

# Delivering the Digital Dividend

Supply chain  
digital readiness:

A survey of 179 European  
Manufacturers

**jda.**

**WMG**  
THE UNIVERSITY OF WARWICK

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# A Roadmap to Digital Advantage

Supply chains are at a pivot point. Optimisation is moving from node to network, planning and decision frequency is changing from periodic to real-time and the supply chain itself is evolving from ‘one-size-fits-all’ to a market segment size of one. In summary, in the digital age supply chains will be how organisations compete. So together with Warwick Manufacturing Group (WMG) at the University of Warwick, JDA set out to identify and analyse the progress and aspirations of European manufacturers on their digital journey.

The research revealed that European manufacturers are at an early stage of the journey. Only 13% have so far reached level 3 and organisations appear to be in the process of bridging the two paradigms. This means that there is a window of opportunity for those that can successfully ride the digital wave and bridge the paradigm gap between process excellence and digital readiness.

As the pace of change increases there will be challenges. However, the flip side of a challenge is opportunity.

## The Technology Challenge

Evolving from node to network, periodic to real-time and to a market segment of one is how organisations capitalise on the digital opportunity as customisation, value and experience become how manufacturers compete. However, many existing processes such as forecasting do not scale to the task and new techniques such as AI must be introduced.

It is not surprising, therefore, that the survey reveals that prescriptive (Level 3) supply chains are set to double to 31% by 2023 and that technology adoption and planning frequency were the two dimensions that demonstrate the greatest ambition for improvement. AI is found to be the fastest growing new technology, but there is evidence that understanding is at an early stage. For example, although machine learning is likely to be the precursor to AI in most cases, there is no corresponding increase in ML adoption.

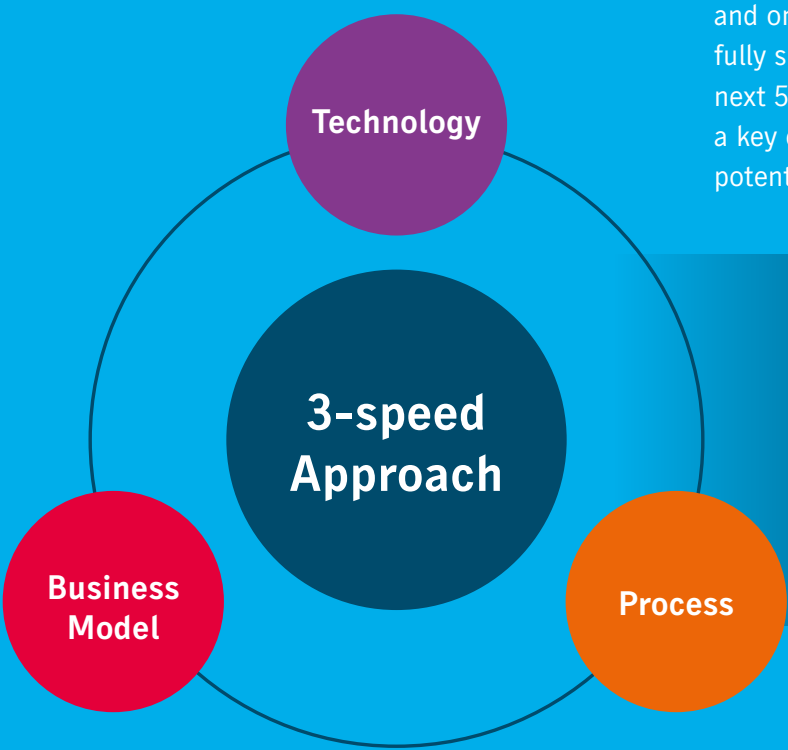
## The Business Model Challenge

To progress, organisations need to push forward on three fronts: process (functional and supply chain), innovation pilots (e.g. machine learning, artificial intelligence, digital control towers) and to consider setting up new business incubators in which complete new business models can be tried.

Moreover, manufacturers are yet to fully harness the potential of digital to compete through greater customer intimacy. Although espousing digital ambitions, between 2016 and 2018 the strategic intent of core supply chain strategy remains unchanged. The primacy of operational excellence over customer intimacy and product innovation for competitive strategy remains unchanged at 40:30:30 <sup>(1)</sup>. In a digital world, one would expect, for example, organisations to be capitalising on big data to create value and differentiation via customer intimacy.

## The Process Challenge

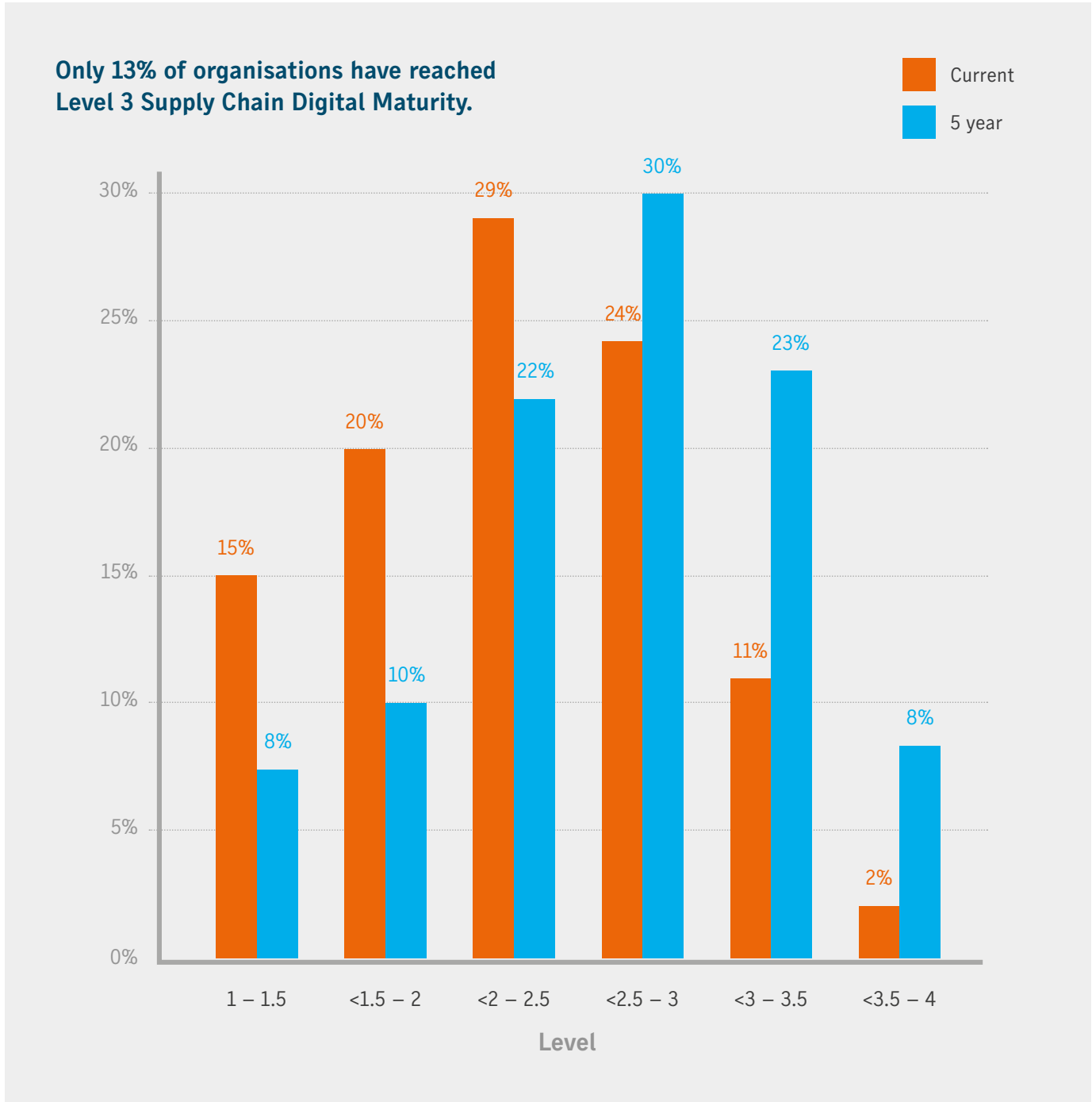
Strong processes are required to navigate a path to profitability in the face of digital complexity and rising customer expectations. Integrated Business Planning (IBP) is critical to achieving end-to-end business optimisation, but there is evidence that progress is faltering. Despite a considerable focus on S&OP in recent years, S&OP was the least mature of the 11 supply processes measured in the survey and only 21% of organisations expect to be able to fully support end-to-end business optimisation in the next 5 years (Level 3). Digital technologies could be a key enabler to break through the impasse, but the potential has yet to be realised.



