NUCLEUS RESEARCH

SUPPLY CHAIN AGILITY INDEX 2024

ANALYST

Samuel Hamway

THE BOTTOM LINE

Nucleus surveyed more than 1,700 supply chain management (SCM) leaders across the United States, the UK & Ireland, and APAC to evaluate current technology spending behaviours and anticipated future investments. More than half of respondents are using artificial intelligence (AI), automation or machine learning (ML) for at least one supply chain management (SCM) application. Among those not currently using these technologies, 59 percent are considering adoption within the next two years. As high-growth organisations (defined by a revenue growth of 20 percent or more over the past three years) continue to demonstrate the productivity benefits of generative AI and automation, it is expected that common concerns – including end-user knowledge gaps, potential job displacement, and security and compliance issues – will decrease. This trend is expected to foster broader acceptance and integration of these technologies, enhancing operational efficiencies and strategic capabilities across industries.

OVERVIEW

The survey findings illuminate a significant trend among organisations, highlighting the concern about escalating costs as the foremost challenge facing supply chains. Nucleus observed that successful and high-growth organisations – defined by a revenue growth of 20 percent or more over the past three years – are proactively embracing emerging technologies such as smart robotics, generative AI, and machine learning as pivotal strategies to mitigate these challenges. More than half of surveyed organisations are either planning to adopt or are considering the implementation of smart robotics, with a majority also planning to integrate generative AI and machine learning into their operations. The primary motivation behind these initiatives is to enhance operational efficiency and optimise resource allocation, predominantly through the strategic reallocation of full-time equivalents (FTEs). High-growth organisations expect a greater impact from these technologies on reallocating full-time employees compared to their non-high-growth counterparts.
This highlights a broader expectation that these advancements will be crucial for future competitiveness. It reflects a comprehensive shift towards using automation technologies not just to streamline operations but as a fundamental component of maintaining a competitive edge in an increasingly volatile global market.

