Reimagining digital factories of tomorrow

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Foreword

Sudipta Ghosh,
Partner, Industrial Products and Data and Analytics Leader

Resilience, innovation and cost leadership are important themes which are driving the adoption of Industry 4.0 in India. As government initiatives are encouraging businesses to build for scale and quality, organisations are developing the roadmap to adopt digital transformation which can enable them to drive their business outcomes effectively. Geopolitical factors across the globe and the increasing focus on ESG are also nudging businesses to be more innovative and efficient.

Many organisations have not seen a positive return on investment on their technology investments. One of the reasons for this could be the way technology adoption programmes are implemented and managed. However, some companies, whom we refer to as digital champions in this report, focus on adequate planning, dedicated project teams and agile delivery models which helps them learn from their failures, scale quickly and build digital literacy across the organisation.

Organisations in India are adopting Industry 4.0 at a rapid pace by modernising existing plants to make them more efficient and setting up new plants using digital technologies. Businesses are also focusing on improving the efficiency of processes such as reducing the down time of assets, minimising the maintenance cost of expensive equipment, cutting down the cost of poor quality by understanding the parameters needed for the golden batch using digital twins, automation of processes like connected workstations, using IoT for better visibility at the shop floor, workflow-based automated solution for efficient scheduling, enhancing the safety for surveillance and alerts, and reducing the time to market by using digital twins to optimise product life cycle.

Analytics continues to play a significant role in improving the decision-making process both on the shop floor as well as across the entire supply chain. The return on investments will be governed by how organisations are using the data to generate insights and take timely decisions.

This is a very interesting time for organisations, especially in India, who have embarked upon the journey of digital adoption and we hope that this report will provide businesses with the necessary insights which will help them become fit-for-future.

Foreword

Ankur Basu
Partner, Digital Operations Leader

Manufacturing companies, across many geographies and sectors, are adopting Industry 4.0 at scale to drive business outcomes. In the domestic market, a conducive ecosystem has been created against the backdrop of various government initiatives such as the Production Linked Incentive scheme (PLI) and the Make in India initiative. Manufacturing companies are putting up strategies to drive value by investing in upskilling and reskilling the workforce, adopting new technologies and aligning processes.

While majority of the companies have implemented fit-for-future technologies in some capacity, only few are able to implement it successfully across the organisation. Adopting digital technology effectively requires the commitment of the leadership team with a clear roadmap for implementation. Companies can learn from success stories, both from similar industry verticals and manufacturing at large, that are bound to raise awareness and help plan better on probable obstacles. Our study indicates that while improving operational excellence and cost leadership remains a priority, the focus of manufacturing companies is shifting towards sustainability, customer centricity, and faster time to market. The key to achieving a higher degree of success is to put a clear strategy in place and identify high-impact use cases supported by adequate investments.

This report aims to provide an overview of digital transformation in the Indian manufacturing industries with a focus on the driving forces for the transformation. It also highlights the success stories of early adopters. The paper also discusses some of the critical success factors that will help aspiring companies to prepare for the future and adopt digital technologies effectively.

Foreword

Global trends such as disrupted supply chains, focus on environmental sustainability, changing competition and customer demand are challenging companies around the world, and the factories of tomorrow must meet these challenges to ensure a sustainable future. With the introduction of Industry 4.0, there is a fundamental shift in the way global manufacturing and supply chain processes work. Seamless connectivity, availability of real-time data, enhanced data processing and diagnostic capabilities are enabling organisations to improve manufacturing flexibility and reduce system complexity.

Digitisation is a unique chance for less mature manufacturers to drastically increase their manufacturing performance and leapfrog the global competition. India with its high IT competencies, manufacturing capabilities and pragmatic approach has a clear chance to bundle its competencies and accelerate the performance of the manufacturing sector.

Based on PwC Germany's global Digital Factory Transformation Survey 2022, PwC India has prepared an insightful report that outlines the current digital transformation trends in the Indian manufacturing landscape. The survey covered Indian manufacturing organisations in key sectors such as retail and consumer goods, hi-tech and electronics, chemical and process industries, pharma and MedTech, automotive and transportation, and industrial manufacturing.

PwC India's research shows that Indian organisations are in the early stages of planning their digital transformation. 38% of Indian companies who participated in this survey have not yet developed their roadmap, while only 2% of their global counterparts are at this stage. Despite the slow progress, digitisation is high on the agenda and the key drivers of digitisation in India are resilience, transparency and sustainability.

The survey also seeks to draw a parallel between global and Indian trends in terms of technology adoption, implementation of IT solutions and use cases, payback periods and organisational set-up. A majority of Indian organisations are following the global trend of implementing advanced technology solutions such as additive manufacturing, analytics, artificial intelligence (AI), augmented reality (AR)/ virtual reality (VR) and smart devices. One of the differences which has been observed between Indian manufacturers and their global counterparts is the inclination of Indian organisations towards implementing product lifecycle management (PLM) solutions in the Indian industry, while MES is more popular in the global landscape. Indian companies have shorter perceived payback periods across solutions and use cases, illustrating higher optimism in terms of return on investment (ROI). When it comes to overall organisational strategies, Indian companies tend to focus more on people, policies and mindset, while global companies prefer to build the right system to drive their transformation.

Knowing where to start may seem challenging due to the number of new technologies and solutions available with limited internal specialist teams and constrained budget allocations, however, it's important to embrace change to stay relevant in the dynamic global ecosystem and manufacturing companies must come up with a roadmap for their digital transformation. PwC India's insightful research provides a glimpse of the road ahead and a direction for creating a successful strategy. Do not miss out on the opportunity that digitisation offers for India, it is time to start now.

Michael Bruns
Partner, Digital
Operations
PwC Germany

Jens Wunderlin
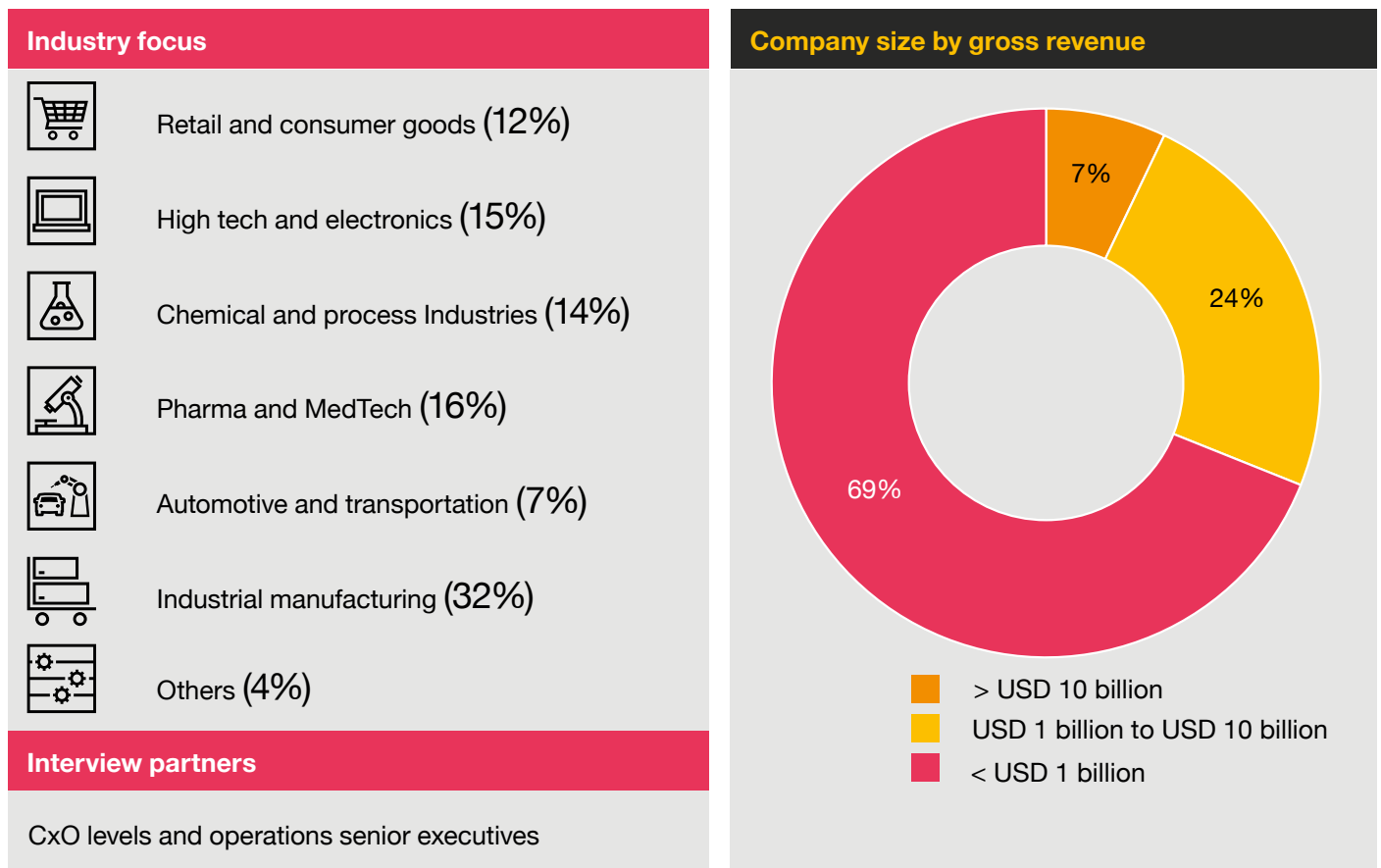Director, Factory
Transformation
PwC Germany

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Decoding the current digital landscape

The manufacturing sector plays a significant role in the Indian economy. Of late, several factors such as competition from new tech-based players, decoupling of the global supply chain, shifting consumer preferences, new distribution models, increased focus on environmental, health and safety issues, and an emphasis on non-financial reporting (ESG disclosures) have impacted the sector, and given rise to new opportunities for manufacturing companies. These firms are innovating and redesigning their business models by embracing digital technology to transform operations through end-to-end digitisation and data integration in the value chain.

Furthermore, in response to the Indian government's announcement of the PLI programme, global manufacturers are trying to expand their operations in India, develop new capabilities and raise incremental investments and sales of industrial goods. India is also perceived as a lucrative investment destination by new investors. To attract foreign direct investment (FDI), take advantage of cutting-edge technologies, and boost efficiency through factory automation, India's industrial sector is working to establish international partnerships, alliances and joint ventures.

Given this context, PwC India conducted a survey earlier this year to understand the current digital landscape in the Indian manufacturing industry and assess the prospect of laying down the future roadmap. CXOs of organisations in the domestic market, including multinational companies (MNCs), were interviewed to gain insights into the digital transformation trends of the manufacturing sector broadly comprising six segments – retail and consumer goods, high tech and electronics, chemical and process industries, pharma and MedTech, automotive and transportation, and industrial manufacturing.

Figure 1: Survey coverage: respondent profile

Industry focus	
🛒	Retail and consumer goods (12%)
💻	High tech and electronics (15%)
⚗️	Chemical and process Industries (14%)
🔬	Pharma and MedTech (16%)
🤖	Automotive and transportation (7%)
🏭	Industrial manufacturing (32%)
⚙️	Others (4%)

Interview partners

CxO levels and operations senior executives

Company size by gross revenue

- 7% — > USD 10 billion
- 24% — USD 1 billion to USD 10 billion
- 69% — < USD 1 billion

Source: PwC Digital Factory Transformation Survey 2023

The survey provided insights into the current trends related to digital technology in the manufacturing sector and highlighted areas where there is room for progress. Some of the benefits of adopting digital technology in the manufacturing sector are:

- achieving productivity gains and operational efficiency

- enabling cost competitiveness and profitability

- reducing asset downtime and improving reliability

- identifying quality issues efficiently to improve production yield

- optimising operations such as flexible deployment of machinery, raw materials and plant planning

- minimising the time and effort for prototyping and designing new products

- reducing the time to market (TTM)

- improving fuel and energy efficiency, thereby complying with the ESG mandates.
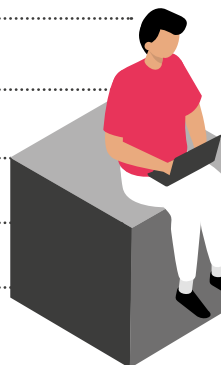
Figure 2: Classification of participants

Road to digital transformation of factories					
No plans/ developing roadmap	Beginning transformation	Initial progress	50% complete	75% complete	Achieved complete digital transformation