“Organisations must be prepared to take a 3-speed approach, simultaneously addressing the process, technological and business model opportunities that the digital era presents.”

# The State of Digital Supply Chain in Europe

To benchmark the state of digital development, WMG, the University of Warwick and JDA developed a four level model. The methodology enabled granular resolution into each supply chain function as well as generating a headline number. It was designed to enable linkages to emerge.

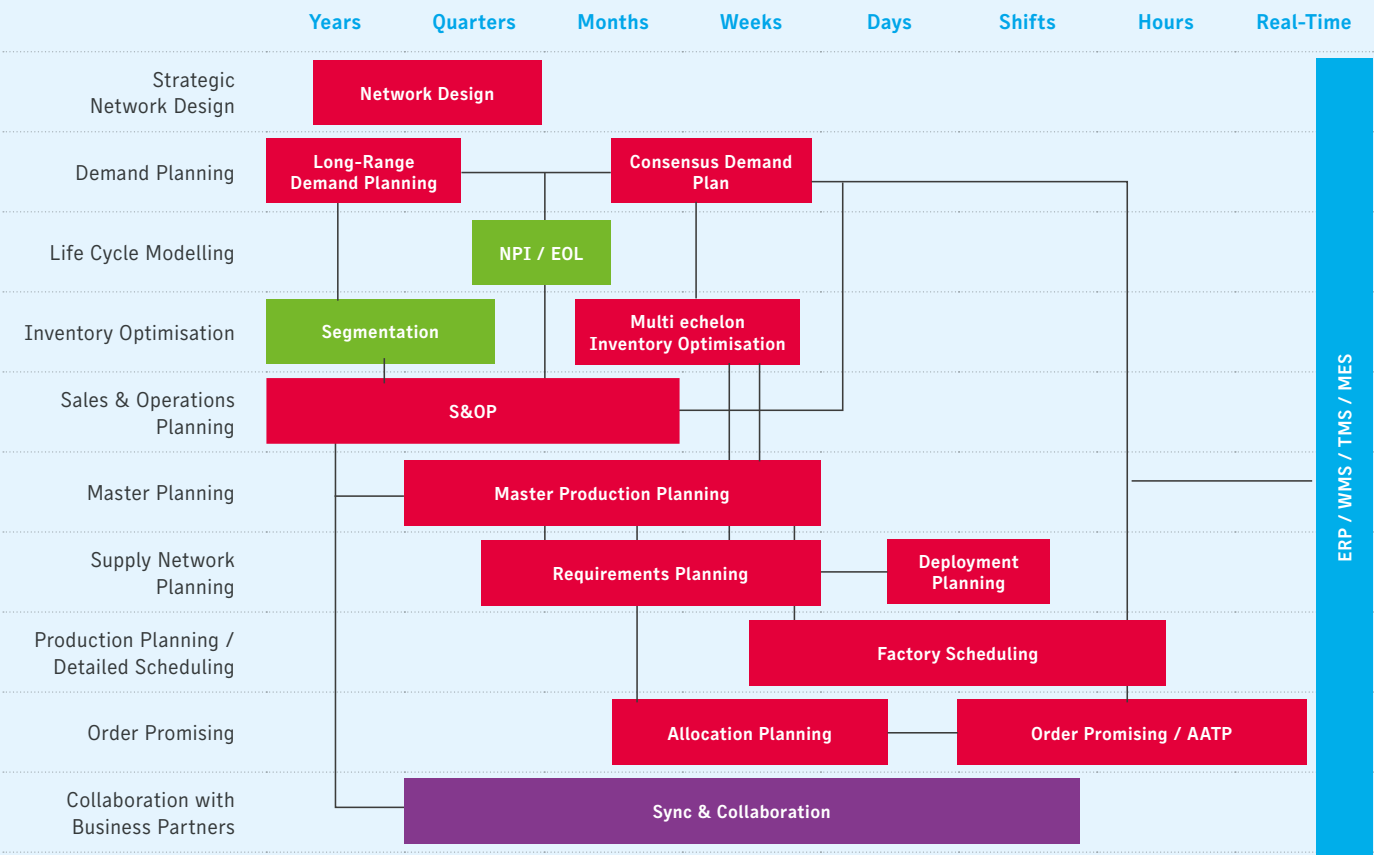


	Level 1	Level 2	Level 3	Level 4
	Visibility	Predictive	Prescriptive	Self-learning Autonomous
Planning frequency	Ad-hoc	Regular with some unplanned changes appropriate to planning cycle	Regular and appropriate planning cycle, with alerts if business conditions change	Continuous planning with real-time response to a change in business conditions
Strategic objective	E2E Visibility Departmental Reporting	Efficiency Functional optimisation	Dynamic end-to-end supply chain business optimisation	Pro-active end-to-end business optimisation with total ecosystem visibility
Digital technology adoption	Processes supported by basic ERP systems  Manual S&OP and processes supported by general purpose tools	Specialist tools and professional techniques  Some process automation with segmented policy profiling	Incorporates some machine learning and AI connected to Digital Control Tower  Mature IBP and connected professional SC tools	Fully digital process  Extensive use of AI and ML Autonomous where appropriate
Digitally enabled reporting & analysis	Limited analytics  Supported by spreadsheets as required	Analytics tools used for reporting on key metrics, to support cost optimisation	Advanced analytics  Migration from deterministic to probabilistic analytics  Real-time alerts and recommendations that enable dynamic responses	Autonomous adjustment within defined parameters, with real-time escalation where required

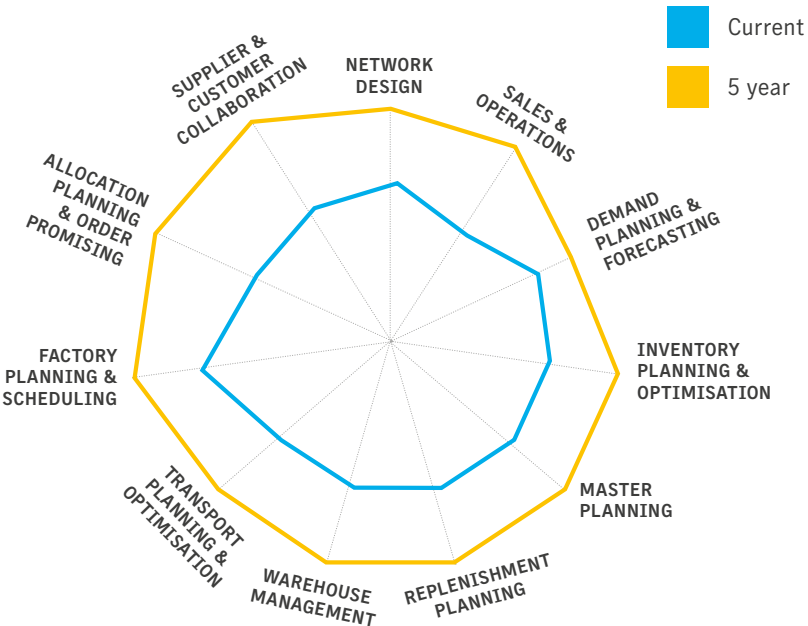


# The Survey

To conduct the survey, the supply chain was broken down into 11 core processes, from which a mission-specific maturity grid was developed for each. Participants were asked to identify their current maturity levels and their ambitions for five years' time, and from those parameters an overall aggregate score was calculated. This methodology enabled patterns in digital maturity to be identified in correlation with ambition and strategic gap analysis