ROBOTICS

Figure A: Use of smart robotics in the warehouse

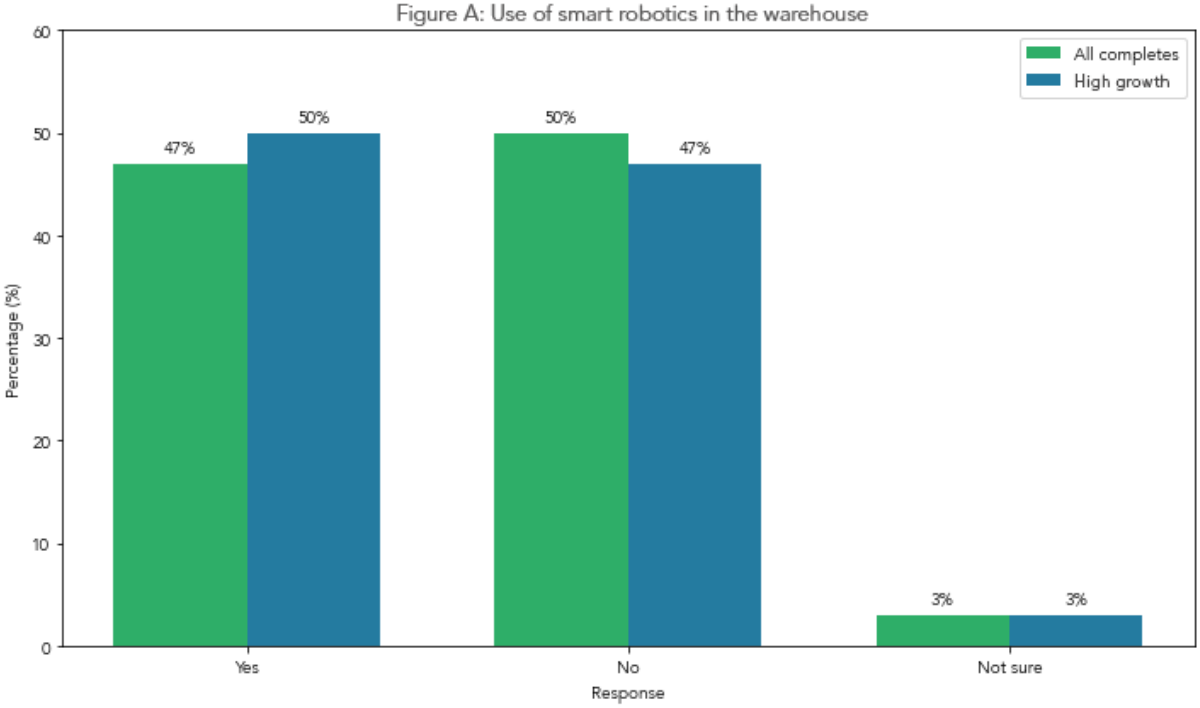
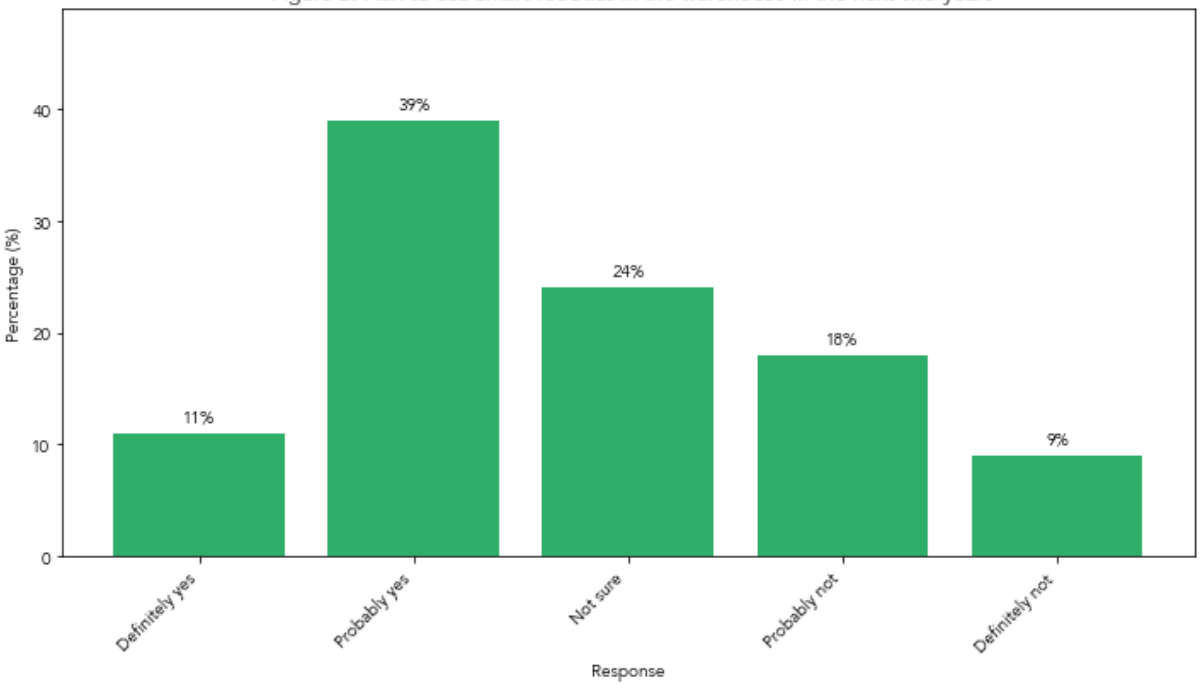


Figure B: Plan to use smart robotics in the warehouse in the next two years



As seen in Figure A, 50 percent of organisations do not use robots in the warehouse setting, while 47 percent do use this technology. Roughly 50 percent of organisations plan to use these technologies over the next two years. The reluctance of 51 percent of organisations to adopt robotics in a warehouse setting may be attributed to uncertainties regarding product suitability and the extensive change management required to integrate robotics into existing processes.

This hesitancy is further exacerbated by a natural resistance to organisational change, fuelled by uncertainty and lack of initial comfort with navigating uncharted technological territories. Overcoming these barriers can be achieved through a strategic approach that includes a thorough evaluation of robotics' fit with specific operational needs, along with robust training and upskilling schemes. The finding displayed in Figure B demonstrating that 50 percent of the organisations plan to use robotics displays the perceived benefits of this technology, such as operational efficiency, cost savings, and competitive advantage – all of which are crucial to mitigating fears and showcasing the long-term value of embracing automation.

Organisations should begin their robotic investments in an incremental manner. For example, rolling out the capabilities in a single warehouse – rather than performing a "big bang" approach across all warehouses – tests an organisation's readiness to change with reduced risk and initial costs. Nucleus advises organisations who are planning to invest in these technologies to focus on automating tasks that are manual, repetitive, and error-prone. It is important to identify areas that will benefit most from automation and to implement robotics in a way that complements the human workforce, freeing employees for more complex tasks that require human judgement.