Implementation stage of use cases, technology deployments and IT solutions

01	02	03	04

Participants

- Champion, 10%
- Innovator, 23%
- Follower, 40%
- Beginners, 27%
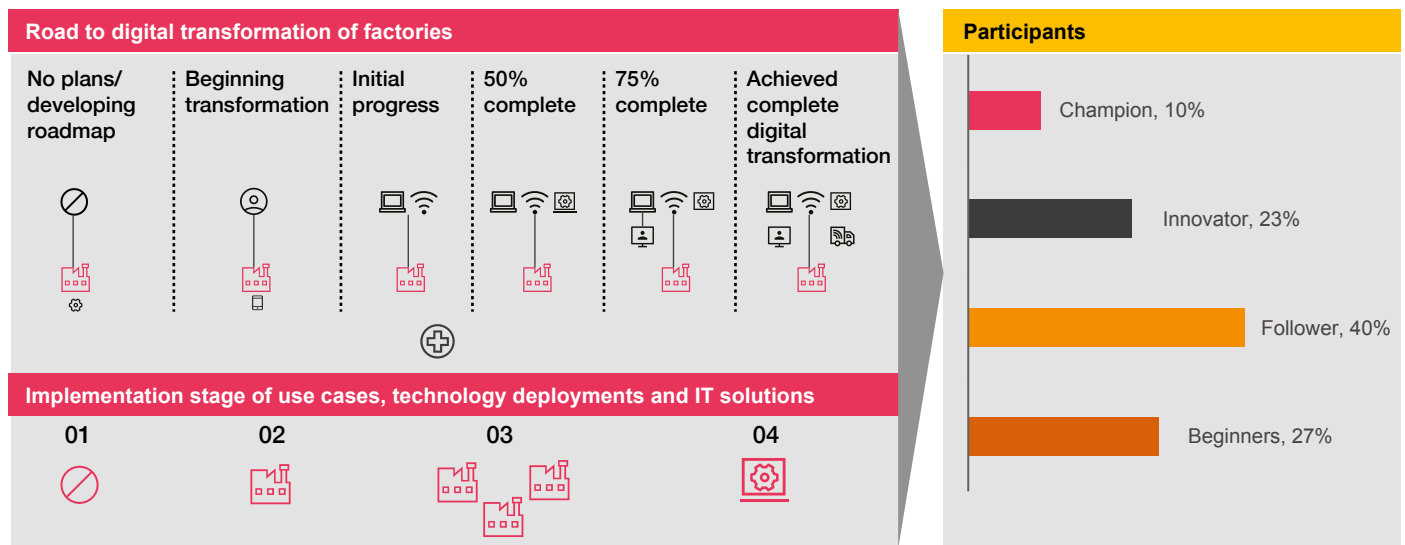
Source: PwC Digital Factory Transformation Survey 2023

The survey divided businesses into four categories based on the maturity of their digital transformations and the scale of their technology implementations. The top 10% of survey participants are digital champions, who have fully or largely completed their digital transformations and have started realising tangible benefits. Next are innovators who have made significant progress in their transformation programmes (23%). Followers are organisations who have developed their transformation roadmaps (40%), and beginners are organisations who have not yet begun their digital transformation (27%).

Figure 3: Key findings of the PwC Digital Factory Transformation Survey

A significant number of Indian companies (as indicated by 38% of surveyed) do not have a roadmap for digital transformation.

Organisations are shifting from adopting a one-size-fits all approach to customised, functional modules, with a preference towards PLM based solutions.

Resilience, transparency and sustainability are the critical pillars for transformation.

Analytics use cases are playing a pivotal role for organisations to provide actionable insights.

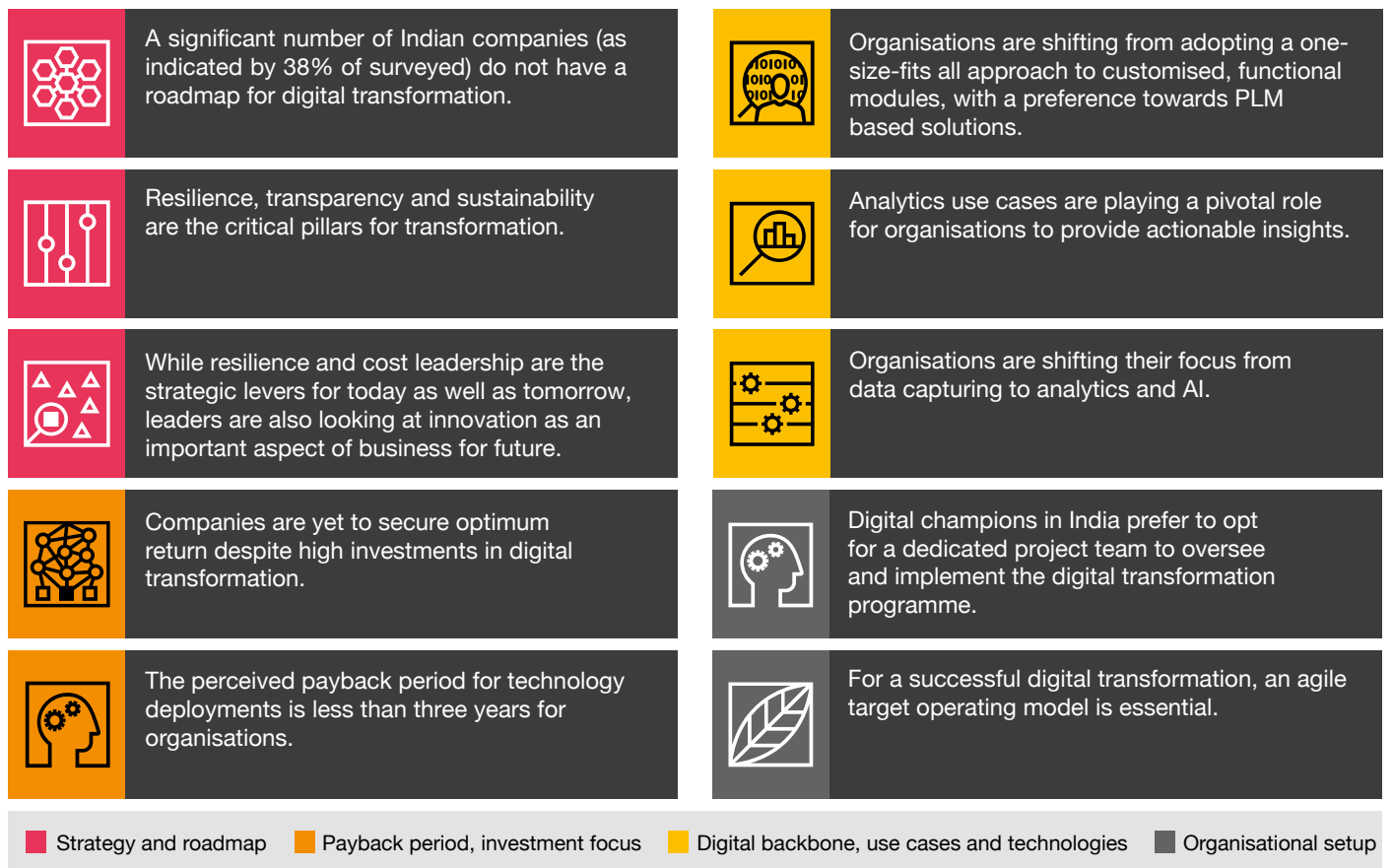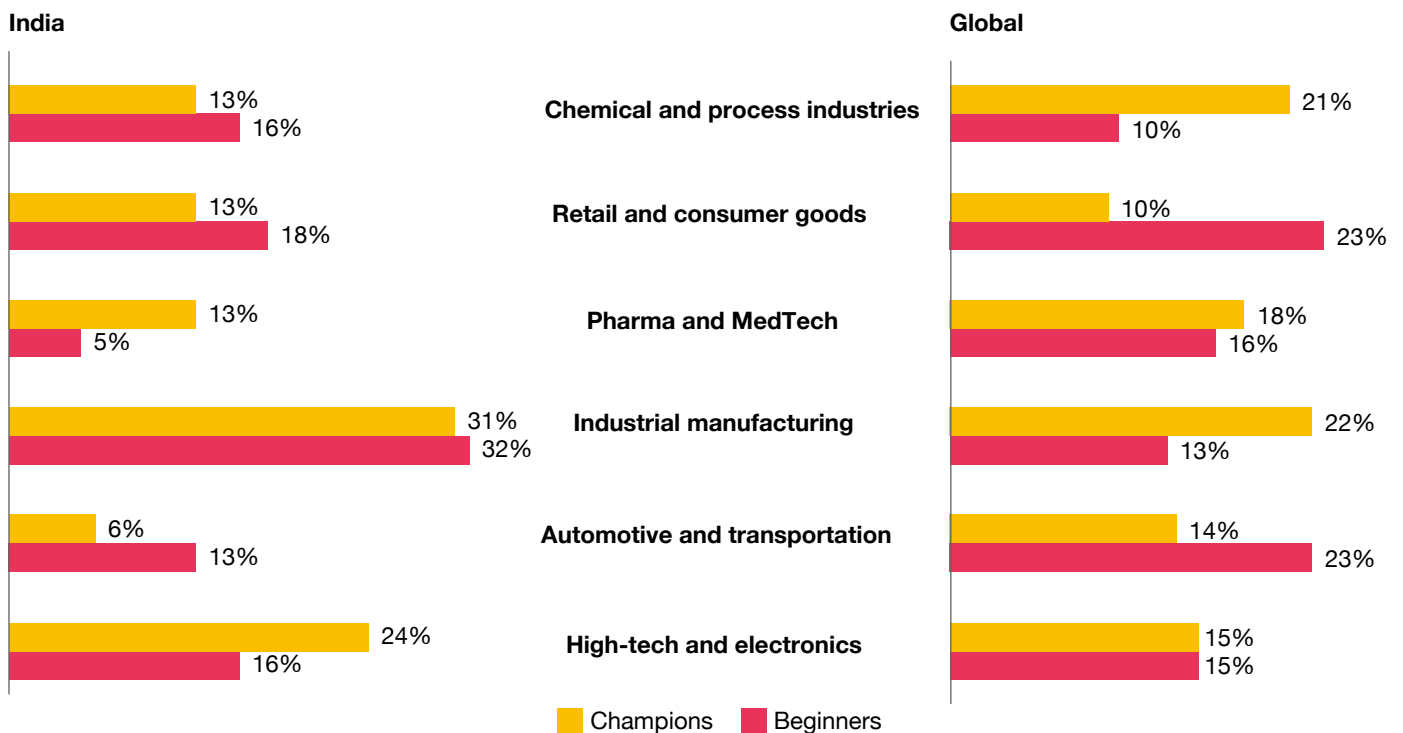While resilience and cost leadership are the strategic levers for today as well as tomorrow, leaders are also looking at innovation as an important aspect of business for future.

Organisations are shifting their focus from data capturing to analytics and AI.

Companies are yet to secure optimum return despite high investments in digital transformation.

Digital champions in India prefer to opt for a dedicated project team to oversee and implement the digital transformation programme.

The perceived payback period for technology deployments is less than three years for organisations.

For a successful digital transformation, an agile target operating model is essential.

■ Strategy and roadmap ■ Payback period, investment focus ■ Digital backbone, use cases and technologies ■ Organisational setup

Figure 4: Sector-wise comparison of champions and beginners (India and global)

India

Sector	Champions	Beginners
Chemical and process industries	13%	16%
Retail and consumer goods	13%	18%
Pharma and MedTech	13%	5%
Industrial manufacturing	31%	32%
Automotive and transportation	6%	13%
High-tech and electronics	24%	16%

Global

Sector	Champions	Beginners
Chemical and process industries	21%	10%
Retail and consumer goods	10%	23%
Pharma and MedTech	18%	16%
Industrial manufacturing	22%	13%
Automotive and transportation	14%	23%
High-tech and electronics	15%	15%

■ Champions ■ Beginners

Source: PwC Digital Factory Transformation Survey 2023

The survey highlighted that every company is at a different stage of evolution in its digital transformation journey. While beginners are focusing more on strategic planning to create the right digital ecosystem for themselves, champions are leading the way by early adoption of digital technologies and creating a level playing field for them to compete at a global level.
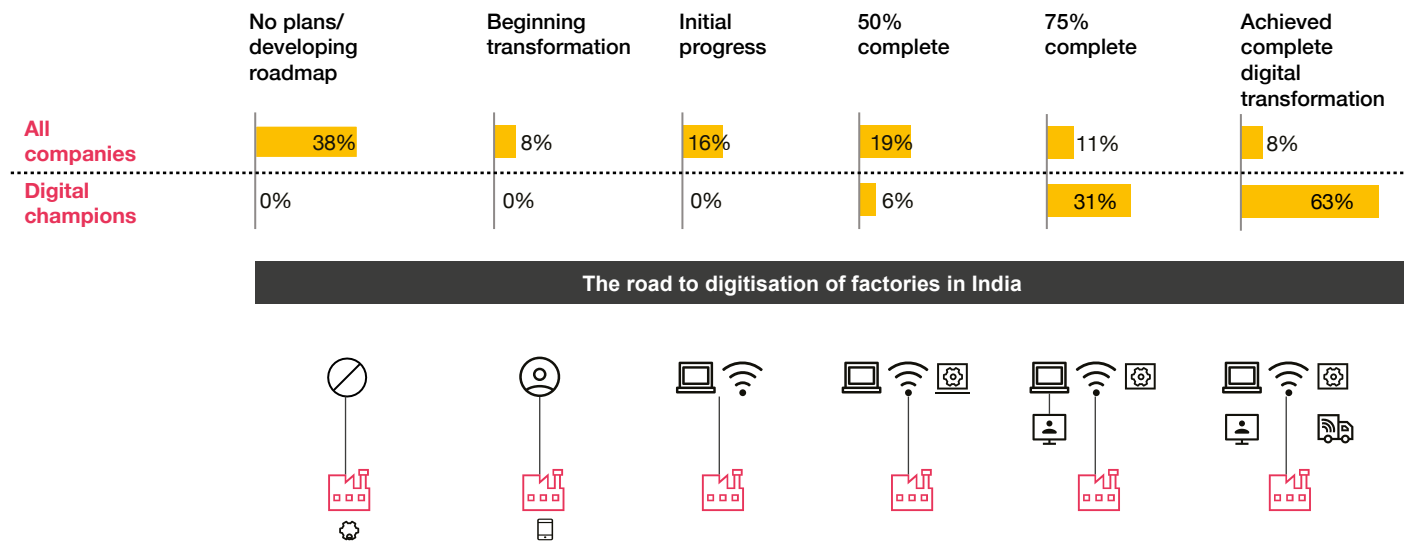
3

Digital adoption trends

Digital transformation is essential for future-proofing organisations and enhancing business outcomes. Statistics in the following figure indicate that India is still at a nascent stage in its digital transformation journey. 38% of the Indian companies which had participated in the survey revealed that they do not have any plans to adopt digital technology for their businesses.