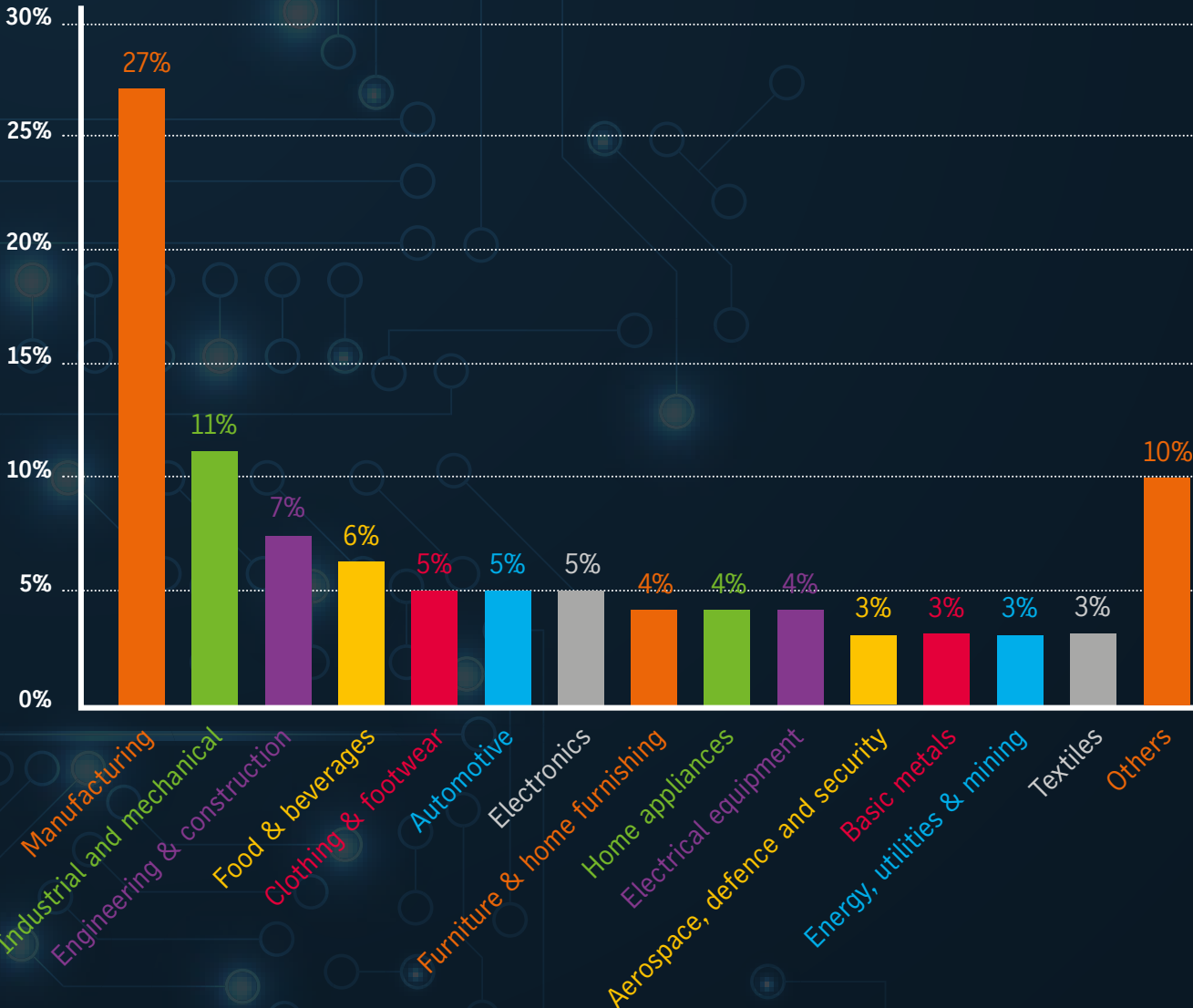
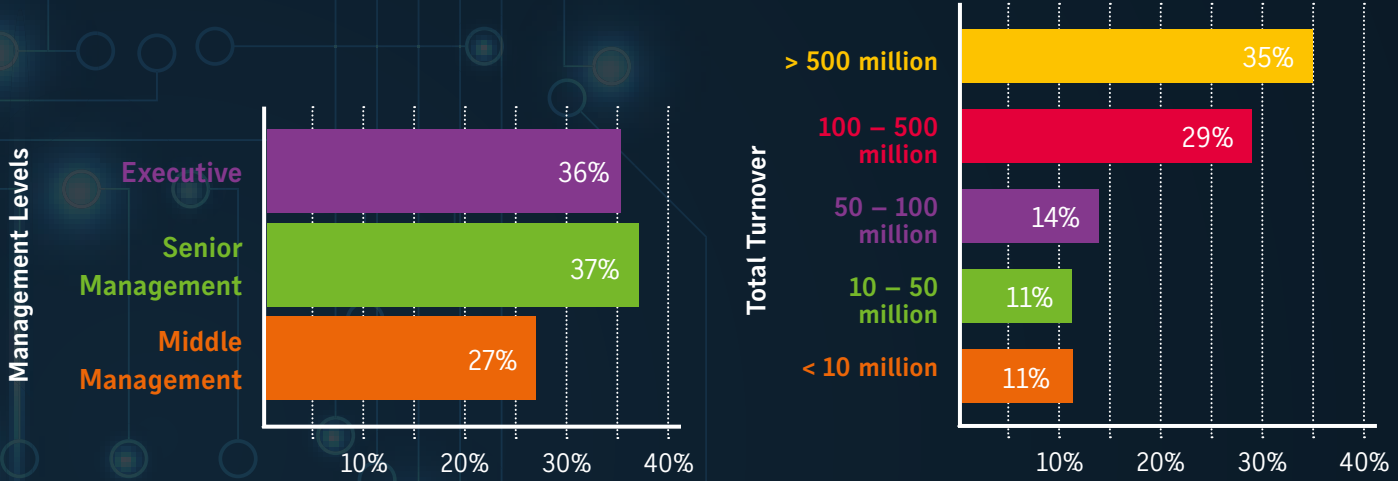


Whilst on the surface the 5-year ambition appeared rather modest, it represents a transition from linear to digital and from functional optimisation to end-to-end supply chain optimisation. The latter has remained an elusive goal for many organisations and digital technologies provide incremental opportunities to connect the functional silos, and optimise the whole.



# The Audience

Demonstrating the overall strategic importance of digital strategy among manufacturers, 73% of respondents were senior level or above. Of the 179 respondents more than 64% were organisations with a turnover of more than £100m and more than one third, above £500m. As seen below, the demographic accounted for a wide spread of organisations from a broad spectrum of sectors.



# The Technology Challenge

## Node to Network

Supply chains have historically been optimised in nodes: for example a factory or a warehouse. In a fast flexing digital world it is the end-to-end network that needs to be optimised. Moreover, complexity and channel proliferation have impacted fulfilment early in the process. It is interesting to note that **Network Design** is the supply chain dimension where the highest proportion of respondents (61%) wished to achieve a level 3 or 4 strategic outcome. Organisations have recognised that the network setup from the past is not ideal to serve future markets and channels. Moreover, it is the dimension which currently has the highest incidence of level 3 and 4 strategic capability. Clearly, in a digital world, network design cannot be resolved in isolation as the digital world flexes from node to network.

## Market Segment of One

The ultimate goal is a market segment of one. The survey suggested that manufacturers are responding through supply chain segmentation: **Allocation Planning and Order Promising** was identified by manufacturers as the process with the highest ambition to adopt digital technology. Doubling over the next 5 years from 30% to 61%, a shift from the lowest level 3 / level 4 adoption to highest. Moreover, it is the process with the highest current adoption and ambition to adopt level 3 / level 4 digitally enabled reporting and analytics, almost doubling with an increase from 34% to 66% by 2023.

In the 2016 survey, Supply Chain segmentation was relatively immature. Only 8% of manufacturers were at level three or above. While the results between the 2016 and 2018 surveys are not directly comparable, the attainment and growth plans would indicate that manufacturers are taking action to develop differentiated value propositions for a fragmenting market. Clearly moving forward, this is an area with its many linkages to which the disciplines of ML and AI can be readily applied.

## Periodic to Real-Time

As the supply chain heads towards real-time autonomous working the underpinning supply chain processes need to flex with greater frequency. **Factory Planning and Scheduling** was the process with the highest current level 3 / level 4 of planning frequency (45%), increasing to 67% within 5 years. By 2023, 20% of businesses believe that their Factory Planning and Scheduling will be able to respond in real-time to a change in business conditions. Meanwhile Sales & Operations Planning was the process with the lowest current level 3 / level 4 of planning frequency (31%), increasing to 48% within 5 years. While, as a strategic process this may not be surprising, there are indications that the planning process is struggling to adapt to the faster pace of decision making.

## Big Data Challenge: Digital Control Towers

Embracing the big data opportunity means reaching out beyond the traditional supply chain to embrace the data in the supply chain ecosystem. This requires a digital control tower to monitor the world of sensors, IoT, social media, weather and news (SNEW). It is filtering the noise and scanning for patterns determined by machine learning that require supply chain action.

## Exploiting Existing Data

Manufacturers continue to struggle to integrate and synthesise data. Back in 2016, the supply chain segmentation survey clearly illustrated that organisations faced an analytical challenge. Data was inconsistent across the supply chain and future decisions were rarely based on dynamic data. Arguably, most manufacturers are still only just beginning to embark on the collection of data from new sources or introduce new techniques such as AI.