GENERATIVE AI

Figure C: Implementation areas of generative AI

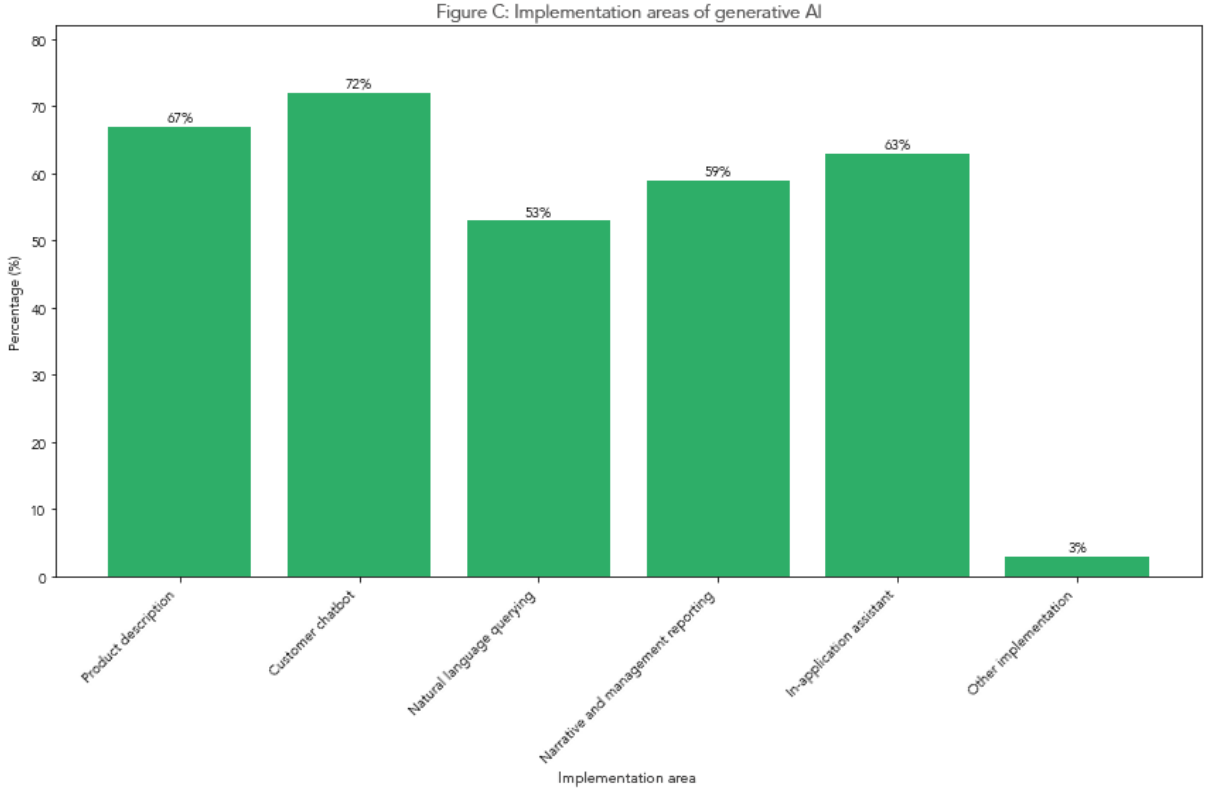


Figure D: Organisational usage of generative AI in SCM

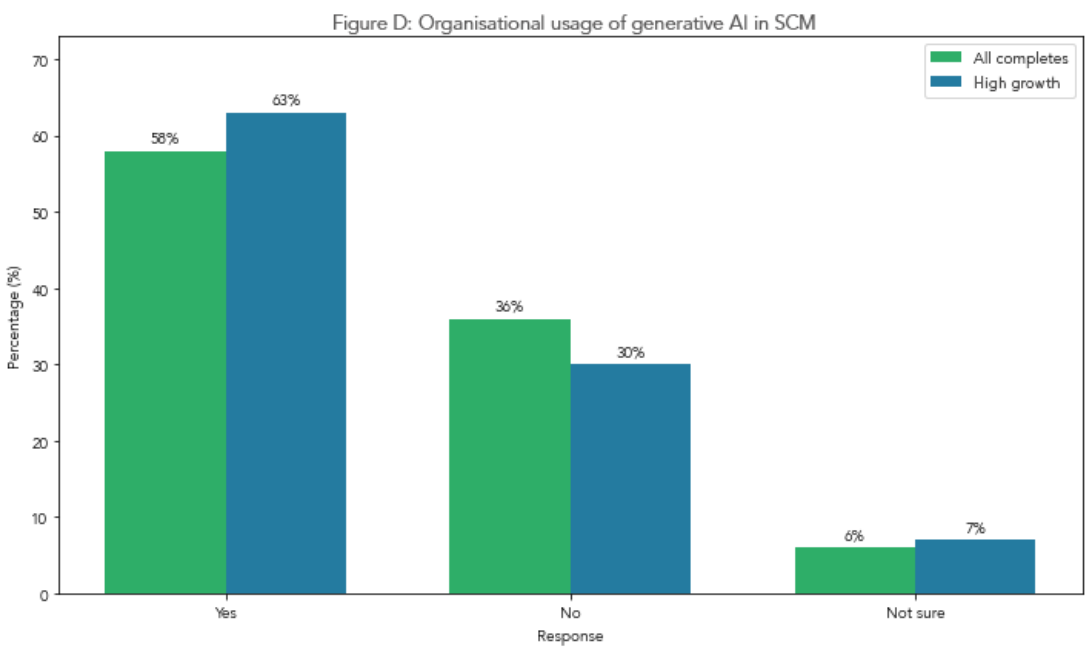


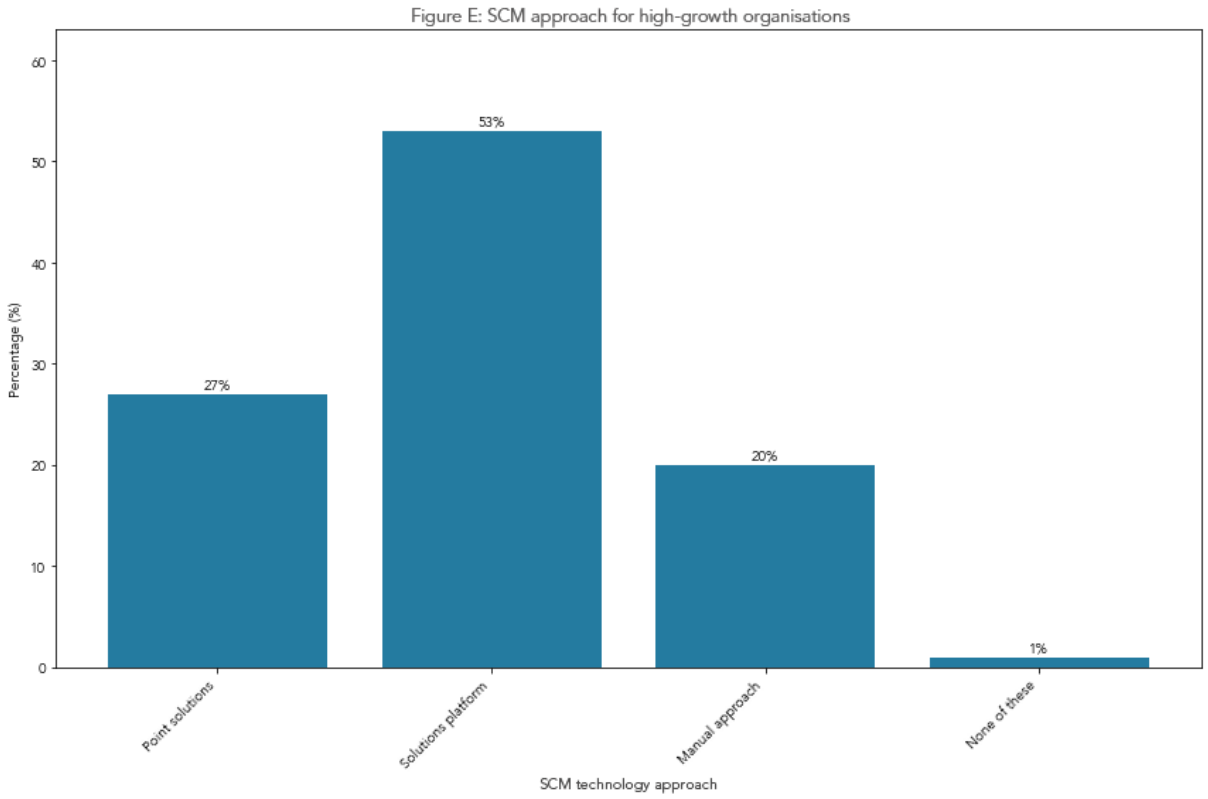
Figure D indicates that 58 percent of organisations have integrated generative AI into their digital supply chain operations, applying it across various functions within their software applications including product descriptions, customer chatbots, natural language querying, reporting, and in-application assistance. A higher percentage, 63 percent, of high-growth organisations have integrated generative AI into their respective supply chain operations through their enterprise resource planning (ERP) and SCM software applications. This widespread use reflects a strategic move toward enhancing operational efficiency and customer engagement through advanced technology, particularly among high-growth organisations.