Figure 5: Current scenario of digital transformation of Indian manufacturing industry

	No plans/ developing roadmap	Beginning transformation	Initial progress	50% complete	75% complete	Achieved complete digital transformation
All companies	38%	8%	16%	19%	11%	8%
Digital champions	0%	0%	0%	6%	31%	63%

The road to digitisation of factories in India

Source: PwC Digital Factory Transformation Survey 2023

There is a shift from the traditional approach as manufacturing companies in India are adopting the agile method to implement digital technology. To adopt digital technology, organisations require:

1 a commitment from the leadership team

2 adequate budgets to implement digital technologies

3 developing the organisational mindset and skills to adopt new ways of working.

It is the responsibility of the C-suite to align the roadmap of adopting digital technologies to the organisation's long-term vision. Therefore, developing a strategy with a well-thought execution plan can become an enabler for embracing digital transformation and reaping its benefits.

'Be world class. Shape the future.'

To fuel our next exponential growth wave, Aarti industries has laid the foundation for Aarti 4.0 transformation with the theme 'Be world class. Shape the future' with a focus on sustainability, prosperity, well-being of the people, and enhance the stakeholders' satisfaction.

Through its aspirational digital transformation programme UNNATI, Aarti Industries has initiated the journey to be a data-driven organisation by FY25. Through manufacturing digital twin and organisation analytics initiatives the organisation aims to:

- enable every key decision-maker to take business decisions based on data-driven insights in areas of operational excellence, quality control, product development and safety monitoring.
- improve employee productivity, yield and energy efficiency of their operations.
- identify inefficiencies in their processes and suggest ways to improve them through actionable insights.

To ensure the success of the endeavour, we have established an analytics Center of Excellence co-created by our information systems vertical and digital business champions, invested in state-of-the-art digital platforms, and established a cross functional transformation office to drive seamless adoption of technology.

Bhavesh Gandhi
Senior Vice President and Chief Digital and Information Officer,
Aarti Industries Limited

The four key pillars which are driving digital transformation in the Indian manufacturing sector have been discussed below.

Figure 6: Key drivers of digital factory transformation (India and global)
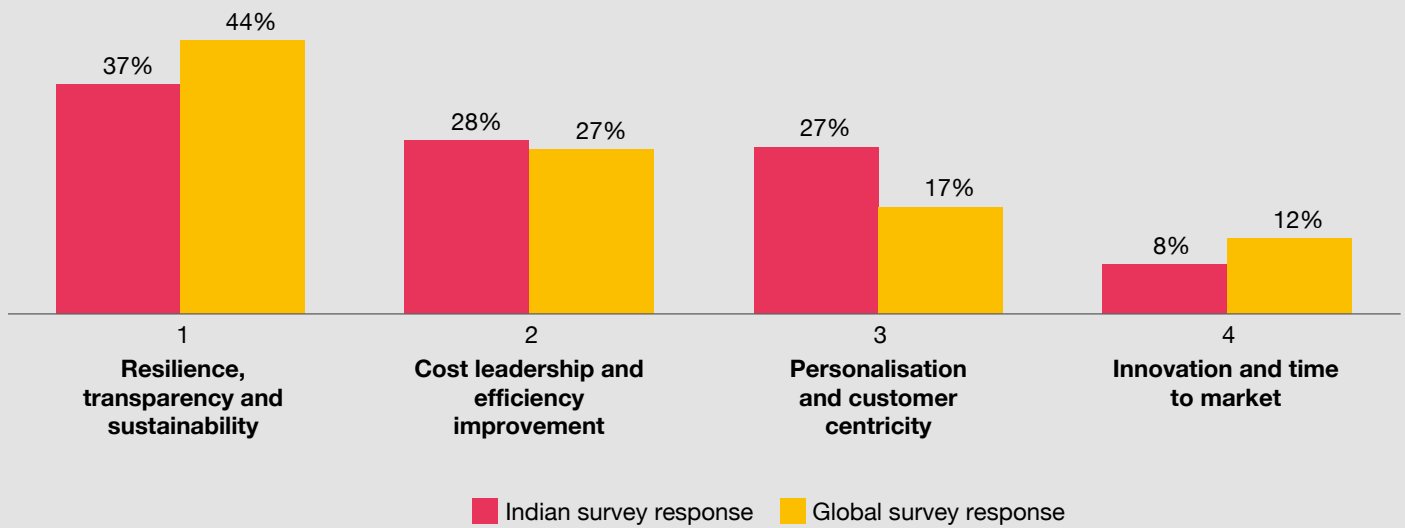
Source: PwC Digital Factory Transformation Survey 2023

1. Resilience, transparency and sustainability

End-to-end visibility of the manufacturing processes in the shop floor (transparency), ability to course correct the operations plan based on multiple disruptions from supply and demand sides (resilience) and capturing the GHG emissions, carbon footprint and circularity (sustainability) has become critical drivers of the digital transformation of factories.

2. Cost leadership and efficiency improvement

Automation of shop floor processes, data-driven decision-making for asset maintenance, sensor-driven feedback loops for yield improvement are some examples of efficiency improvement and cost leadership which would drive the digital transformation of factories.

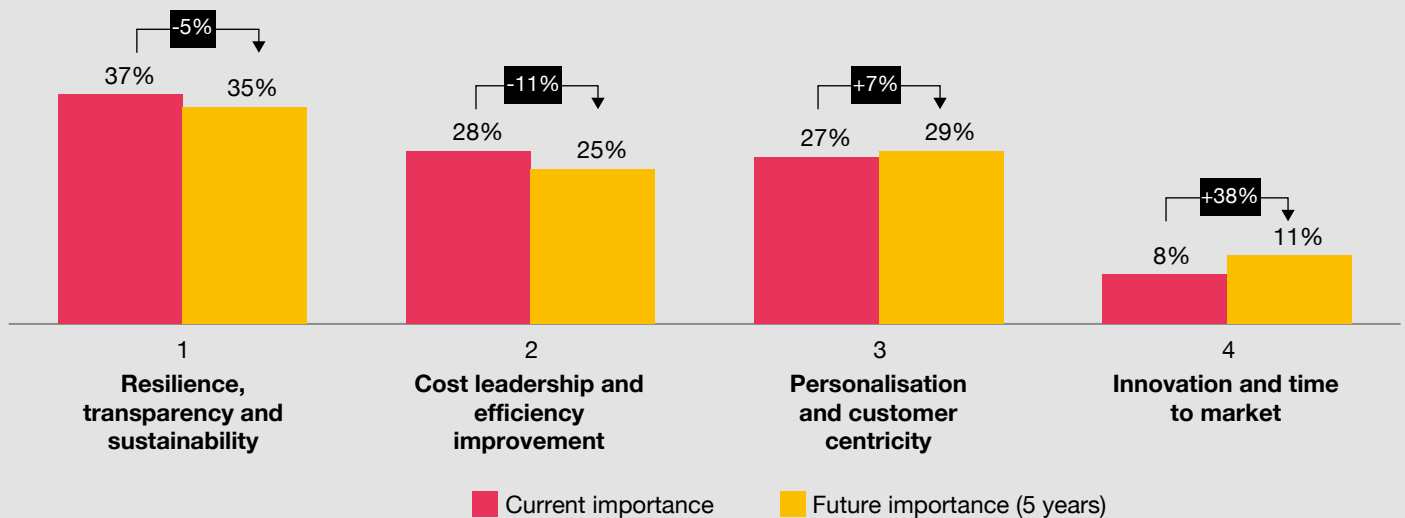### 3. Personalisation and customer-centricity

Close to one-fifth of the global and Indian companies have highlighted personalisation and customer-centricity as crucial factors for digital transformation.

Several large and mid-scale industries are looking for ways to have mass-customised products which can help them sell their offerings at a premium price, increase brand awareness among customers, build customer loyalty, and have a distinct advantage over competitors. Several technologies are available to help manufacturers achieve these objectives ranging from robotics to additive manufacturing and PLM solutions.

4. Innovation and time to market (TTM)

For many of the respondents, innovation and TTM are also important factors to drive growth and maintain the status of their product line. Developing a balanced innovation strategy requires finding the right mix of investment in innovation across products and services, business models, technology and processes, customer experience, and supply chain. The dynamic nature of the manufacturing sector, emergence of new technologies and implementation of Industry 4.0 will push manufacturers to innovate, stay relevant and have a competitive edge in the market.

Figure 7: Current and future drivers of digital transformation in factories

Legend: Current importance ■ (pink), Future importance (5 years) ■ (yellow)

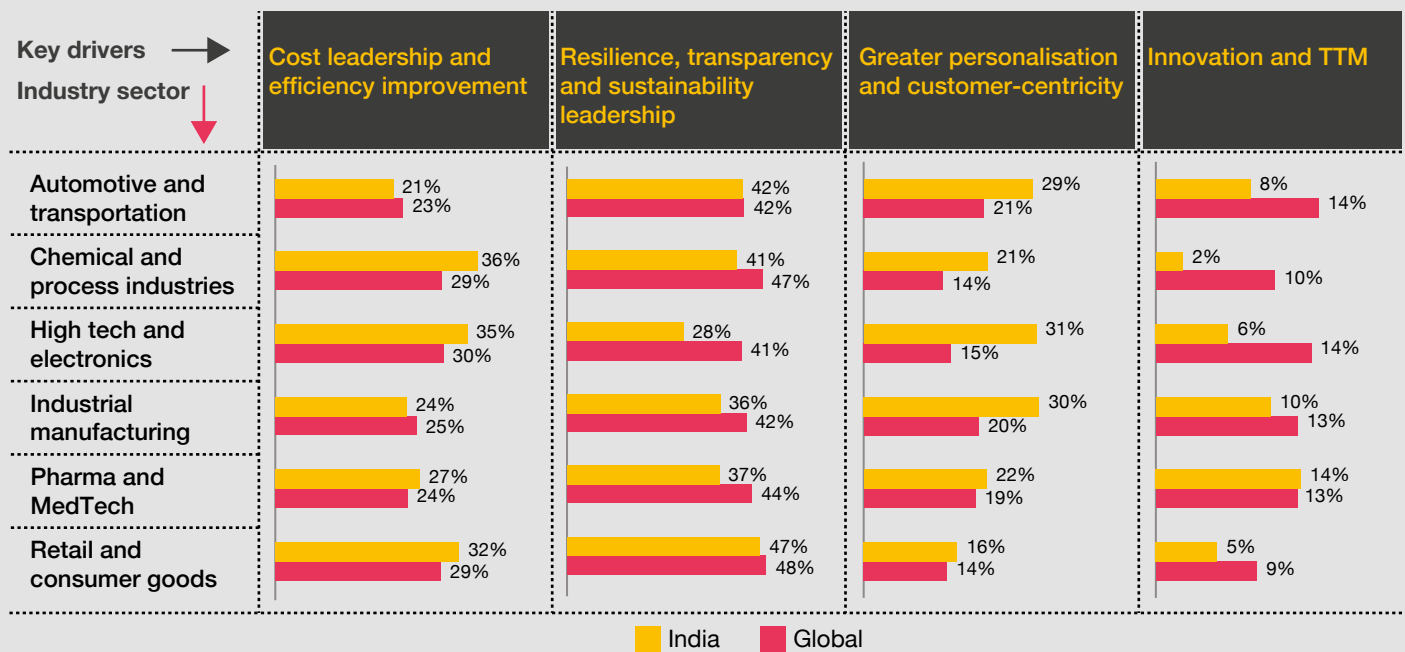| Driver	Current importance	Change	Future importance (5 years)
1 Resilience, transparency and sustainability	37%	-5%	35%
2 Cost leadership and efficiency improvement	28%	-11%	25%
3 Personalisation and customer centricity	27%	+7%	29%
4 Innovation and time to market	8%	+38%	11%

