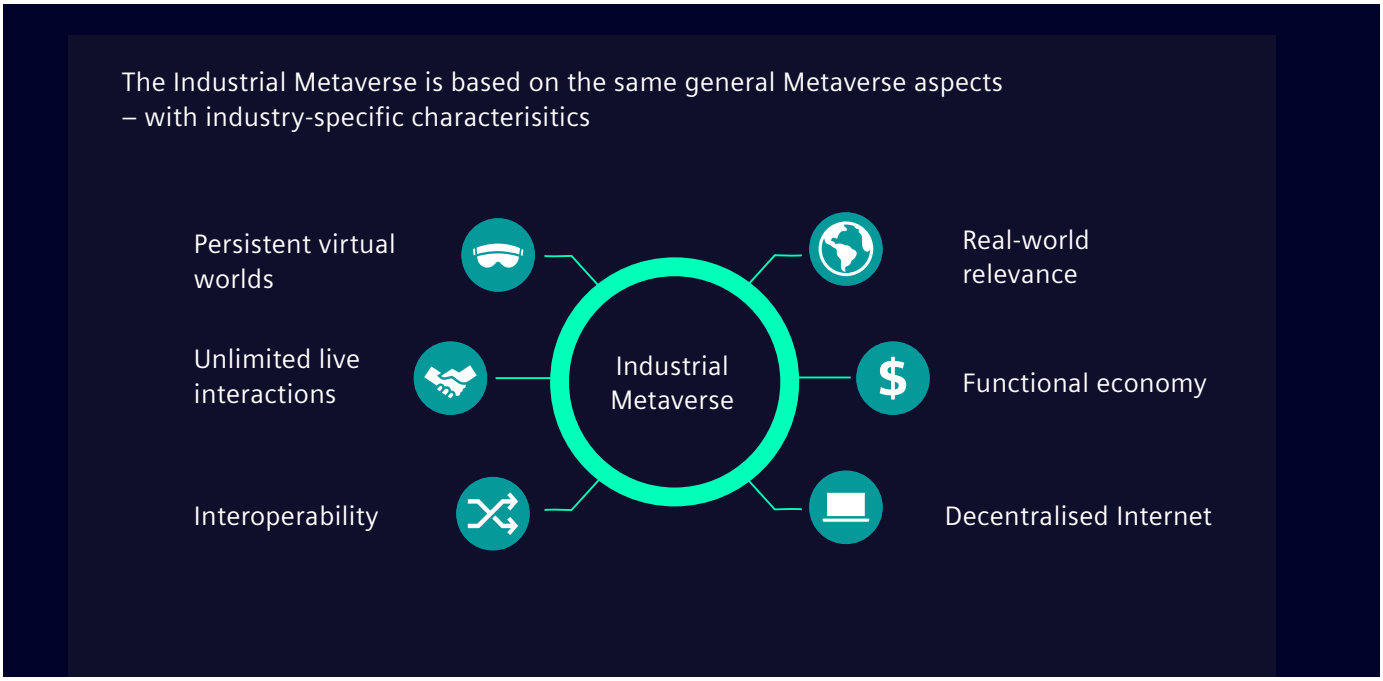
This allows them to 'imagineer' without restriction. We are exploring and achieving the art of the possible to be the best version of us that we can."

"Transformation and innovation are happening all the time. We will never be done." - Peter Koerte,
Chief Technology Officer, Siemens AG

The industrial metaverse

Peter Koerte describes this integrated world as the 'Industrial Metaverse', adding: "The Industrial Metaverse sounds like science fiction. But it will only be the result of the natural evolution of technologies that we're already using today."

Koerte has several real-life stories to illustrate the benefits of the industrial metaverse: "One neat example we see a lot is where AI is used to teach robots to deal with real-world issues, but in the virtual environment. For instance, we can digitally create different levels and types of visual glare that occur on the shop floor, and this is used to coach robots to read labels accurately when they are assembling products.



"We have also been working with an underwater farming project called Nemo's Garden. In order to optimally design their underwater glass dome, we tested design options through virtual world simulations. To have done this only in the real-world, where the parameters we were testing occur only rarely, would have been almost impossible, and certainly unaffordable.