Specifically, the adoption of generative AI in customer service chatbots, noted by 72 percent of organisations, is highlighted as the most prevalent use case in Figure C. This widespread implementation is attributed to the technology's ability to streamline customer interactions in various sectors such as customer support on retail websites. Similarly, 67 percent of organisations currently employ generative AI for creating product descriptions, using the technology's capacity to analyse customer sentiment, forecast market demand, and consult materials science databases. This enables a more informed approach to product design and feature development.

Beyond these initial applications, there is a significant opportunity for organisations to extend generative AI functionality to SCM processes, such as demand forecasting. By analysing extensive datasets, including historical sales data, point-of-sale transactions, and supplier information, generative AI can unearth trends not readily apparent. This facilitates more efficient inventory management by mitigating the risks of overstocking or understocking, ultimately reducing associated costs.

Current deployment of generative AI is predominantly seen within the marketing, sales, and customer service domains of the value chain, where it enables the creation of customised marketing materials, analysis of sales trends, and provision of responsive customer service. This not only enhances the efficiency of post-sale processes but also promotes a more dynamic, customer-focused engagement strategy, converting data into actionable insights that bolster sales and customer loyalty. Looking ahead, companies can leverage generative AI to supplement training materials, develop dynamic pricing strategies based on real-time market data, and create detailed, data-driven supply chain reports. These applications offer practical, resource-saving solutions that can build efficiency for make, move, and sell customers, providing tangible benefits throughout the value chain.