Change % = (Future importance% – Current importance%)/ Current importance%

Source: PwC Digital Factory Transformation Survey 2023

The survey shows that innovation rate and TTM strategy is gaining significant prominence with an expected growth of 38%, while the cost leadership and efficiency improvement approach is declining with an expected drop of 11%.
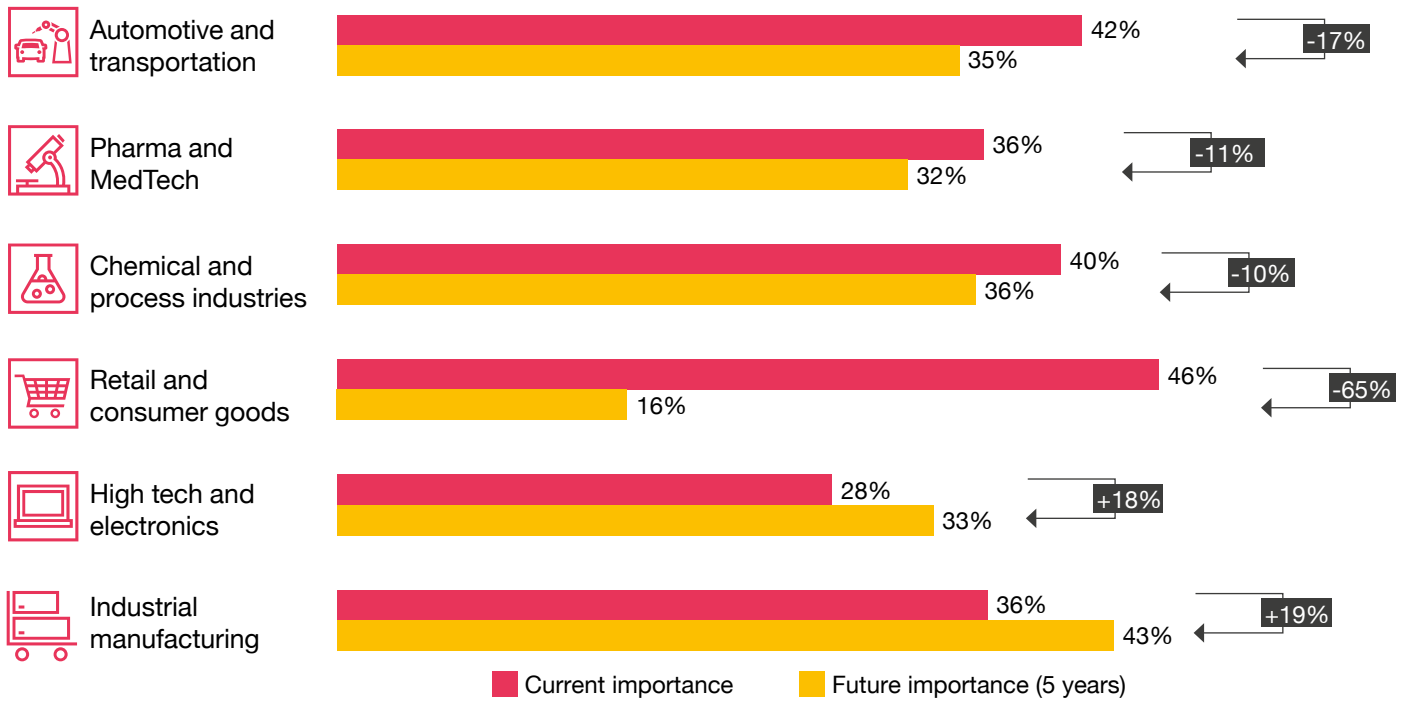
Figure 8: Improved innovation rate and TTM

Key drivers / Industry sector	Cost leadership and efficiency improvement		Resilience, transparency and sustainability leadership		Greater personalisation and customer-centricity		Innovation and TTM	
	India	Global	India	Global	India	Global	India	Global
Automotive and transportation	21%	23%	42%	42%	29%	21%	8%	14%
Chemical and process industries	36%	29%	41%	47%	21%	14%	2%	10%
High tech and electronics	35%	30%	28%	41%	31%	15%	6%	14%
Industrial manufacturing	24%	25%	36%	42%	30%	20%	10%	13%
Pharma and MedTech	27%	24%	37%	44%	22%	19%	14%	13%
Retail and consumer goods	32%	29%	47%	48%	16%	14%	5%	9%

Legend: India ■ (yellow), Global ■ (pink)

Source: PwC Digital Factory Transformation Survey 2023

Digital champions from India across the six sectors believe that being resilient, transparent and sustainable will prepare them for future growth. However, they must also note that Innovation and TTM will help them to stay relevant in the competitive landscape in the coming days.

Figure 9: Prominent sectors which consider resilience, transparency and sustainability as the key drivers

Sector	Current importance	Future importance (5 years)	Change
Automotive and transportation	42%	35%	-17%
Pharma and MedTech	36%	32%	-11%
Chemical and process industries	40%	36%	-10%
Retail and consumer goods	46%	16%	-65%
High tech and electronics	28%	33%	+18%
Industrial manufacturing	36%	43%	+19%

■ Current importance   ■ Future importance (5 years)

Change % = (Future Importance% – Current Importance%)/ Current Importance%

Source: PwC Digital Factory Transformation Survey 2023

Though resilience, transparency and sustainability are critical for sectors like automotive and transportation, retail and consumer goods, and chemical and process industries, it is also gaining importance in sectors such as industrial manufacturing and high tech in the future.
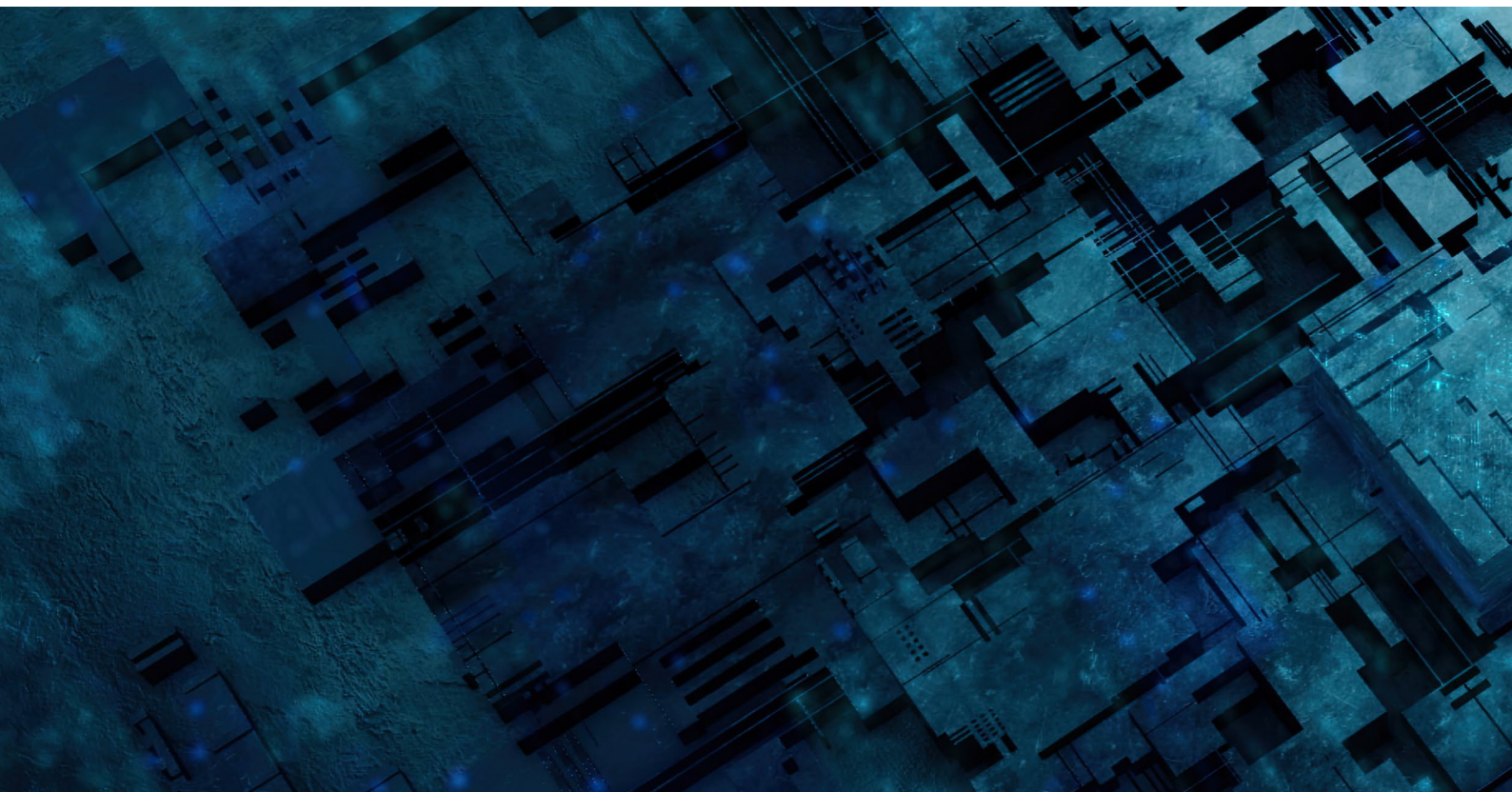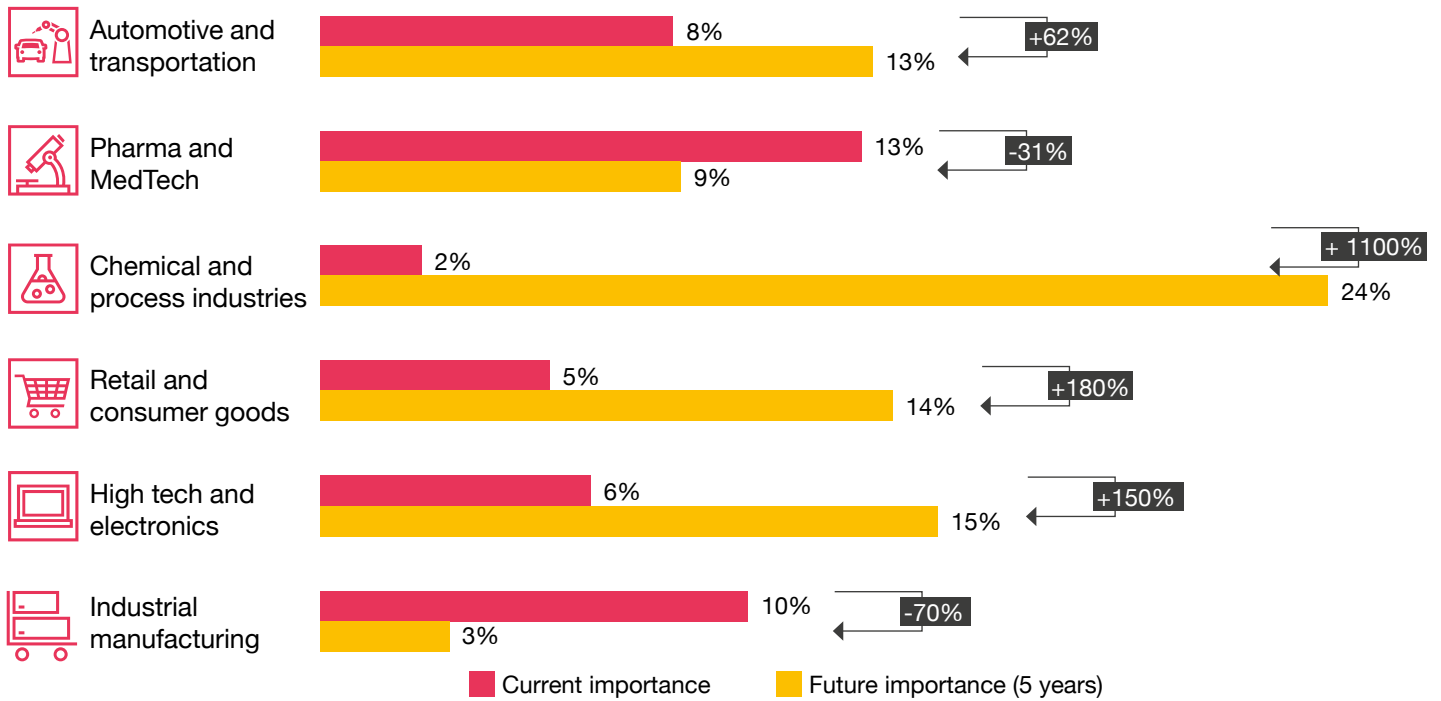
Figure 10: Prominent sectors which consider Innovation and TTM as the key drivers

Automotive and transportation
- Current: 8%
- Future: 13%
- Change: +62%

Pharma and MedTech
- Current: 13%
- Future: 9%
- Change: -31%

Chemical and process industries
- Current: 2%
- Future: 24%
- Change: + 1100%

Retail and consumer goods
- Current: 5%
- Future: 14%
- Change: +180%

High tech and electronics
- Current: 6%
- Future: 15%
- Change: +150%

Industrial manufacturing
- Current: 10%
- Future: 3%
- Change: -70%

Legend: Current importance | Future importance (5 years)