"Finally, the island of Hawaii wanted to move from 65% renewable energy generation to 100% renewable. However, traditional power plants with their huge rotational turbines play an important role in grid stability which renewable inverters cannot. A digital twin assistant can forecast how the island grid would respond to critical events, and the algorithms developed by Siemens Technology provide the grid operator with alternative settings for the inverters of their renewables to reduce oscillation."

Measurable outcomes

Daniel Watkins, Oracle Red Bull Racing, stresses the importance of digital tools for cost management. “The use of digital technology, and the associated processes that wrap around it, helps us to improve continuously and accelerate that on-track and business performance. It’s also helping us to diversify into other revenue streams – such as our ‘advanced technologies’ where we apply learnings from F1 into other applications such as consumer motoring.”

Standardisation and interoperability

Thought leaders are generally agreed on the importance of standardisation and integration of different digital technologies for better collaboration. Nick Bateman, Executive Chairman of vertical farming and hydroponics firm GrowPura, stresses: “We have a digitalised technology that moves the plants around all the time – and allows us to know what we’re doing and working to stimulate the plant, rates of growth, nutrition, etc. The whole technical ecosystem has to integrate seamlessly and we rely on our partners to make this easy. Even the building itself is an automated technology unit which influences the growing process.”

Daniel Watkins, Oracle Red Bull Racing, adds: “My job over the last ten years has been to consolidate bespoke systems – islands of digitalisation – around the organisation. My aim is to get rid of data duplication, and a situation where everyone is managing their own bespoke tools. I’ve been integrating the bespoke systems we had created and bringing them into our key business systems – then automating the process that pushed data around the business.

"The result is to make it easier for everyone to get the data they need and make better decisions, confidently and faster. Making data usable and findable wherever you are in the business means we have a single source of the truth delivered through a single portal.”

Gregory Albertson of Sanofi stresses the importance of preliminary analytics in his digital twin project with Siemens. He says: “The time up front understanding our problem was key. We didn’t jump headfirst into what solutions are available, but focussed on what it was we were trying to solve. We were looking for a partner, not a particular solution. It’s not about the particular technology or tool... it’s working out what could help us become even better at what we’re already doing – in manufacturing for example.”

"It's not about the particular technology or tool... it's working out what could help us become even better at what we're already doing."

- Gregory Albertson, Sanofi

Siemens Xcelerator *is a new, open digital business platform designed to help organisations accelerate their digital transformation. Featuring a curated portfolio of IoT-enabled hardware and software, a powerful ecosystem of partners, and a marketplace, Xcelerator offers software and IoT-enabled hardware that is easy to access and easy to integrate, with access to an open ecosystem of experts, partners, peers, and developers. Its technical governance principles enable different solutions to work seamlessly together.*

Rob Passmore, Commercial Lead, Biosphere Foundation comments: "Our vision is to harness the power of nature to address the climate emergency that we all face.

"We're doing that in partnership with Siemens, the Environment Agency and the UK Government.

"We're looking to redirect private investment into nature-based solutions; building an online platform to create the transparency needed and the blockchain-like technology to create seamless infrastructure that enables this market.