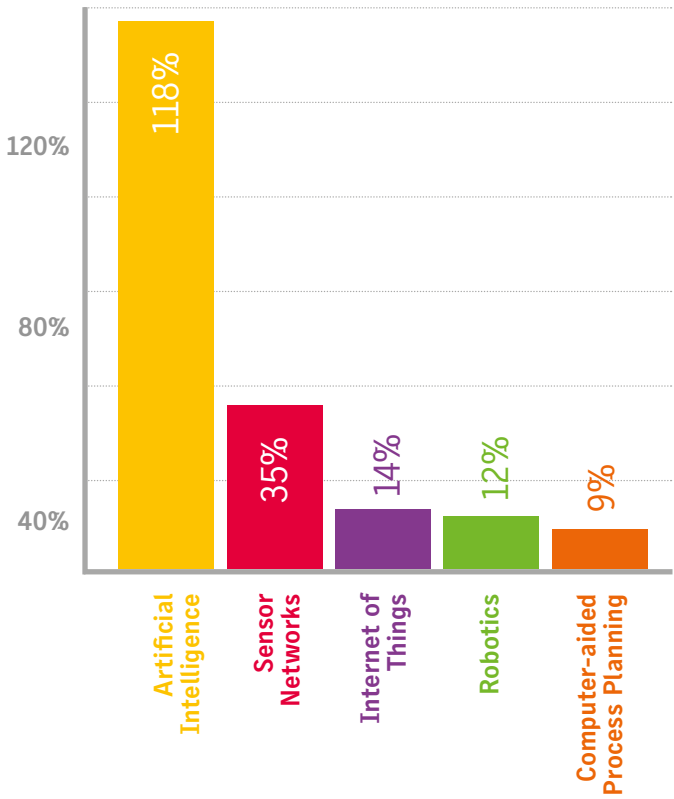
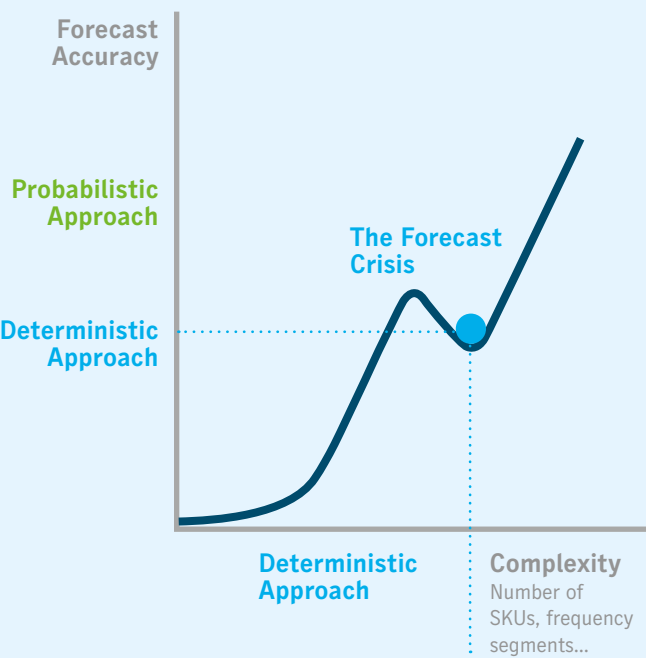
## Existing Techniques Simply Cannot be Expected to Scale

Human analysis and traditional methods such as statistical forecasting are not well suited to skimming big data to find meaningful patterns. However, machine learning and AI are fundamental new tools for addressing big data analytics and translating the output into predictive and prescriptive decision making. These are processes which can ultimately be automated.

**Machine Learning:** Reveal the linkages between cause and effect in complexity

**Artificial Intelligent:** Automating decision making

## Demand: Segment Proliferation Fulfillment: Digital Complexity

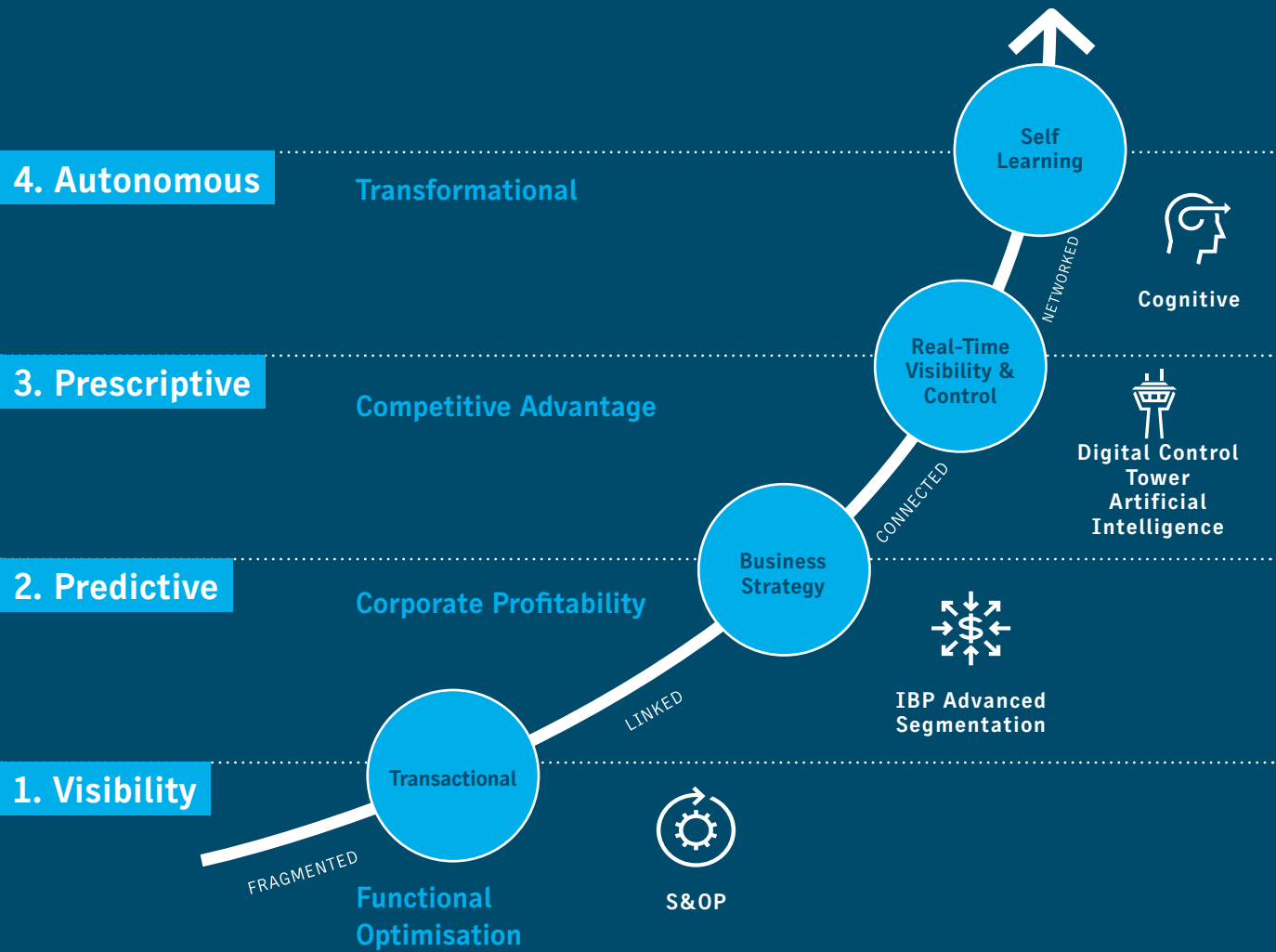


## AI: The Fastest Growing Technology But at an Early Stage of Adoption

AI adoption is forecasted to increase 3 times faster than adjacent technologies in the coming years; sensor networks (35%) and IoT (14%) following some way behind. While this suggests that practitioners understand the need to solve the analytical side of big data, there is also a sign of confusion regarding how exactly to go about it. Despite machine learning being a likely precursor to AI in most cases, there is no corresponding increase in ML adoption.

The rate of AI adoption is set to double

# The Technology Roadmap



Term	Definition
Artificial Intelligence	Computer systems capable of automating decision making normally requiring humans.
Digital Control Tower	Scans the digital ecosystem searching for meaningful patterns (established by ML) that should trigger supply chain action. It is an ergonomic visibility layer for human interaction to facilitate transparency across arising issues, and to help establish alternative approaches.
Digital Ecosystem	All digital signals relevant to supply chain action. This extends from robotics, through to business systems, through to transport networks, IoT, social media, news and weather (SNEW).
Internet of Things (IoT)	A network of physical devices embedded with sensors connected to the internet and capable of data sharing.
Machine Learning	Machines that can learn and improve without programming. In the context of supply chains, ML systems have great utility in understanding linkages between input/output and cause/effect; and making predictions relating to the performance of complex networks. The output of ML may be an input into system design or AI.
Robotics	Automation of repetitive tasks.