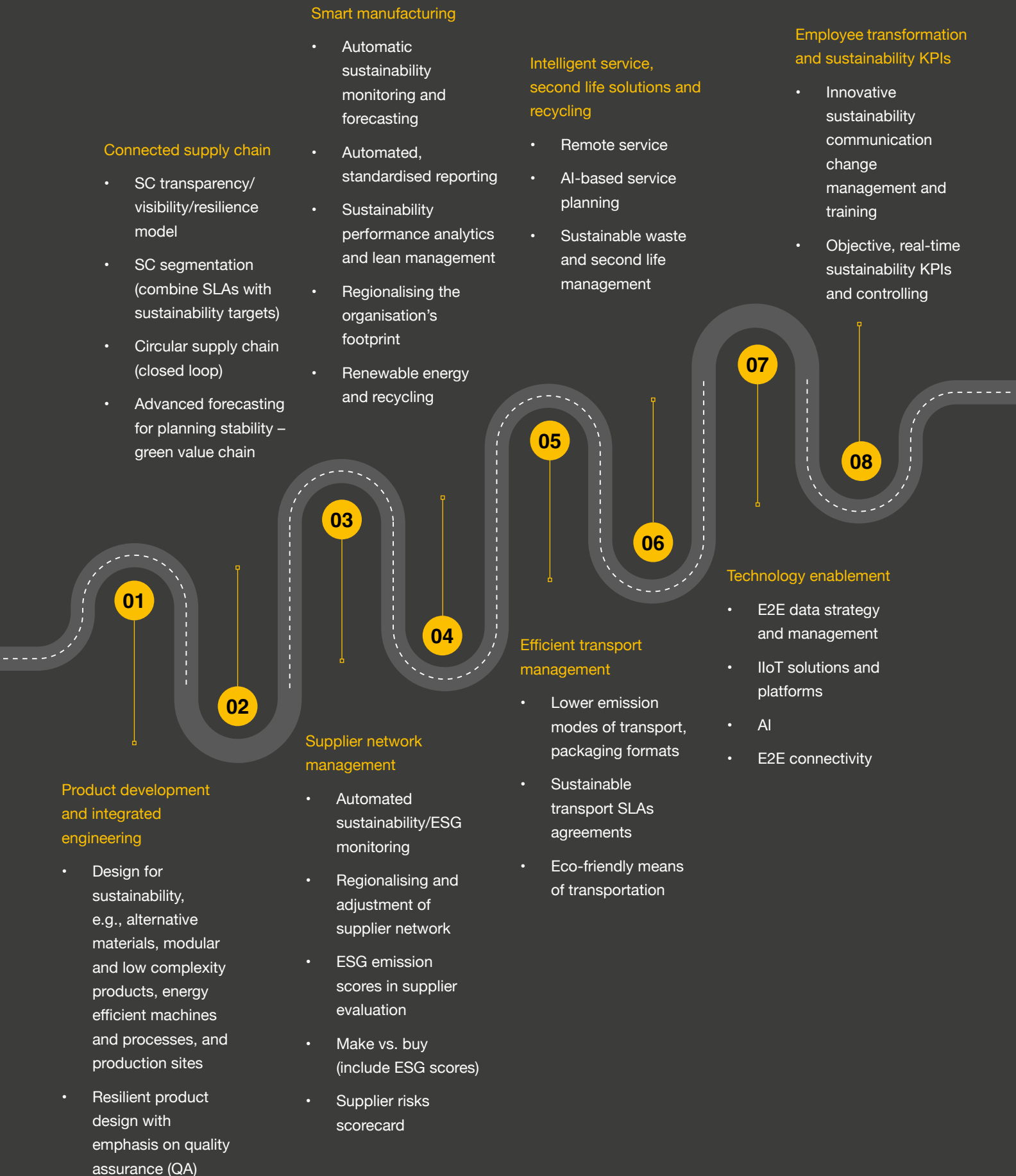Change % = (Future Importance% – Current Importance%)/ Current Importance%

Source: PwC Digital Factory Transformation Survey 2023

While innovation and faster TTM have been critical for sectors like pharmaceuticals, automobiles and industrial manufacturing, the importance of innovation is increasing in sectors like chemical and process industries who are moving towards manufacturing specialised products.

Given below are the key steps to enable digitalisation in an organisation.

## Figure 11: Key aspects for enabling digitalisation

Smart manufacturing

- Automatic sustainability monitoring and forecasting
- Automated, standardised reporting
- Sustainability performance analytics and lean management
- Regionalising the organisation's footprint
- Renewable energy and recycling

Intelligent service, second life solutions and recycling

- Remote service
- AI-based service planning
- Sustainable waste and second life management

Employee transformation and sustainability KPIs

- Innovative sustainability communication change management and training
- Objective, real-time sustainability KPIs and controlling

Connected supply chain

- SC transparency/ visibility/resilience model
- SC segmentation (combine SLAs with sustainability targets)
- Circular supply chain (closed loop)
- Advanced forecasting for planning stability – green value chain

07

08

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02

Technology enablement

- E2E data strategy and management
- IIoT solutions and platforms
- AI
- E2E connectivity

Efficient transport management

- Lower emission modes of transport, packaging formats
- Sustainable transport SLAs agreements
- Eco-friendly means of transportation

Supplier network management

- Automated sustainability/ESG monitoring
- Regionalising and adjustment of supplier network
- ESG emission scores in supplier evaluation
- Make vs. buy (include ESG scores)
- Supplier risks scorecard

Product development and integrated engineering

- Design for sustainability, e.g., alternative materials, modular and low complexity products, energy efficient machines and processes, and production sites
- Resilient product design with emphasis on quality assurance (QA)

Source: PwC Digital Factory Transformation Survey 2023

Case study 1

Digital transformation of a manufacturing organisation

A global leader in manufacturing process plant equipment partnered with PwC India to embark on a journey to design and roll out a digital transformation programme that would enable the organisation to achieve its future vision by being more efficient in terms of cost, processes and workforce. The digital transformation programme included manufacturing, supply chain, research and development, and quality management processes. The IT strategy delivered by PwC specialists was aligned with the business strategy and growth plan of the company for the next five years.
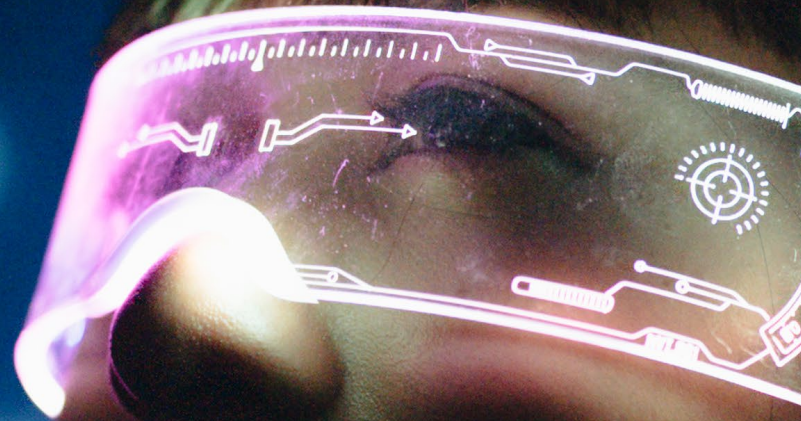
4

Building the digital backbone of an organisation

Developing the digital backbone of an organisation is integral for its digital transformation journey. Businesses can use digital technologies for quality assurance, maintenance, monitoring, and for developing digital twins. Although the survey shows that there is no 'one size fits all' strategy for transformation, certain systems, use cases and technologies, including quality analytics, drones and 5G applications, tend to deliver faster payback, within as little as one year for some companies.

Figure 12: Developing the digital backbone of a company (Global)

	All companies (Global)	Digital champions (Global)
One standardised solution across all plants	32%	33%
One standardised solution with different functionalities/modules	43%	43%
Several solutions	25%	24%
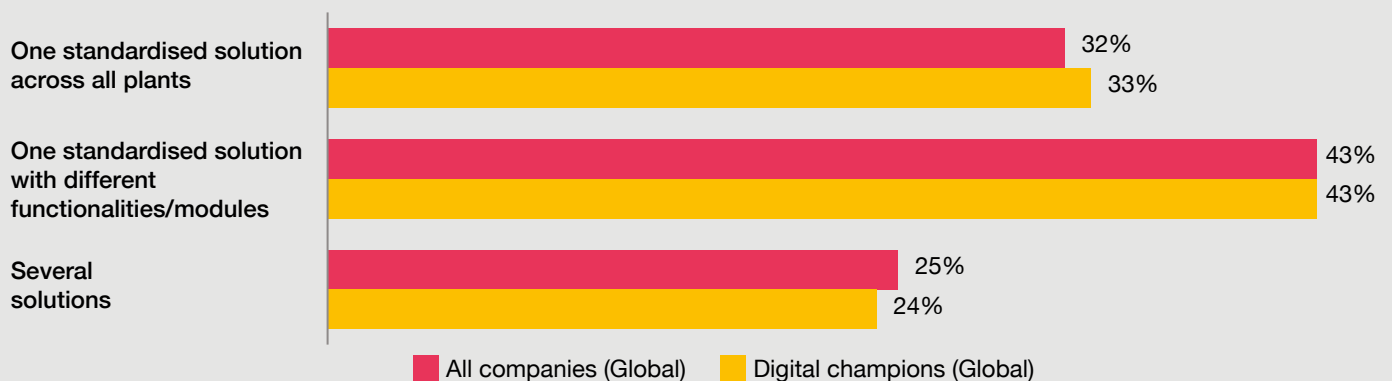
Source: PwC Digital Factory Transformation Survey 2023

Figure 13: Developing the digital backbone of a company (India)

Current trends

A standardised solution across all plants	All companies: 51%	Digital champions: 78%
A standardised solution with different functionalities/modules	All companies: 31%	Digital champions: 16%
Several solutions	All companies: 12%	Digital champions: 6%
No solution	All companies: 6%	

Future trends

A standardised solution across all plants	All companies: 22%	Digital champions: 12%
A standardised solution with different functionalities/modules	All companies: 31%	Digital champions: 69%
Several solutions	All companies: 43%	Digital champions: 19%
No solution	All companies: 4%	

■ All companies   ■ Digital champions

Source: PwC Digital Factory Transformation Survey 2023

Indian manufacturing companies prefer to adopt a standardised digital solution across plants compared to global companies which prefer standardised digital solutions with different functionalities or modules. 78% of digital champions currently in India prefer to have a standardised solution across their plants. An example of this is the preparation of a business case-based solution for an organisation's product portfolio. In the next five years, however, India is expected to witness a significant shift in the approach. From adopting a standardised solution across a plant, 69% of digital champions prefer a standardised solution with different functions and modules. An example of this can be one pricing module for products in different markets. The shift towards adopting modularised solutions could indicate the realisation of Indian manufacturers to have several platforms that are fit-for-purpose for the various needs of individual plants to cope with the increasing operational complexities and requirements of the respective companies. Companies are using digital twins to understand the individual needs of their operations, for example, plant 1 would use digital twin to simulate design engineering while plant 2 would use it to virtually simulate shopfloor layout for expansion projects. In this manner, individual needs of the various plants or aspects of an organisation can be catered to using digital twin technology.

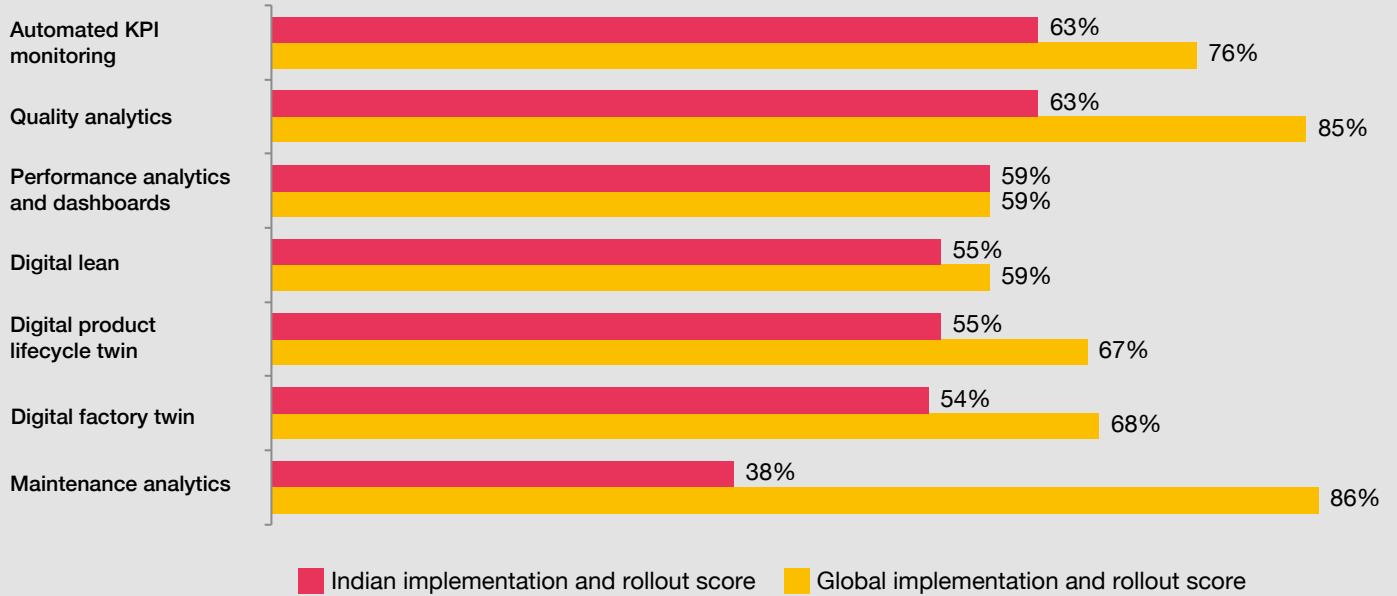## Figure 14: Implementation score of IT solutions (India and global)
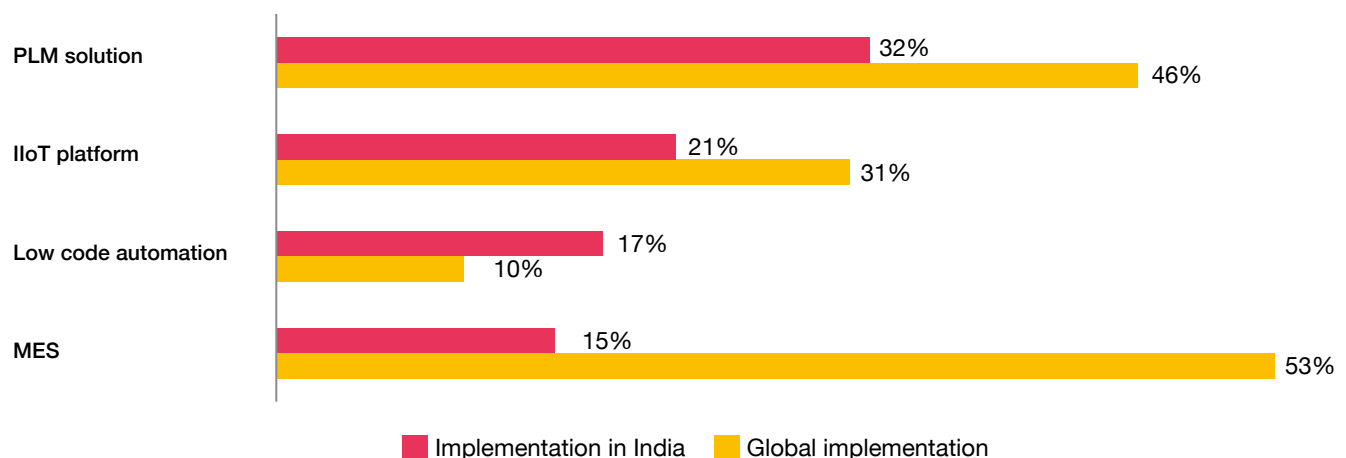
	Implementation in India	Global implementation
PLM solution	32%	46%
IIoT platform	21%	31%
Low code automation	17%	10%
MES	15%	53%