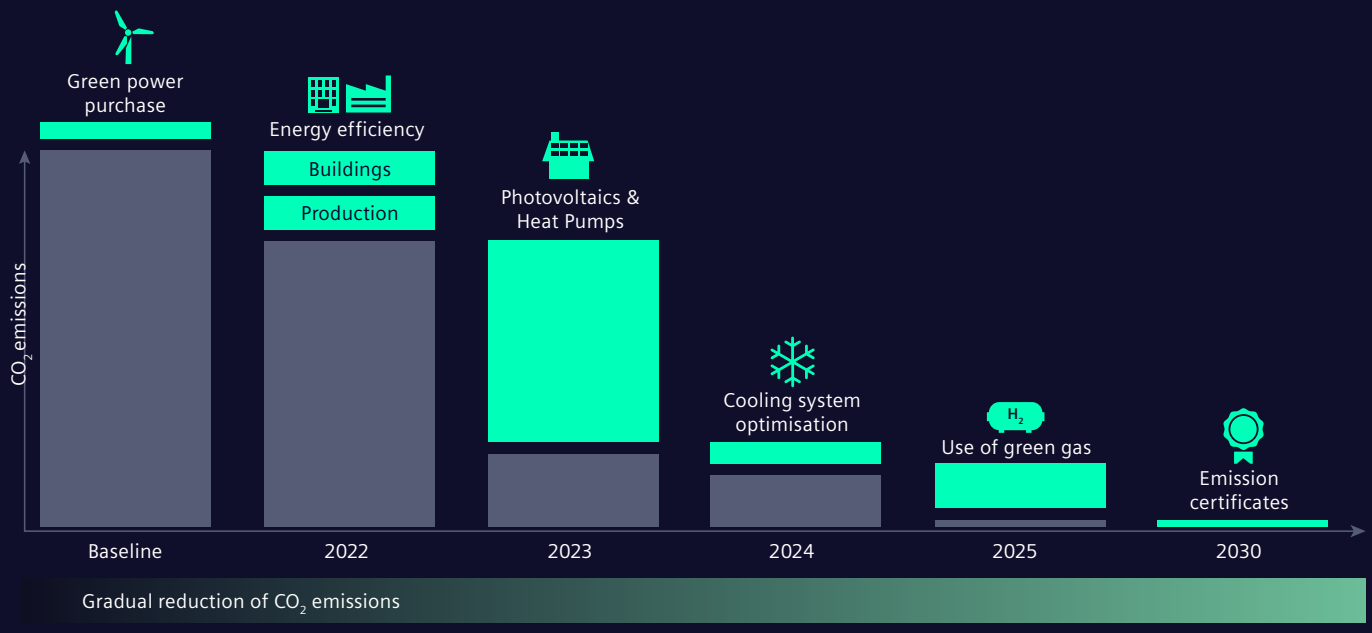
"A lot of our infrastructure is built on Siemens tech, acquired through Siemens Xcelerator, and majoring on Mendix and Mindsphere."

Meeting Scope 3 environmental targets

Rob Passmore of the Biosphere Foundation sees open standards and seamless integration as integral to managing and meeting environmental standards up and down the supply chain (known as Scope 3 emissions). He says: “Collaboration and technological openness is critical to co-operative action towards carbon targets up and down the supply chain – no-one can do it on their own and these supply-chain wide targets are part of the mandatory path in Europe. Wider, open application of digital and blockchain is critical to introducing levels of transparency and trust in the nature-based solutions which will always be needed for offsetting.

"Technology also helps aggregate small units of sequestration, for instance, up to an investment scale – where corporations can buy into the volumes they need in a trustworthy, reliable fashion. And smart sensors help to monitor the effectiveness in meeting those carbon, water quality, and other targets. It’s a massive digital infrastructure piece that we’re building and the component parts all need to plug-and-play.”

Decarbonisation measures for a factory achieving CO_2 neutrality



Peter Koerte emphasises that managing Scope 3 climate targets up the supply chain carries a high cost of failure. He notes: “One global chemical company I know generates some €2 billion in carbon emissions each year. That’s a huge target to mitigate by 2030. Moreover, the likelihood is that the pricing of carbon permits will go up further.

"When it comes to understanding how carbon plays out in the supply chain too, we are increasingly looking at how existing tools can provide guarantees for this. Blockchain technology has been searching for a killer application for some time, and this is perhaps it – verified but discreet monitoring of supply chains’ environmental performances. This is where SiGREEN can guarantee reliable tracking of a product's carbon footprint across the supply chain while preserving data sovereignty."

Asif Ghafoor, CEO of electric vehicle charging company Iduna, stresses the importance of supplier-buyer collaborations for the transition to a low-carbon economy. He notes that: “People are a little bit scared about making the wrong decision.

"It is quite an upheaval putting infrastructure in the ground. We spend a lot of time sitting with customers and helping them to develop their strategy for a five or 10-year transition. We are not afraid to put anyone together for productive conversations and cross collaboration across the whole electricity ecosphere.”