# The Technology Opportunity

## Level 1: Visibility

Efficiency and visibility are the prime concerns. Efficiency is managed departmentally using general purpose tools such as spreadsheets or ERP. Meanwhile planning is also siloed where functional plans are aggregated up via spreadsheets in S&OP. With luck they will balance out periodically, at least on paper. The process may inform of departmental target variances but provide limited visibility of what is actually happening at any given time across the supply chain. The objective is to join up the picture to create an end-to-end visibility that includes, where possible, suppliers and customers.

## Level 2: Predictive

Having created end-to-end communication, the next stage is to proactively steer the supply chain to corporate purpose. IBP cascades corporate goals and establishes cross-departmental collaboration. Moreover, it ideally enables the modelling of scenarios so that manufacturers can be prepared to respond profitably to business contingencies.

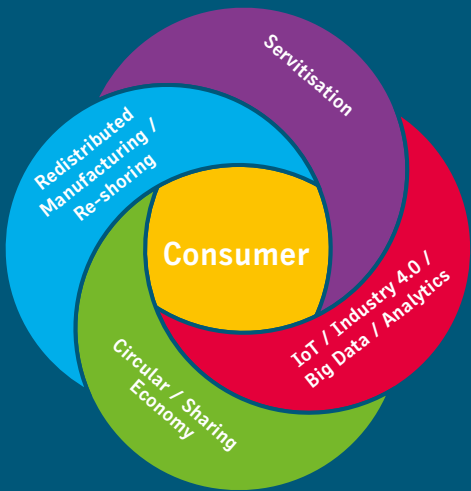
While intelligent IBP injects medium and long-term business goals, segmentation takes the baton to dynamically reconfiguring the supply chain for maximum differentiation and profitability for each segment.

## Level 3: Prescriptive

When every decision is data-driven, and when consumers have high expectations and supply chains are longer than delivery expectations, manufacturers need a new form of intelligence to get ahead of the market. They must understand the impact of every linkage in their network, and how to interpret patterns in their ecosystem. This is where machine learning comes in. It tirelessly scans the data lake, filtering out noise to detect patterns that link cause and effect. AI can then, when appropriate, support decisions relating to the configuration of the supply chain. This deep network understanding enables manufacturers to get ahead of the game and transform their supply chain from predictive to prescriptive; thus providing intelligent, system-wide execution.

## Level 4: Autonomous

Level 4 represents a self-learning, autonomous supply chain. Digital Control Towers detect the pattern of signals that ML reliably predicts will trigger an issue or opportunity in the ecosystem. Moreover, it is a scenario for which AI has indicated that there is an optimum supply chain response in anticipation of future events. Where appropriate, the system can automatically take appropriate actions to optimise issues and opportunities to ensure the supply chain responds most effectively.



## Interconnected Trends

Multiple social and economic and technological trends will continue to disrupt manufacturing. For example, servitisation can be a response to changing consumer preferences as well as a consequence of the circular economy, enabled by IoT and analytics. As a result of servitisation contracts, modular components are replaced and probably manufactured by locally-distributing manufacturing and service facilities.

# The Business Model Challenge

## Adapting supply chain strategy to digital opportunities

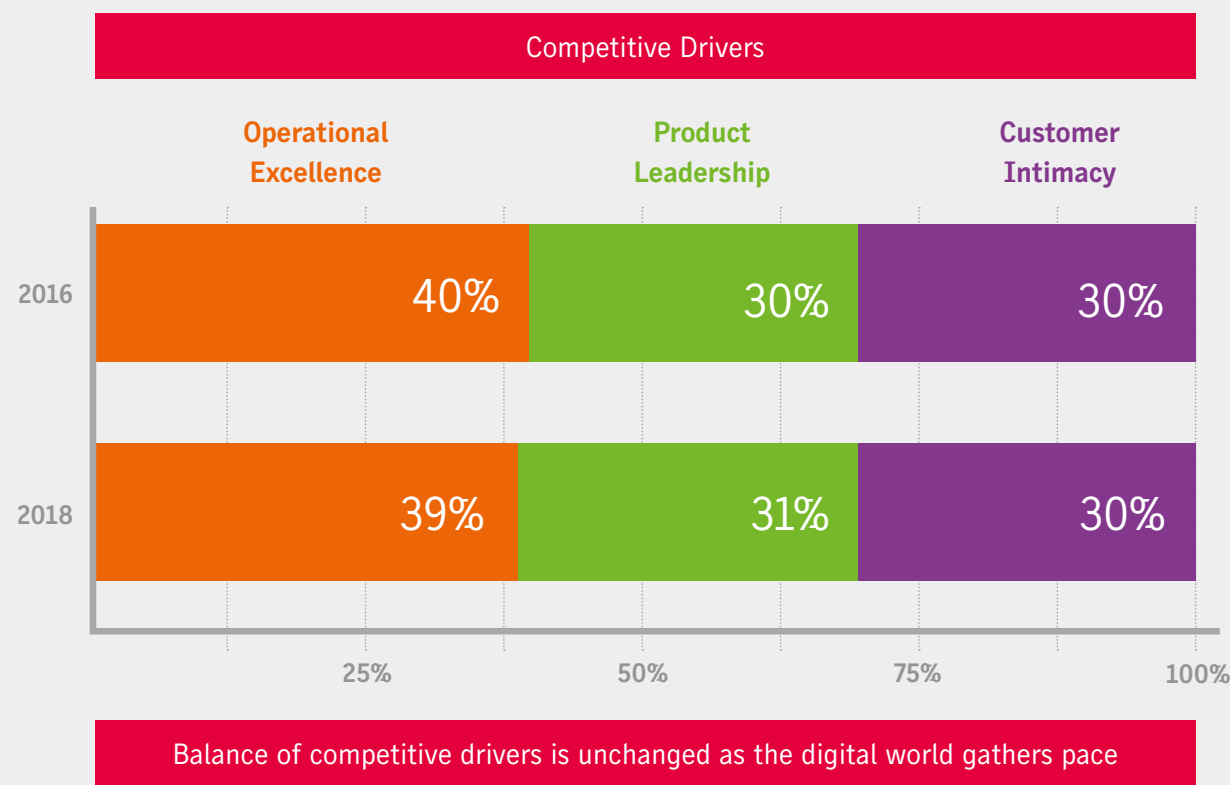
There is prima facie evidence that organisations are not yet flexing their supply chain strategy to capitalise on the opportunities of the digital world.

In 2016, and again in 2018, JDA and Warwick Manufacturing Group (WMG) tested the competitive drivers that steer supply chain strategy. When given 100 points to split between competitive drivers, both surveys delivered similar results: 40 for Operational Excellence (OE), 30 for Product Innovation (PI) and 30 for Customer Intimacy (CI). This shows that companies

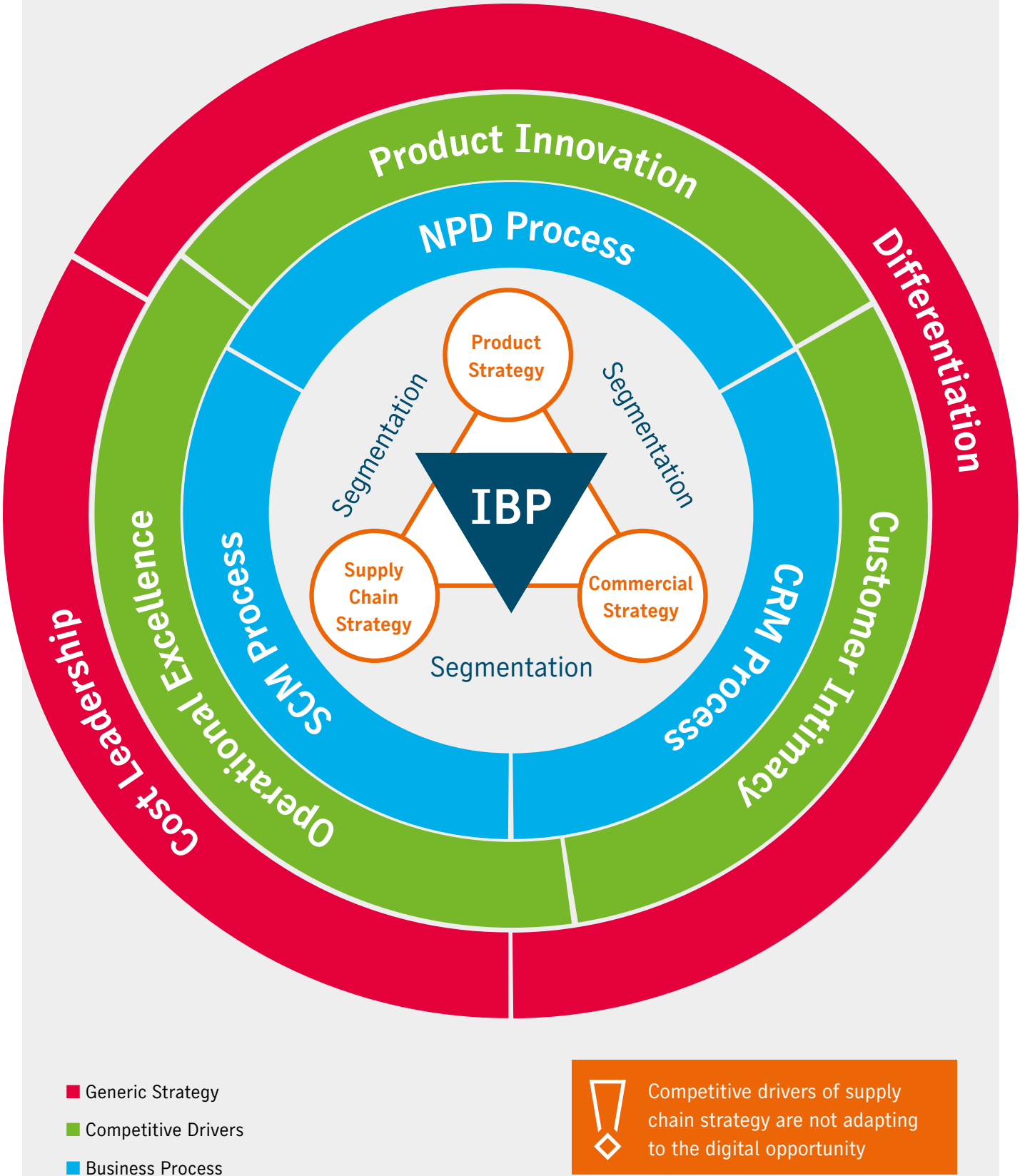
are underpinned by a base level of OE from which they then compete on a combination of PI and CI.