■ Implementation in India   ■ Global implementation

Industry-wise IT solution implementation	Industrial manufacturing	High-tech and electronics	Pharma and MedTech	Chemical and process industries	Automotive and transportation	Retail and consumer goods
Indian	24%	26%	18%	18%	25%	18%
Global	40%	33%	35%	38%	29%	33%

Source: PwC Digital Factory Transformation Survey 2023

The survey asked companies about the current state of their digital backbone implementations. While Indian manufacturers are at an early stage of implementation of digital technology, they are trying to catch up with the global companies. 32% of the Indian champions are opting for PLM compared to 46% of global champions, whereas 21% of the Indian champions are opting for IIoT compared to 31% of global champions. Low code automation is gaining importance in Indian champions as compared to their global counterparts.

Figure 15: Implementation score for selected use cases (India and global)

Use case	Indian implementation and rollout score	Global implementation and rollout score
Automated KPI monitoring	63%	76%
Quality analytics	63%	85%
Performance analytics and dashboards	59%	59%
Digital lean	55%	59%
Digital product lifecycle twin	55%	67%
Digital factory twin	54%	68%
Maintenance analytics	38%	86%

Source: PwC Digital Factory Transformation Survey 2023

Analytics is an important factor for the success of digital implementation in global and Indian organisations. The survey reveals that automated KPI monitoring and quality analytics are important for Indian as well as global organisations. More than 60% of the champions have either implemented it or are in the process of doing so.

Operational analytics has become critical for businesses. Understanding the organisational readiness to implement analytics through data discovery, pattern analysis, and tracking key metrics is the first step of their analytical journey. Manufacturing companies have shown a great adoption rate in this area. There is a gradual shift in preference from adopting descriptive analytics to predictive analytics. Organisations are trying to minimise the effects of future uncertainties and disruptions by leveraging data-driven insights. Technologies like digital twin help users replicate the current state and simulate all possible disruptions around customer behaviour, supply shocks, bottlenecks around logistics and unplanned availability of personnel or machines on the shop floor. This helps them to identify vulnerabilities and obstructions, and plan for redundancies in operations and supply chain without a significant increase in the cost. More than 50% of champions have adopted the digital product lifecycle twin and digital twin use cases.

Figure 16: Implementation score for selected technologies (India and global)
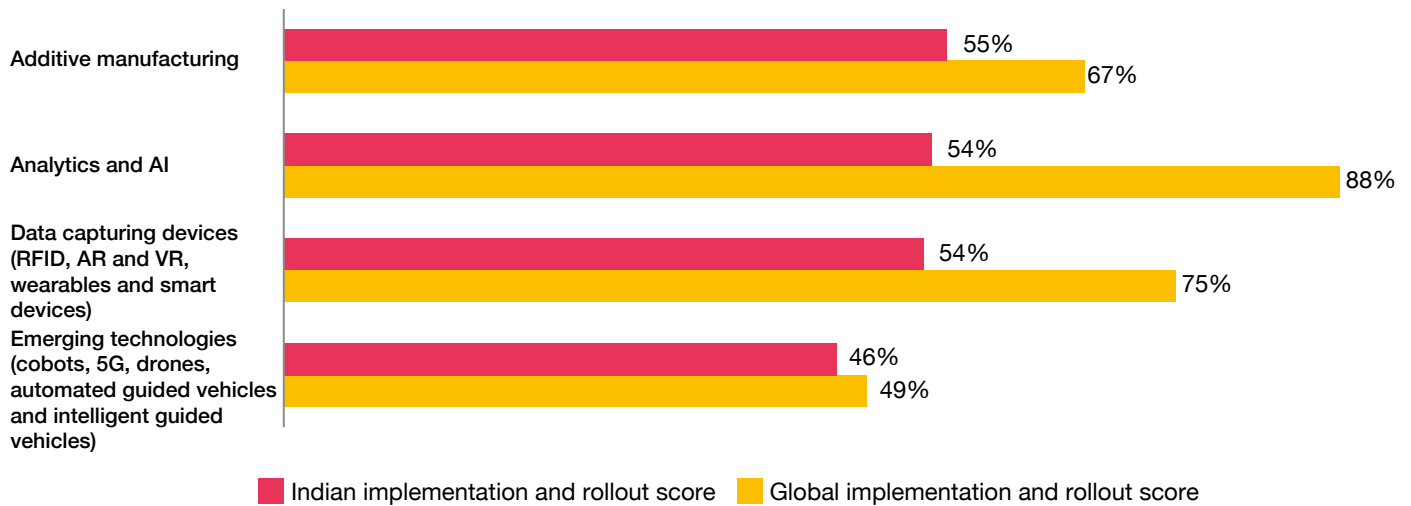
| Indian implementation and rollout score | Global implementation and rollout score |

Additive manufacturing: Indian 55%, Global 67%
Analytics and AI: Indian 54%, Global 88%
Data capturing devices (RFID, AR and VR, wearables and smart devices): Indian 54%, Global 75%
Emerging technologies (cobots, 5G, drones, automated guided vehicles and intelligent guided vehicles): Indian 46%, Global 49%

Industry-wise IT solution implementation	Industrial manufacturing	High-tech and electronics	Pharma and MedTech	Chemical and process industries	Automotive and transportation	Retail and consumer goods
Indian	53%	58%	48%	50%	56%	51%
Global	74%	72%	72%	73%	67%	61%

Source: PwC Digital Factory Transformation Survey 2023

The technology adoption rate in India is promising. According to the survey, more than 50% of the Indian digital champions have implemented technology across industries. Global champions are showing a similar trend with a penetration level of more than 60%. In India, additive manufacturing industries is where technology has been adopted the most with an adoption rate of around 55%. Global champions are majorly focusing on analytics and AI, with an implementation score of around 88%.

The adoption of smart devices, wearables, radio frequency identification (RFID) and AR/VR can enable organisations to capture large volumes of data. Once the data has been collected, the next step is to develop analytics capabilities with the help of AI and other emerging technologies to access insights from the data. At present, Indian companies are showing an upward trend towards adopting analytics and AI with a current implementation rate of 54%.
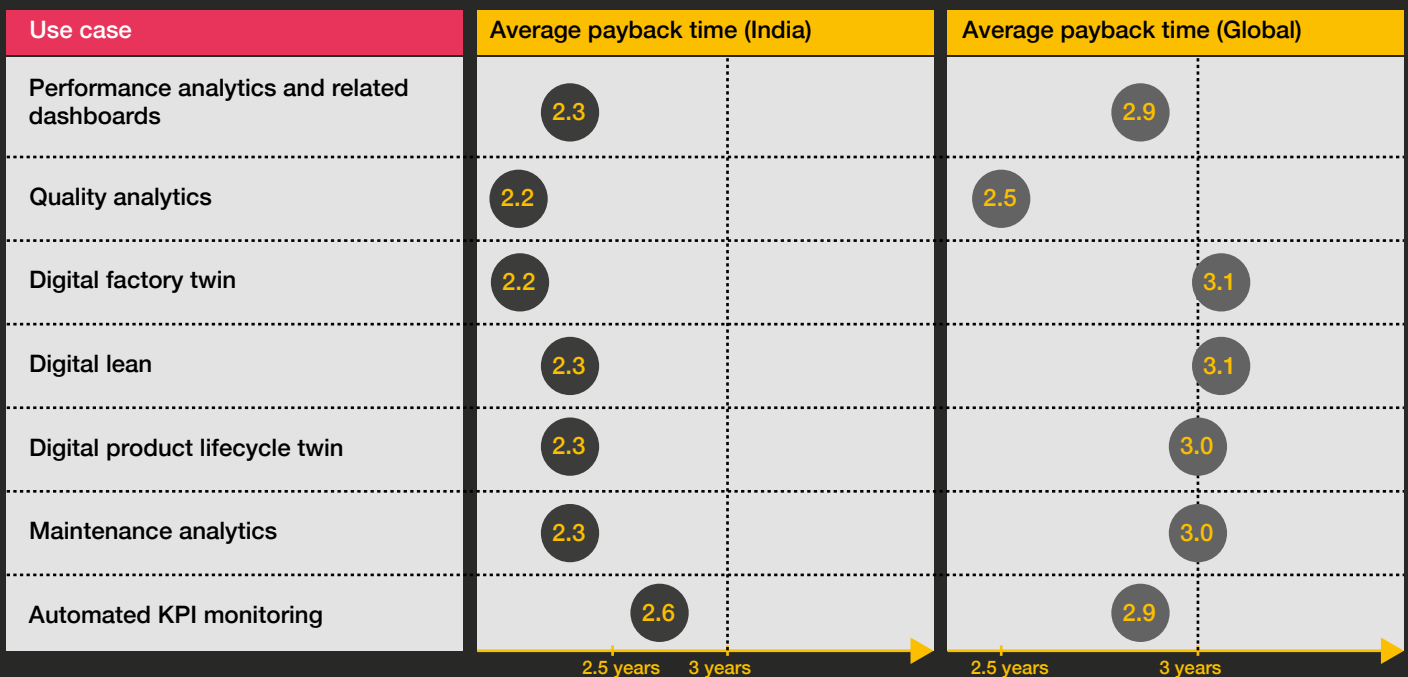
Case study 2

Revolutionising the operations of a manufacturing major by implementing a holistic digital strategy

A leading manufacturer approached PwC India to devise a strategy for its plant and machine connectivity, data storage, and analytics. The company, which used a mix of old and modern technology, had varying degrees of automation, disjointed monitoring, and limited visibility on operations. PwC India helped the organisation to finalise the software/tools needed for implementation by designing strategies for manufacturing analytics, IoT platforms, video analytics, and data integration. The project included strategy and architecture design, comparison and evaluation of eligible platforms, and final selection of the platform with features such as process schematics, advanced analytics, self-service reporting, scalability, agility and availability. The outcome of the project was a strategy for control system connectivity in the manufacturing shop floor, implementation roadmap for an IoT platform and a plan for building a data lake, enterprise application integration, visualisation, and analytics.
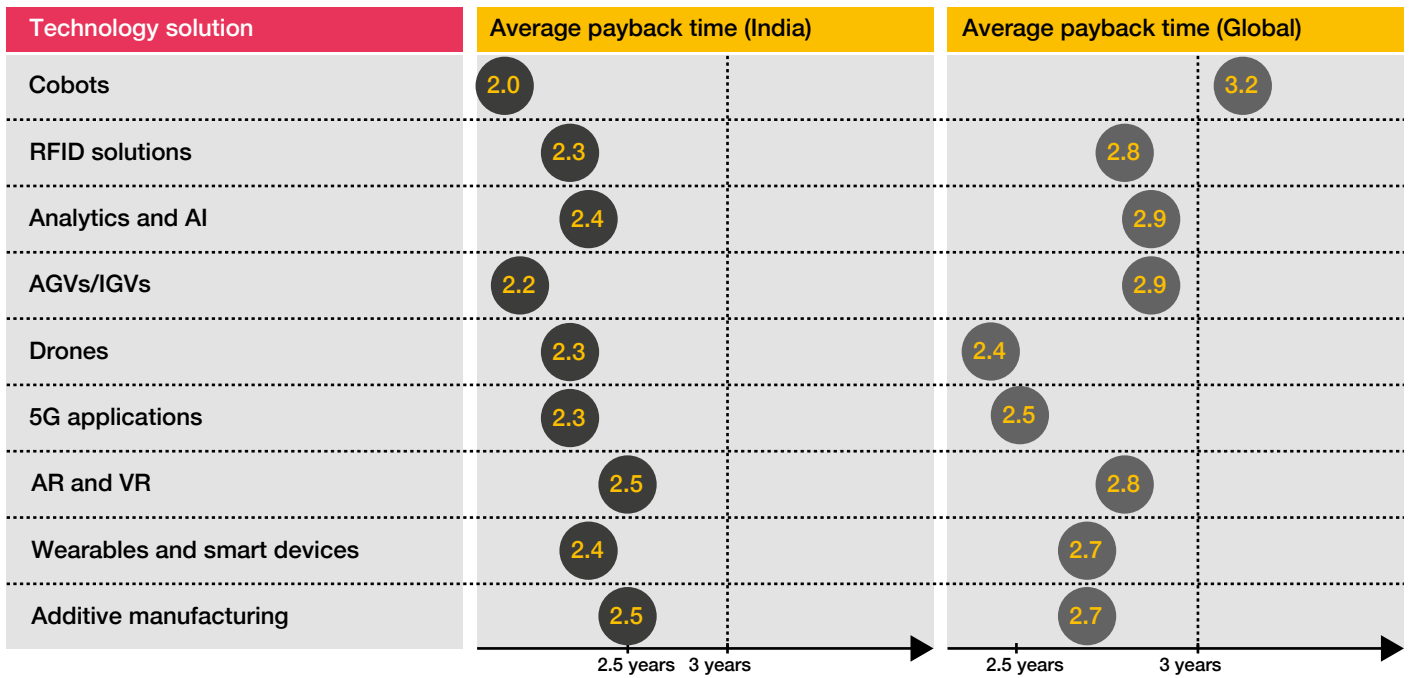
5