More focus on UX targets

Commentators are also arguing that high-functioning technology will not accelerate adoption without good Customer Experience (CX) or User Experience (UX) design. Simple user interfaces are seen as key to the effective and widespread deployment of digital technologies. Dan Watkins, Oracle Red Bull Racing, points out that: "Collaboration is absolutely key to our business, and the digital tools we use for collaboration are on every employee's desktop, laptop, mobile. We are always trying to reduce complexity through a simple, intuitive user interface. While everyone has these sophisticated tools, they do not need to be aware of the underlying technological power. They just need to access what they need, when they need it, simply, easily and in real time."

Rob Passmore, Biosphere Foundation, adds: "We need more computer scientists who have the ability to develop products that do what's needed and are easy to operate – as easy as today's consumer technology has become." And Peter Koerte concludes: "Of the four skills needed for future technological development – coding, electrical engineering, data science, user experience design – I firmly believe we are paying too little attention to user experience and that has to change."

Looking ahead

In short, while digital innovation proceeds apace, ease of adoption, open standards and interoperability, and focus on hard business or sustainability targets are seen as top priorities for what's next in tech.

Joan Mulvihill, Digital Transformation Lead, Siemens Ireland, looks forward to a technology panorama when widespread digital adoption has been achieved: "We now have in sight a 'post-data world', where so much is automated, programmed and roboticised that the work functions left for us all to do will be those that remain truly human and can't be performed by machines. That means our purpose, our intent, our creativity, our imagineering."

Key Takeaways

- **Innovation continues to grow** especially in digital technologies.
- However, the issue for business and society is how to **accelerate the adoption of digital tools** that are already available and have proven their worth in real-life applications.
- Rule of origin issues mean that new generation technologies need to be **manufactured locally**, requiring a wave of national investment.
- **Standardisation and interoperability** are seen as key drivers of adoption, and technology companies need to provide appropriate interfaces.
- **Meeting Scope 3 environmental targets** up the supply chain is a major challenge, requiring a new phase of investment in connectivity.
- There is also a drive to **improve simplicity of user interfaces** to further incentivise and drive adoption of digital solutions.

5. Looking forward – Main Insights

1. Business and the public sector in the UK and Ireland need to **continue building business resilience to manage future challenges** – embracing commercial competitiveness, sustainability goals and social contribution/ inclusivity targets. Organisations primarily want collaborative solutions partners, who analyse a business's problems and challenges before suggesting technology solutions.

2. The '**red thread**' running through all solutions to meet these challenges is **digital transformation**. Real-life experience has revealed the true, measurable **value of existing** strategic investments in digital – which have kept organisations up and running through recent crises. However, the pace of investment and adoption needs to **accelerate** if businesses are to meet ambitious targets and combat future shocks.

3. Moral and commercial **imperatives have now converged**. Environmental, social and governance targets are mandatory, whether through legislative demands or as a result of pressure from the commercial and financial markets. Again, **digital transformation is the key** to achieving corporate responsibility goals while at the same time reducing cost and improving efficiency and agility. Leading companies are therefore taking a longer-term view of their investment in digital, adjusting their strategies to a vision of '**profit with purpose**'.

4. The technology to achieve digital transformation is **here today**. The primary need is to achieve **more widespread deployment** of the technology tools currently in hand. The rate of deployment will be improved through: accelerated **digitisation** of the physical environment (monitors, sensors, energy use metering, data collection/analytics); greater use of virtual world **simulation** (through digital twins); and extended tools for **collaboration** (standardisation and interoperability).

5. **Collaboration needs to extend further** within and between organisations and sectors. There is a rapidly expanding pool of experience – successfully implementing **available solutions**. Yet outdated attitudes to sharing – especially between competitors – may be holding back progress. Government and trade bodies have a critical role to play, enabling collaboration without exposing competitive intelligence.

6. Finally, digital transformation is not simply a matter of technology. **People factors remain critical**. Attention has to be paid to skills development through a **better interface** between industry and education, as well **democratisation** of digital tools on the shop floor. And benefits have to be available to everyone and every community, with **no 'digital exclusion'**.

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