While it may not have been surprising that OE was the average centre of gravity for an organisation's strategy in 2016, it is surprising that CI and/or PI have not increased in relative performance over the two years. Given the expected availability of big data one would have expected differentiation strategies through Customer Intimacy and perhaps greater product innovation to better leverage servitisation and the IoT.

Strategy drivers are not flexing to the digital world



Organisations are not flexing to digital strategies based on customer intimacy and product innovation to create differentiation. The predominant driver remains as Operational Excellence supporting Cost Leadership.





# The Business Model Opportunity

The data suggests that manufacturers are a little overwhelmed by the sheer vastness of the digital challenge. After all, there are significant complexities in capturing and analysing existing data systematically. Clearly, if it has taken this long to achieve actionable analytics in a linear approach, then surely AI is going to take longer and is thus discarded to the ‘too-difficult’ pile?

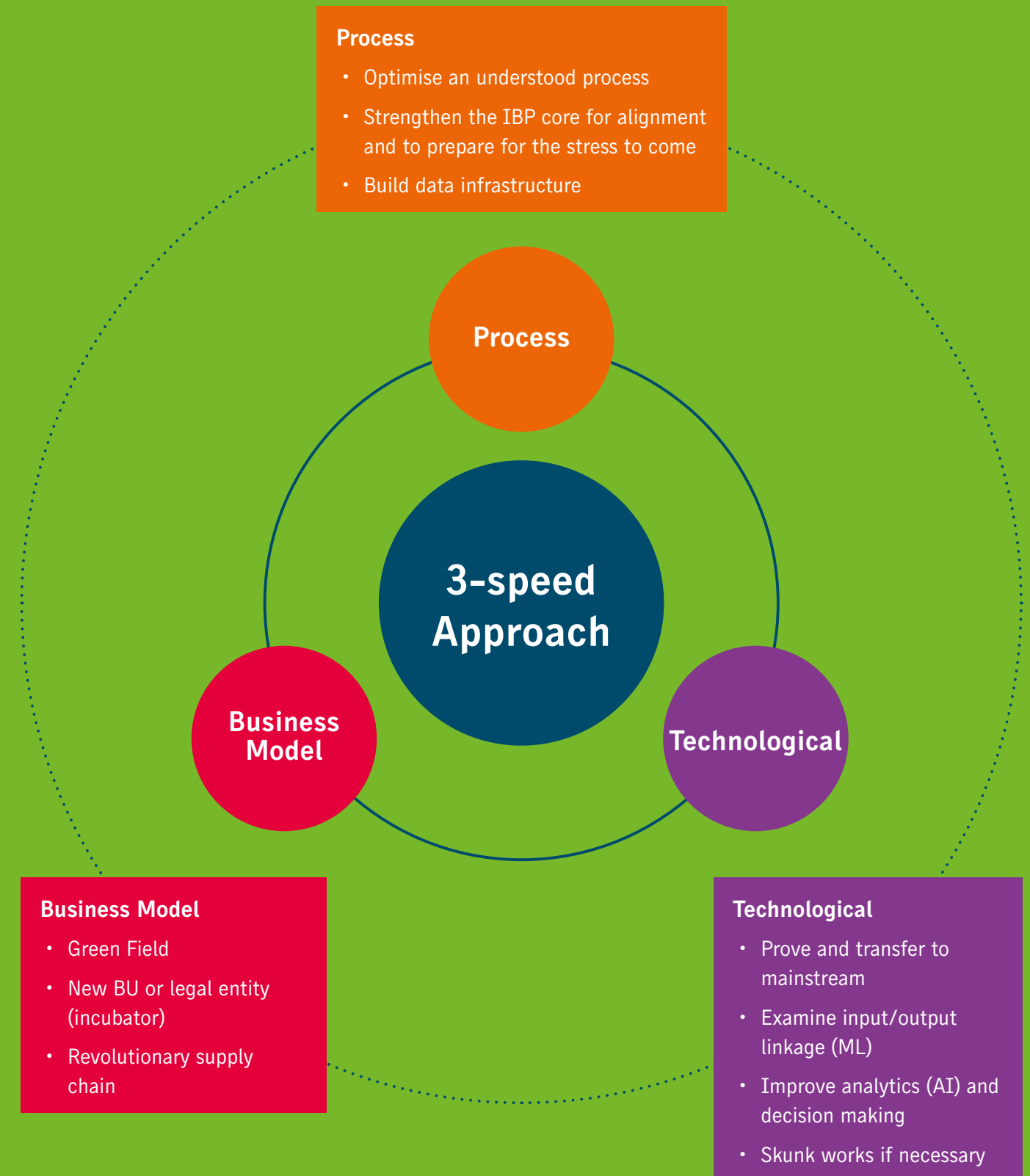
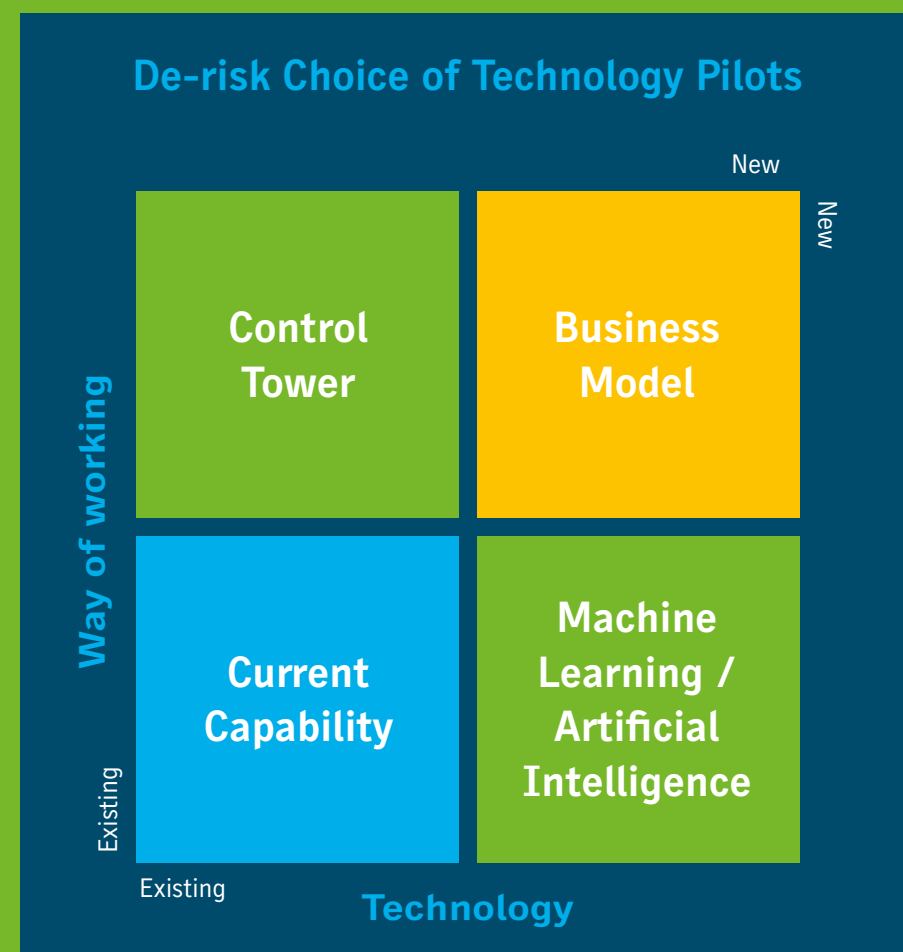
Far from it, **Machine Learning initiatives can generate unprecedented insights in a relatively short space of time compared to process initiatives.**

## Business Model Innovation

Digital technology pilots:

- Start with a known process
- Avoid mixing new technologies with new processes
- Benchmark results against existing methods
- Learn, prove success and roll out more widely

This approach has proven successful for organisations innovating with control Towers, Machine Learning and Artificial Intelligence. It is easier to prove success if the new technique is tested in an established process or function.