Payback period and investment of digital technologies

Figure 17: Payback periods for selected use cases (India and global)

Use case	Average payback time (India)	Average payback time (Global)
Performance analytics and related dashboards	2.3	2.9
Quality analytics	2.2	2.5
Digital factory twin	2.2	3.1
Digital lean	2.3	3.1
Digital product lifecycle twin	2.3	3.0
Maintenance analytics	2.3	3.0
Automated KPI monitoring	2.6	2.9
	2.5 years 3 years	2.5 years 3 years

Source: PwC Digital Factory Transformation Survey 2023

Figure 18: Payback periods for selected technology deployments (India and global)

Technology solution	Average payback time (India)	Average payback time (Global)
Cobots	2.0	3.2
RFID solutions	2.3	2.8
Analytics and AI	2.4	2.9
AGVs/IGVs	2.2	2.9
Drones	2.3	2.4
5G applications	2.3	2.5
AR and VR	2.5	2.8
Wearables and smart devices	2.4	2.7
Additive manufacturing	2.5	2.7
	2.5 years 3 years	2.5 years 3 years

Source: PwC Digital Factory Transformation Survey 2023

The payback period is an effective measure of investment risk. According to the survey, quality analytics has the shortest payback period, around 2.2 years, for both global and Indian companies. This can be attributed to the greater adoption rate of quality analytics across the globe. The average payback period for technology deployment use cases is less than three years.

A shorter payback period encourages organisations to invest in technology solutions. Strategic data-driven investments can help make improvements across the value chain.[1] These include building new capabilities, uncovering efficiency gains and incorporating new technologies like digital twins of the supply chain and business processes, AI-enabled demand sensing, intelligent and integrated planning, and forecasting solutions. Though the primary objective of tech investments is to drive growth at a faster speed and reduce operational cost, the underlying objective is to ensure that the investments yield results.

1 https://www.pwc.in/industries/industrial-products.html

Figure 19: Digital transformation investment rate vs. returns

High return: 13% (Companies who invest up to 2%), 21% (Companies who invest 3% or more), +62%
Moderate return: 58%, 56%, -3%
Low return: 27%, 21%, -22%
No/negligible return: 2%, 2%, 0%

■ Companies who invest up to 2% of their net revenue   ■ Companies who invest 3% or more of their net revenue
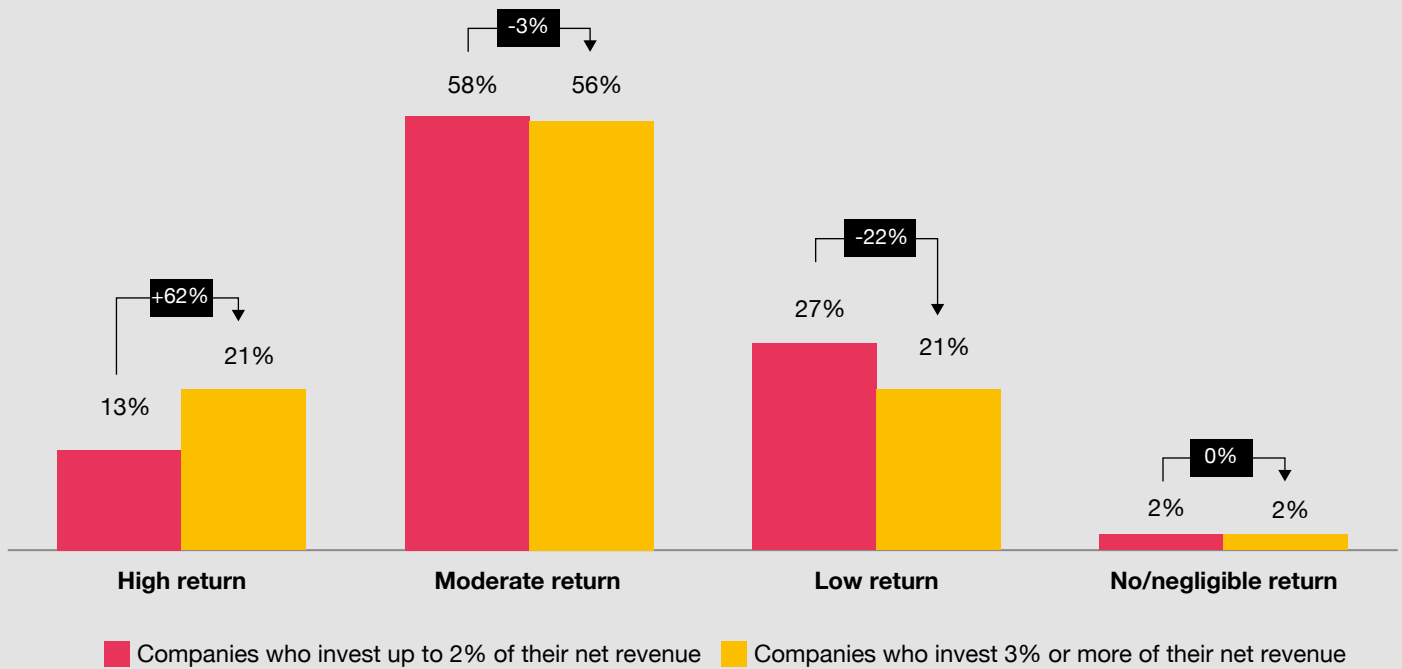
Source: PwC Digital Factory Transformation Survey 2023

Companies in India that invested at least 3% of their entire revenue in digital transformation had a higher proportion of high returns than those who invested 2% or less of their revenue. However, most companies have seen moderate to low returns irrespective of the investments due to a lack of alignment between their business strategy and digital transformation plan. Therefore, investing a major part of the revenue without a well-planned strategy is unlikely to yield high results.

Though investment in digital technology remains a challenge, lack of planning for aligning digital transformation with the organisation's objectives and implementing digital technology remains a greater problem. Collaborating with the right team can devise a custom digital transformation strategy which is suitable for the organisation and working with the right enablers in implementing the strategy is important to increase the ROI. Organisations also need to determine aspects of tangible returns apart from the financial outcomes to ensure that implementing digital technology has a holistic, long term and sustainable impact on the business.

6

Organisational set up for digital transformation

Organisational support is essential for the successful adoption of digital transformation in any sector. Indian digital champions focus more on the right mindset and organisational set up while global champions give importance to standardised systems, clear strategy and choosing the right use case with maximum business value. Indian companies also tend to focus more on people, policies and mindset while global companies prefer to build up the right system for driving any transformation. However, it is important to consider these differences while driving the transformational journey.

Figure 20: Key success factors for a digital factory transformation (India and global)

Category	India	Global
The right organisational set-up and target operating model	18%	14%
Understanding of the business value of the digital use case	17%	21%
Digital mindset and skills	16%	7%
Standardised machine connectivity concept and approach	11%	19%
Clear strategy and roadmap	11%	14%
Sufficient funding to get started	11%	7%
Standardised digital factory transformation approach	7%	5%
Working cybersecurity strategy	7%	11%
Highest degree of freedom for plants and business units	2%	2%

Source: PwC Digital Factory Transformation Survey 2023

Figure 21: Key success factors for the digital transformation of a factory in India (Present vs future)

Category	Present	Future
The right organisational set-up and target operating model	18%	15%
Understanding of the business value of the digital use case	17%	13%
Digital mindset and skills	16%	10%
Standardised machine connectivity concept and approach	11%	12%
Clear strategy and roadmap	11%	12%
Sufficient funding to get started	11%	10%
Standardised digital factory transformation approach	7%	9%
Working cybersecurity strategy	7%	12%
Highest degree of freedom for plants and business units	2%	7%

Source: PwC Digital Factory Transformation Survey 2023

The results of the survey show that most effective transformations take place in the context of an agile operating model. A top-down, structured approach which clarifies the strategic intent combined with collaborative, empowered teams from a bottom up perspective has been the most effective way of adopting new technological solutions. This approach requires training and a dedicated transformation team working with agile frameworks such as SCRUM and scaled agile framework (SAFe), plus an interdisciplinary team set-up of business users, developers, and IT operations experts (BizDevOps) to enable continuous value generation.

Cybersecurity is another aspect which is necessary for companies to ensure the security of the employees, customers, and assets from cyber threats. 11% of the global champions have cited cybersecurity to be an important aspect of their digital transformation journey. Indian companies are also paying attention to this aspect of digital transformation and in the next few years the focus on cybersecurity will increase significantly.
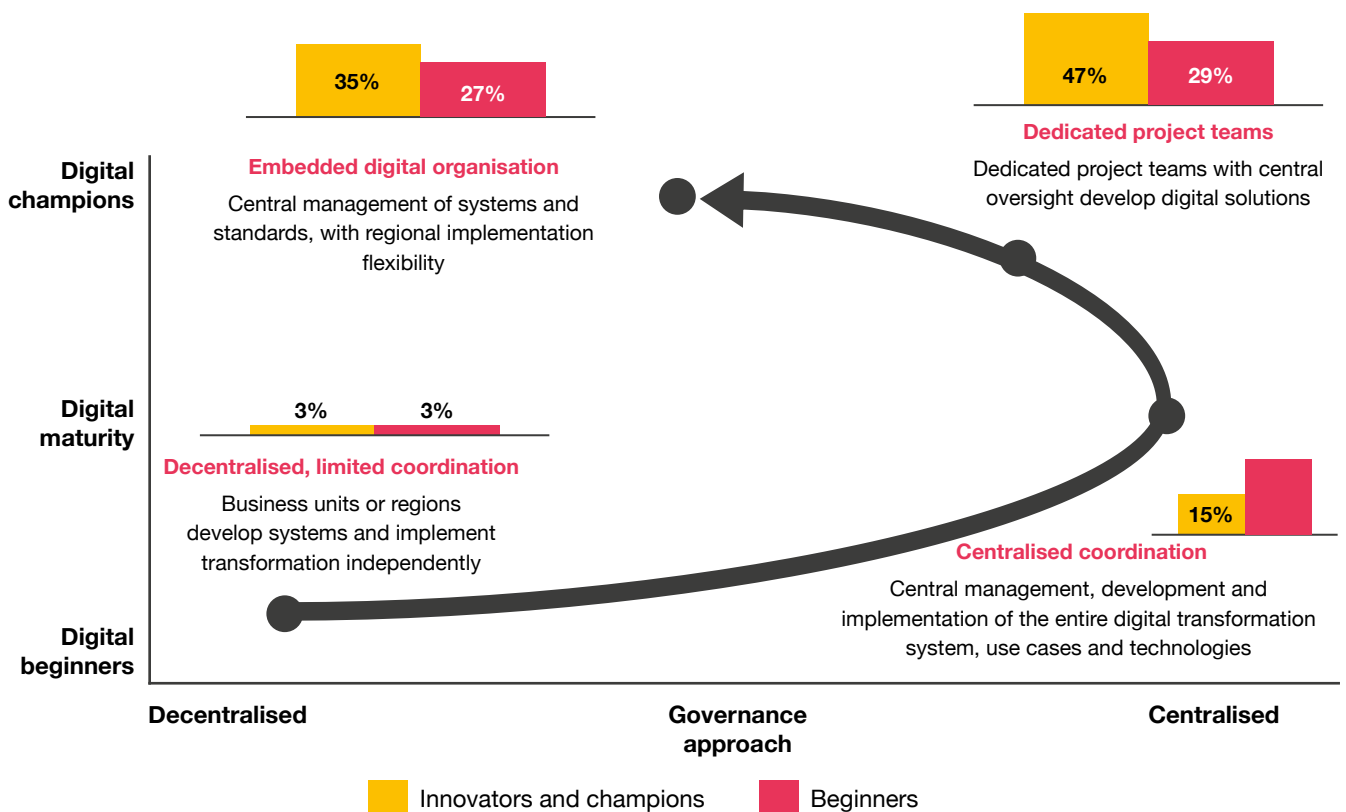
Figure 22: Digital capability build-up priorities for India (Dedicated project team)

Digital champions

25% 26%

Embedded digital organisation

Central management of systems and standards, with regional implementation flexibility

Dedicated project teams

41% 29%

Dedicated project teams with central oversight develop digital solutions

Digital maturity

13% 8%

Decentralised, limited coordination

Business units or regions develop systems and implement transformation independently

Centralised coordination

19% 29%

Central management, development and implementation of the entire digital transformation system, use cases and technologies

Digital beginners

Decentralised   **Governance approach**   **Centralised**

■ Innovators and champions   ■ Beginners

The figures are based on relevant responses.