PLATFORM APPROACH VS. POINT SOLUTIONS

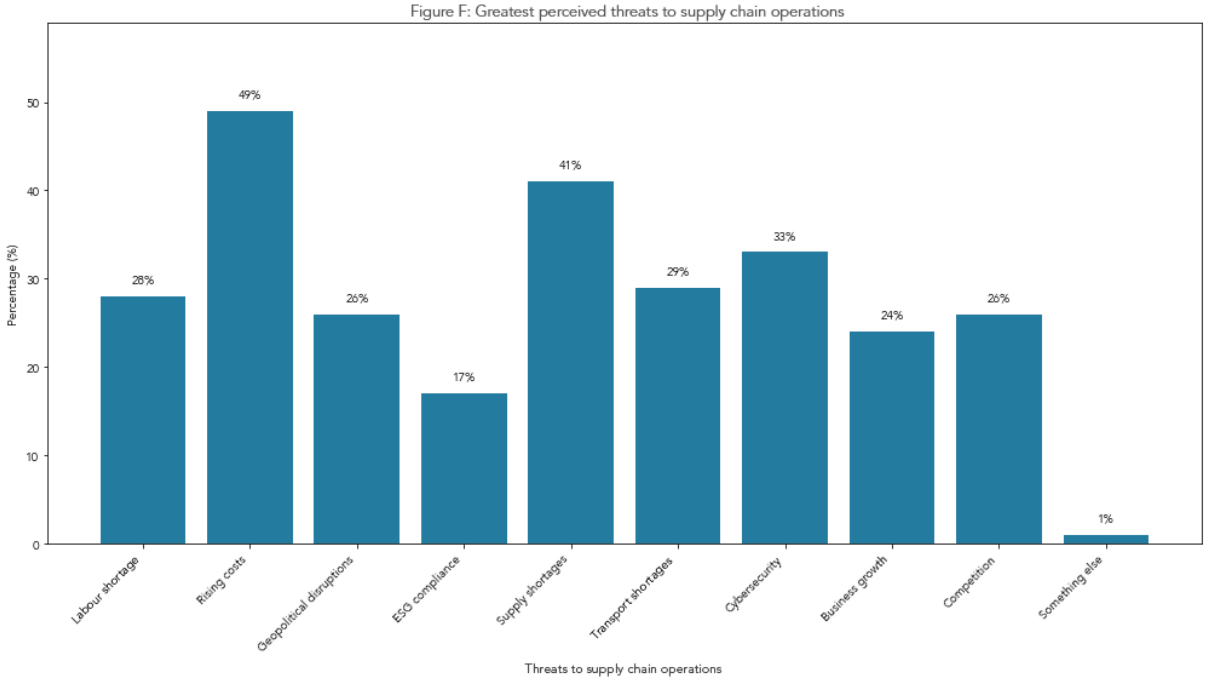


Nucleus found that 53 percent of organisations reported that they take a platform approach to their SCM technology ecosystem, compared to 27 percent of organisations that take a point solution approach and 20 percent that take a manual approach. When prioritising a platform approach, data flows seamlessly from an ERP solution to supply chain planning, transport management, and warehouse management systems – giving organisations the comprehensive visibility essential for diving into digital operations. A majority of organisations surveyed leverage their ERP solution for SCM because centralisation allows for the correlation of financial data with warehouse inventory levels; this enables better optimisation of inventory distribution and more accurate transport planning. In contrast, using isolated point solutions often leads to a fragmented view, where data reliability is compromised, reducing the ability to make quick, effective decisions.

Consequently, over one-third of surveyed organisations use a unified system that merges ERP and SCM capabilities. By using a unified system that merges ERP and SCM capabilities, businesses can achieve a bigger picture view, enabling more rapid, data-driven choices.

COSTS REMAIN MOST IMPORTANT

Figure F: Greatest perceived threats to supply chain operations

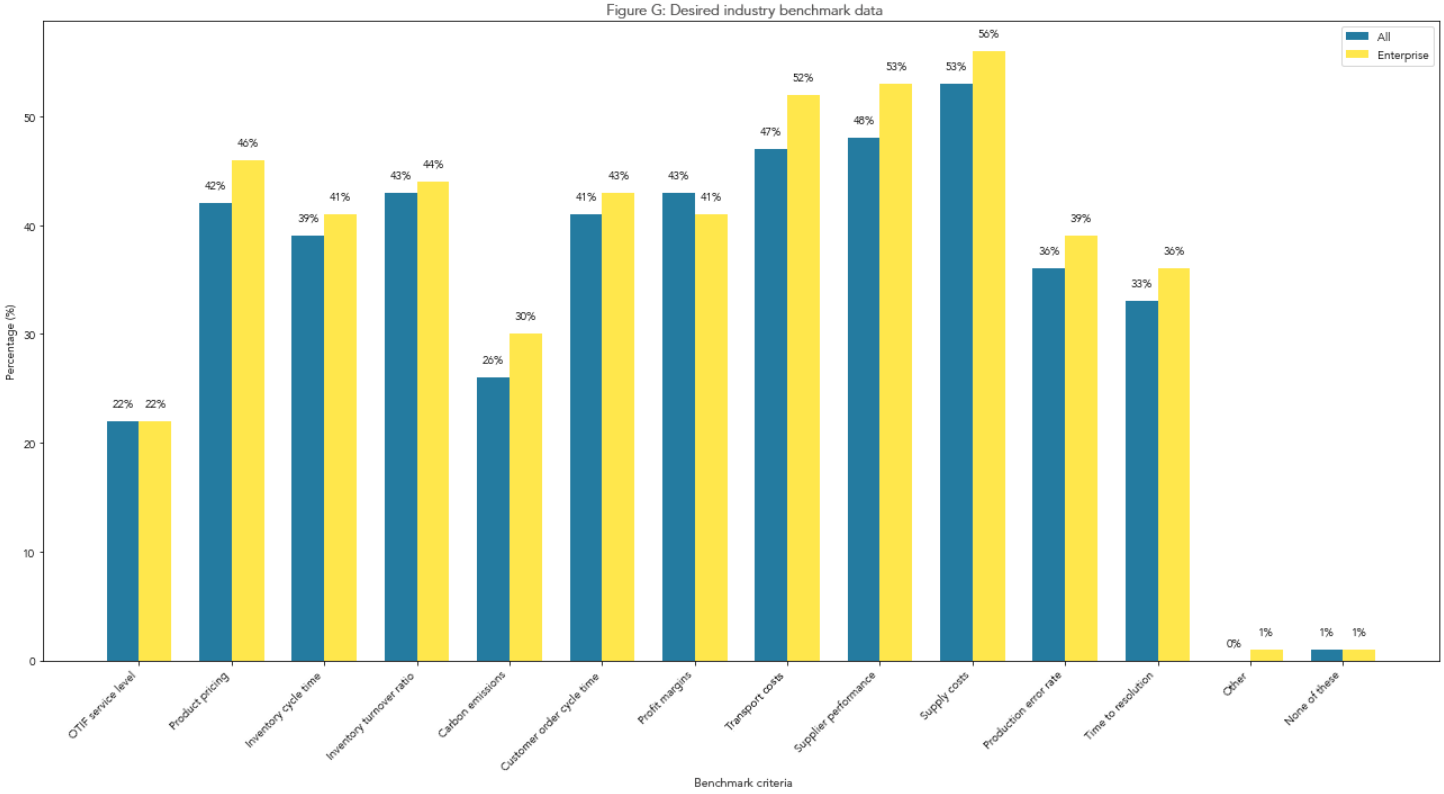


The primary challenge facing supply chain management is rising costs, as reported by 49 percent of companies surveyed. Despite this threat, organisations are actively seeking technological solutions to effectively navigate potential issues through automating processes, increasing workforce productivity, and ultimately reducing costs.