“Organisations must be prepared to take a 3-speed approach, simultaneously addressing the process, technological and business model opportunities that the digital era presents”



# The Process Challenge

## Core process underpins digital transformation

The results emphasise that historic focuses on operational excellence are still very much present today. **Factory Planning and Scheduling** were the processes with the highest current Level 3 and 4 parameters for attainment of planning frequency (45%); a number that's expected to grow to 67% over the next 5 years. In fact, by 2023, 20% of businesses believe that their Factory Planning and Scheduling will be able to respond in real-time to a change in business conditions.

## The S&OP challenge

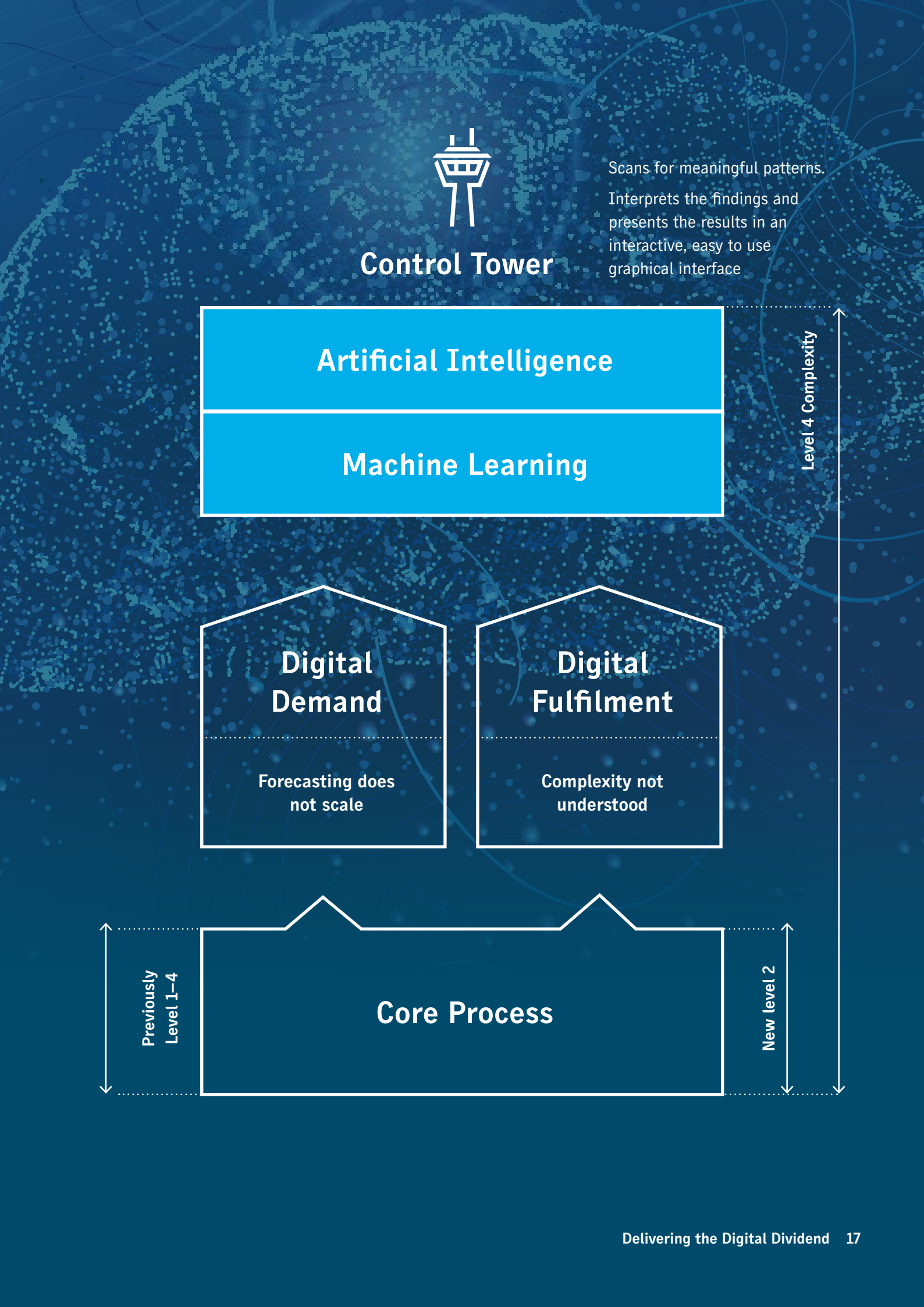
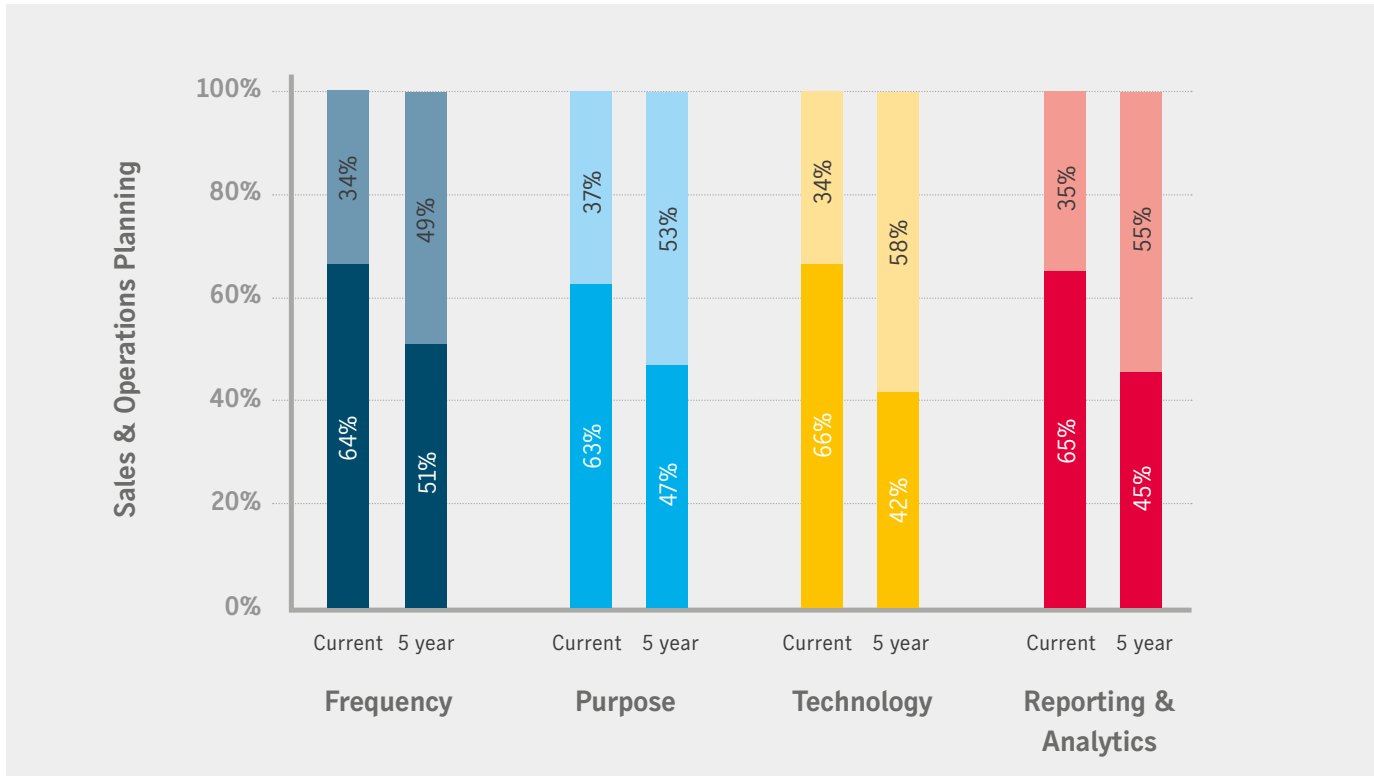
However, this exists upon a backdrop of organisations struggling to mature their S&OP processes, despite the fact that S&OP & IBP have arguably been the foremost supply chain focus for most organisations in recent years. Alarming, S&OP was the process with the lowest current Level 3 and 4 for planning frequency (31%), increasing to 48% within 5 years.