Source: PwC Digital Factory Transformation Survey 2023

Figure 23: Digital capability build-up priorities for global (Embedded and centralised)

Digital champions

35% 27%

Embedded digital organisation

Central management of systems and standards, with regional implementation flexibility

Dedicated project teams

47% 29%

Dedicated project teams with central oversight develop digital solutions

Digital maturity

3% 3%

Decentralised, limited coordination

Business units or regions develop systems and implement transformation independently

Centralised coordination

15%

Central management, development and implementation of the entire digital transformation system, use cases and technologies

Digital beginners

Decentralised   **Governance approach**   **Centralised**

■ Innovators and champions   ■ Beginners

Source: PwC Digital Factory Transformation Survey 2023

PwC's Digital Factory Transformation Survey 2023 shows that most companies start their transformation journey with a centralised approach to digitalisation where almost 29% of Indian beginners centrally manage, develop and implement their digital systems, use cases and technologies. However, many companies quickly learn that rigid centralisation is not the optimal structure for an effective digital transformation for the diverse operations of the organisation. Nearly 80% of digital champions have moved away from centralised governance towards a more balanced model that stresses centralised determination of principles, standards and digital backbone development, with the implementation of use cases and technologies managed at a local level, while leveraging central resources for scale and speed. Less than 15% of the companies drive their digital transformation on a decentralised model with limited coordination. Most Indian companies prefer dedicated project teams with central oversight. An embedded organisation is one where everyone believes in the organisational principles and displays them consistently in their actions, behaviour and effort. Such organisations have a clear advantage as the adoption rate of digital transformations is higher. Even functions other than the core transformation team follow the guiding principles laid out by the central management. In this way, companies can leverage the full innovation power of their workforce while maintaining a necessary level of standardisation and harmonisation. This results in a fast, flexible and successful transition and adoption while avoiding unnecessary costs through standardisation and harmonisation.

One of the key observations of the PwC Digital Factory Transformation Survey is that successful digital transformation demands elements of centralised standard-setting to establish best practices and guidelines, accompanied by centralised teamwork for local implementation. Over-centralisation fails to leverage the potential knowledge within an organisation while a lack of centralisation undermines the opportunities to transform and scale at speed. In order to succeed in the dynamic world of the manufacturing sector, the digital backbone, standards and principles of an organisation should be developed, managed and orchestrated centrally, while individual solutions and factory-related implementations should be embedded in the business.

Case study 3

Implementing a smart factory programme for a manufacturing company

A manufacturing company, which is a global leader in heavy engineering and capital goods, collaborated with PwC India to implement a smart factory programme and to adopt Industry 4.0. The company faced inconsistent business processes, high defect rates, disjointed monitoring and control, and limited visibility of operations. PwC's team established a connected plant architecture, integrating machines across factories with an IoT platform, manufacturing KPIs, performance benchmarking, condition monitoring, and predictive breakdown. The program also included an ERP system integration and an integrated application architecture incorporating IoT platform components of a cloud platform. A global digital dashboard and governance model was implemented, along with a supplier portal, cross-docking, supplier evaluation automation, and packaging management. The outcome of the project included multiple plants integrated on a common IoT framework, a one-company-one-dashboard system covering production and supply chain, higher plant reliability and productivity, and improvements in key metrics such as overall equipment effectiveness (OEE), mean time to repair (MTTR), machine availability, scrap reduction, supplier performance and warehouse throughput. The project resulted in a significant increase in machine availability and a reduction in defect rates.

The road ahead[1]

Digital needs are specific for each company, based on their operational targets and organisational structure. Though there is no single model for success, companies should frame a transformation blueprint and answer key questions before committing to a digital transformation path. Companies that have mastered successful factory transformation have not only focused on adopting best-in-class technology solutions but have also taken significant steps in setting up an effective transformation organisation and governance team. They have also prioritised communication with their employees, provided adequate training and keep revisiting their upskilling and communication plans as they proceed through the various phases of implementation. Some of the key questions that an organisation should answer before they plan their digital transformation journey are:

- Why should the organisation embark on a transformation programme?

- What is the best way to evolve the organisational set-up to deliver factory transformation based on the company's digital maturity?

- How does the company identify the resource requirements for functional and IT positions, including how many people are to be employed and when they are needed at each stage of the transformation path?

- Is the optimal operational delivery model agile or waterfall? How should the company prioritise tasks in the delivery model?

- What is the most effective way to drive change in the company and keep communicating with key employees throughout the transformation process?

- How should the company develop a training and external hiring concept to deliver transformation?

- How can the company best support its workforce during the transformation process?

Apart from the questions above, companies should also consider the following points to develop their transformation strategy:

Digital strategy

Companies should be clear about their strategic targets and digital vision when it comes to the selection of use cases, applications and technologies. They should consider scalability right from the start, and map their dependence on underlying enabling services, resources and data requirements for likely use cases and technologies. Once use cases, technologies and applications are defined, a detailed business case should be developed to validate and potentially modify the transformation focus areas.

IT architecture design

The architecture archetype, or digital backbone, is the key to achieving targets. The underlying IT architecture is both a solution and a risk area where companies can potentially lose the capability to implement digital solutions at speed and scale. For some capabilities, like established MES solutions, the IT architecture decisions are relatively straightforward, however, for others like customised traceability solutions, performance analytics or digital twin applications, decision-making is more challenging because such applications are case-specific. Companies should also address shop floor connectivity. The sooner the questions about connectivity standards for business data and assets are addressed, the easier it is for organisations to implement their digital transformation strategy.

Strategies, technological requirements and detailing

Strategies and technological requirements should be selected based on critical business needs. Organisations should pre-select use cases and technologies that can be standardised and scaled up across multiple plants of a manufacturing company. They should also be able to prioritise which applications are essential and which are secondary. Digital requirements are not the only criteria for selecting use cases and technologies and supporting processes, employees' skillskets and end users' needs are also important factors while selecting digital technologies.

Vendor strategy

Companies should consider whether they should devise their own digital solutions or buy them from external service providers. For third-party solutions, it is important for organisations to determine whether an existing standard solution is sufficient, or whether a high level of customisation is required to make it fit-for-purpose before they engage with a third-party solutions provider. Although solution provider decisions tend to be simple calculations of requirement fulfilment versus total cost of ownership, system integration poses greater challenges and raises questions about matching current and future in-house capabilities and resources, and ways in which responsibilities and accountabilities will be managed. Companies may choose internal management for greater control or outsourcing it to a general systems contractor for clearer accountability.

Agile platform, system, use case and process development

During the development phase, the key question companies should consider is whether an agile delivery model is more suited to the organisation's needs or whether they can implement the traditional waterfall model. An agile delivery model is more beneficial when there is greater scope for in-house development and customisation. An agile model is a sprint-based system which works with templates and process blueprints and continues with coding and customisation, and allows constant feedback-based adjustments.
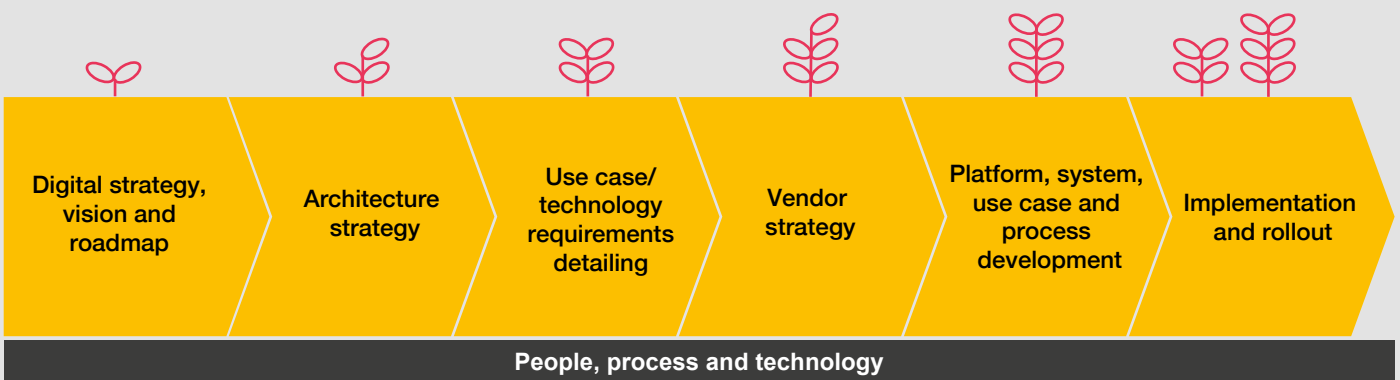
Implementation and rollout

Digital rollouts can either be executed in a step-by-step manner or in a single rollout. However, the speed of simultaneous rollout carries its own risks, and companies should conduct a risk-benefit assessment before they implement it. Successful scaling of solutions across factories is also critical. Based on a pilot plant implementation, key plants across regions or business units should be addressed in a second wave before a company-wide rollout. Each factory needs to decide whether a full implementation of all use cases is economically viable, or whether a partial or base version of factory intelligence is sufficient for some sites. Individual use case solutions should be kept to a minimum.

Organisation, people and change

Driving digital transformation collectively and ensuring its acceptance among employees is the most important task for decision-makers. Often, neglecting an active change management strategy is an underlying cause of slow or failed digital transformation programmes. According to the survey, digital champions spend a significant amount of resources on upskilling key personnel. They also have a well defined strategy of recruiting fresh talent in cases where certain capabilities cannot be developed in-house. Most digital champions establish a centralised team to implement the transformation strategy while allowing teams in different regions and business units to take the lead in implementing the strategy at their level.

Therefore, for a successful digital transformation strategy, organisations should consider the various aspects of their operations and select the best strategy based on their needs. Given below is a step-by-step process which can be adopted for a successful digital transformation of factories. Though organisational needs may vary, the framework given below can be customised and adopted to ensure a systematic implementation of the digital strategy of an organisation.

Figure 24: The route to digital transformation of factories

Digital strategy, vision and roadmap → Architecture strategy → Use case/technology requirements detailing → Vendor strategy → Platform, system, use case and process development → Implementation and rollout

People, process and technology

Source: PwC Digital Factory Transformation Survey 2023

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Glossary

Manufacturing execution system (MES)/ manufacturing operations management (MOM)	MES/MOM is the operational control element of the factory. It integrates the top floor with the shop floor, and schedules, executes and steers operations across production, inventory, quality and maintenance.
Cobots (collaborative robots)	Cobots are robots that allow direct collaboration with humans and are designed to share a workspace with them. Unlike traditional industrial robots, they are not isolated from human contact. They are easy to train and flexible to use.
End-to-end (E2E)	End to end covers a whole process – from beginning to end to deliver complete outcomes.
Automated guided vehicle (AGV)/intelligent guided vehicle (IGV)	AGV is equipped with an optical guidance device or electromagnetic sensors, which can follow the specified guidance path, with safety protection and a variety of transport functions. IGV is an intelligent guided vehicle.
Industrial internet of things (IIoT)	IIoT facilitates advanced analytics like data mining, AI or machine learning and integrates multiple functions/solutions like MES, ERP or control systems across the value chain. It also provides a channel for integrating third-party information.
Product lifecycle management (PLM)	PLM is a strategic approach to managing the end-to-end (E2E) product lifecycle within an integrated IT system landscape. It embraces the entire value chain of an industrial company. PLM integrates all necessary processes and information that accrue during the entire E2E lifecycle of any product an industrial company brings to market.
Low code automation	Low code automation enables automation of workflows with limited programming skills. It enables business units to become more flexible and to develop automated workflows using a combination of visual interfaces and coding sectors, without the involvement of IT departments.
Service level agreement (SLA)	Service level agreements are commitments between a provider and a customer documenting what services the provider delivers and which standards must be met.

Source: PwC Digital Factory Transformation Survey 2023

9

References

1. https://www.pwc.de/en/strategy-organisation-processes-systems/operations/digital-factory-transformation-survey-2022.html

2. https://www.pwc.in/industries/industrial-products.html

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Contact us

Sudipta Ghosh
Partner - Industrial Products, and Leader - Data and Analytics

Ankur Basu
Partner, Digital Operations Leader

Authors

Sudipta Ghosh, Ankur Basu, Mousumi Sahoo

Contributors

Debayan Chandra, Manan Tolat, Swarnendu Srimany, Swastik Paul, Shreyash Mantri, Anup Dubey

Editorial support

Vishnupriya Sengupta

Rubina Malhotra

Design

Shipra Gupta

pwc.in