Supply chain management incurs substantial expenses, requiring a constant pursuit of cost efficiency to help ensure profitability. Factors contributing to these rising costs include the volatility in raw material prices along with escalating expenses associated with transport and labour. This surge in transport and labour costs, propelled by factors such as fluctuating fuel prices, limited availability of transport resources, geopolitical tensions, and a shortage of skilled labour, has heightened the complexity of managing supply chain operations. Despite the predominant focus on cost containment, organisations are concurrently investing in technologies such as warehouse automation, robotics, SCP/control tower/transport management system (TMS)/warehouse management system (WMS) platforms, and generative AI. These investments aim to streamline processes, enhance supply chain visibility, centralise operations, and strengthen quality control, all with the principal goal of achieving bottom-line objectives while maintaining operational efficiency.

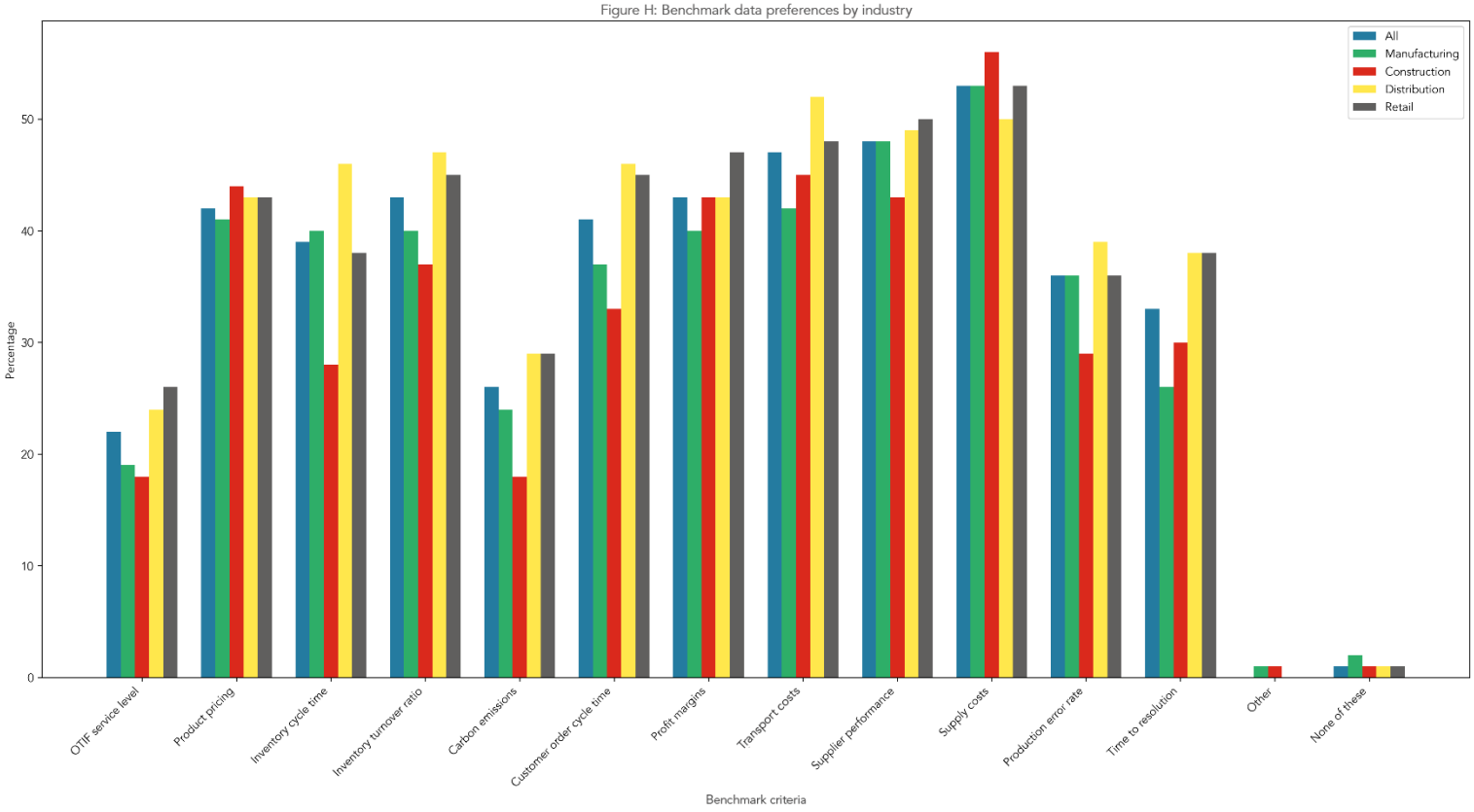
CUSTOMERS ARE CURIOUS ABOUT KPIS DRIVING THE BOTTOM LINE

Figure G: Desired industry benchmark data



Supply chain practitioners prioritise understanding key performance indicators (KPIs) that significantly influence the bottom line – their principal focus remains identifying metrics that offer insights into cost efficiencies and overall financial performance within the supply chain. It's notable that concerns about "carbon emissions" – here a stand-in for ESG performance compared to competitors – do not feature prominently in their considerations. This suggests that, for these supply chain practitioners, ESG performance relative to industry peers is not a significant priority.

Figure H: Benchmark data preferences by industry



HIGH-GROWTH ORGANISATIONS EXPECT GREATER FTE REALLOCATION

The strategic optimisation of the existing workforce in response to market dynamics is crucial for sustaining agility, resilience, and a competitive edge in the global market. By automating routine tasks and redirecting workers into more complex, revenue-generating areas of the business, companies can help enhance workforce productivity and reduce mundane task workload.

BENEFITS OF AUTOMATION TECHNOLOGY ADOPTION

PRODUCTIVITY GAINS AND EMPLOYEE REDEPLOYMENT

The integration of automation technologies into SCM processes primarily enhances productivity by reallocating tasks, which can mitigate prevailing labour shortages rather than eliminate existing jobs. ML, generative AI, and robotics are capable of automating routine and time-consuming tasks, freeing employees to engage in more strategic and meaningful activities. This reallocation not only addresses immediate productivity concerns but also empowers the workforce by enabling them to focus on complex problem-solving and decision-making tasks better suited to human reasoning. For instance, although AI can optimise inventory levels based on predictive analytics, human oversight is crucial for managing unexpected supply chain disruptions that require nuanced decision-making.