Only 21% of organisations have the ambition to use S&OP to support end-to-end business optimisation by 2023 and a further 22% support end-to-end supply chain optimisation.

Worse still, IBP has the lowest maturity level of all 11 supply chain dimensions that were measured, in spite of it being able to capture strategic business objectives and inject this logic into the supply chain process.

If it is important in a linear supply chain, it is vital in a digital supply chain, and even more imperative during this stormy period. Again, ML and AI have a role to play by seeing through the fog of exponentially increasing data, to filter out the noise, and to reveal more accurate and timely insights that inject relevant information into both long-term planning and day-to-day operations.

The challenge remains for supply chains to mature to Levels 3 and 4 far quicker than has been seen in recent years.



# The Process Opportunity

## The Process Opportunity

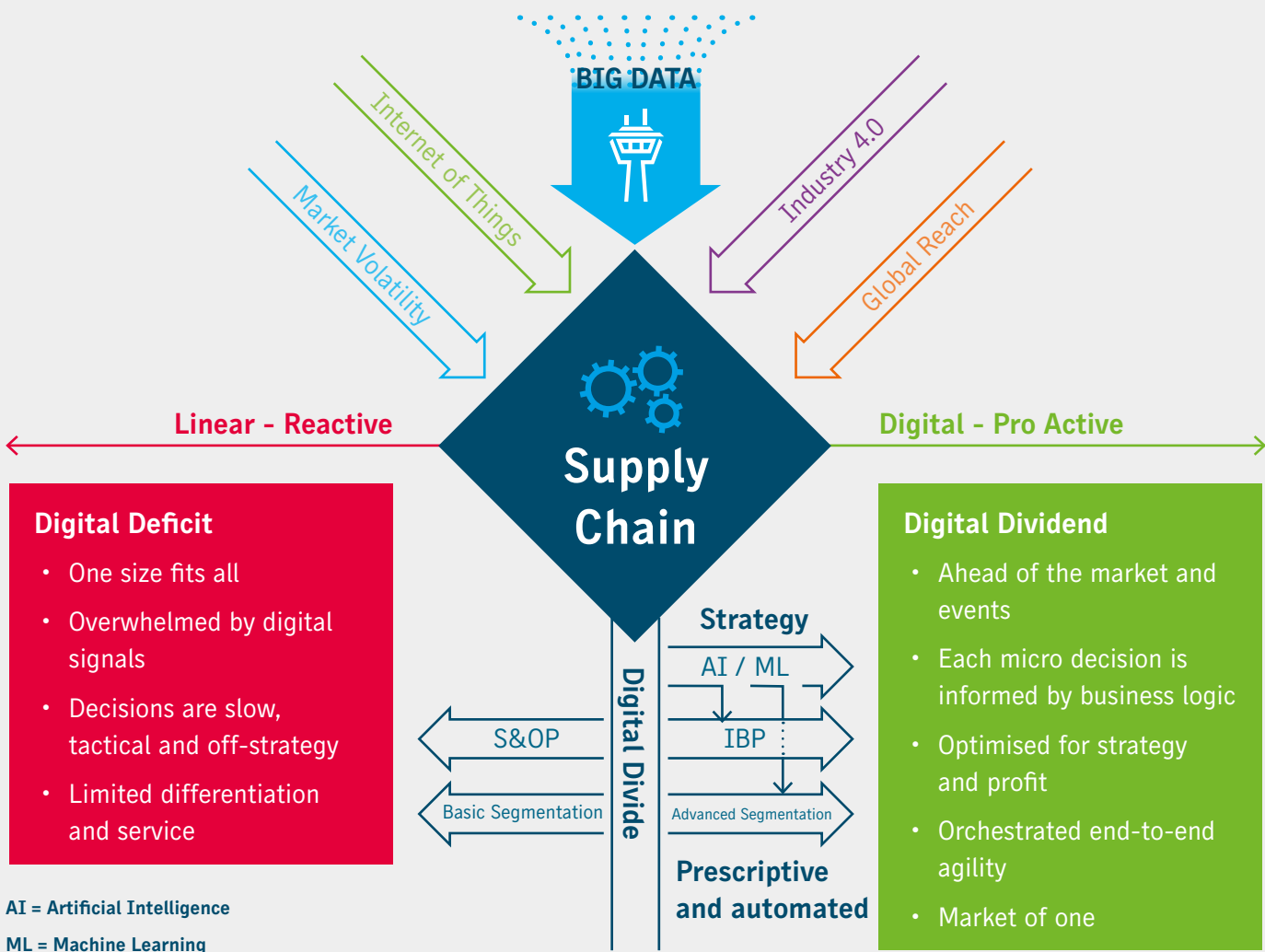
Digital means a greater volume and frequency of decision making. To reap the ‘digital dividend’ each decision must be injected with direction and commercial purpose. IBP is the link between business strategy and supply chain optimisation. Failure to do so will result in confusion and a ‘digital deficit’. The impact of that will be cumulative as time passes.

Therefore, the digital supply chain pivots on strong process and the core capabilities of integrated business planning (IBP) and advanced segmentation. Supply chain success will be contingent on a company’s ability to detect market opportunities and

disruptions in near real-time and respond dynamically and profitably. As we have seen, this requires a radical shift in supply chain function to incorporate digital control towers and cognitive capabilities.

## Boost IBP maturity with a digital injection

Clearly, it is tempting to suggest that digital complexity can potentially overload existing processes. But by supporting these processes with appropriate analytics and intelligence, incremental improvements will be complementary, not overwhelming.



AI = Artificial Intelligence  
ML = Machine Learning

# Digital Readiness Survey – Harvesting the Digital Dividend

The report confirms that achieving digital maturity is the primary supply chain goal across many sub-verticals.

Many organisations may consider AI a big stretch when they have been struggling to attain high quality analytics for a much simpler linear supply chain. The good news is that JDA has supported organisations undertaking DCT, AI and ML pilots. The results have been both fast and dramatic. I would encourage manufacturers to set the bar high and to be pragmatic in their internal approach. The philosophy laid out within is designed to achieve early results that can be re-applied more widely.



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To maintain and enhance competitive advantage, organisations need to develop 3 aspects of their supply chain digital transformation simultaneously.

1. Leverage digital technologies to support core SC process excellence.

Use digital technologies such as AI and ML to leverage the data currently within your business to optimise core supply chain processes and expand digital envelope via sensors and IoT.

2. Organise for end-to-end supply chain optimisation by adding a business process layer to your organisational structure to leverage functional excellence whilst breaking down the silos. Support this with metrics that balance financial, business process, and functional performance. Use digital technologies to support the optimisation of supply chain business processes end-to-end.

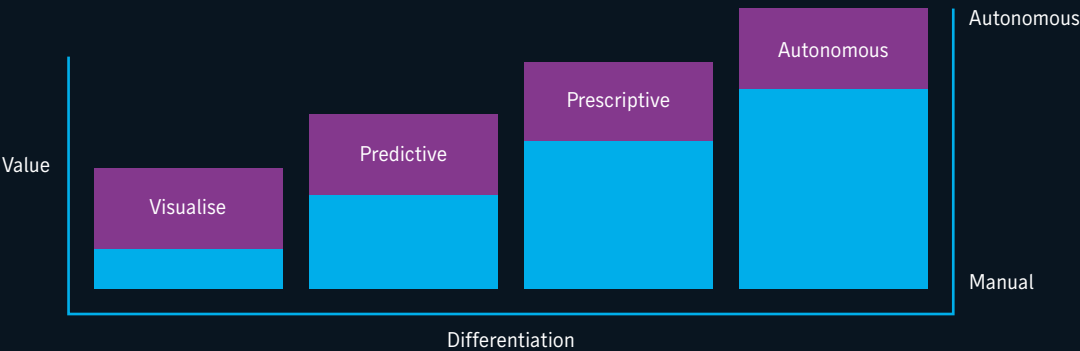
3. Design for end-to-end business optimisation using digital technology to break through the IBP impasse. Create ‘safe places’ to experiment with new digital technologies to enhance current ways of working. You may wish to consider the creation of a separate business entity for more radical experimentation with new digitally enabled business models.



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## The journey to the autonomous supply chain





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