ENHANCING SUPPLIER INTERACTIONS

Automation technologies play a significant role in improving the efficiency of supplier interactions. For example, advanced robotic systems can be used in manufacturing settings to streamline the movement of parts around the factory floor, enhancing overall operational efficiency. Generative AI chatbots also enable streamlined query handling and transaction facilitation, which can streamline communication channels between businesses and their suppliers. As these systems evolve, they are expected to handle more complex interactions, further integrating and synchronising supply chain management activities. Ongoing workforce education about these systems is essential to maximise their usefulness, helping ensure that all users are proficient and comfortable in leveraging automation technologies for enhanced supplier communication.

BROADENING THE BENEFITS: BEYOND COST EFFICIENCY

Although efficient operations are a primary incentive for automation technology adoption in supply chains, these technologies' capabilities extend beyond financial efficiency. Automation systems can generate real-time alerts and actionable recommendations, helping proactive management of the supply chain. These systems analyse vast datasets to identify trends and anomalies, allowing for timely interventions that can prevent costly disruptions and enhance operational reliability. Furthermore, automation can also facilitate better compliance management and quality assurance through consistent monitoring and analysis, reducing the risk of non-compliance penalties.

OPERATIONAL IMPLICATIONS AND STRATEGIC RECOMMENDATIONS

To effectively leverage automation technologies in SCM, organisations should adopt a phased implementation strategy, starting with non-critical operations to assess each new technology's impact and integration complexities. This approach minimises risks and allows for iterative learning and adaptation. Organisations should also focus on developing robust training programmes and change management strategies to foster a technology-accepting culture among their workforces. By adopting these technologies, organisations can not only enhance their operational efficiencies but strategically position themselves to adapt to rapidly changing consumer demands. This adaptive capacity is crucial for maintaining competitiveness in a volatile global market.

STAGES OF AUTOMATION MATURITY MODEL

To navigate the complexities of modern supply chain management, organisations increasingly turn to automation. The following Stages of Automation Maturity Model outlines the progressive integration of technologies such as AI and robotics, demonstrating how each phase enhances operational efficiency and cost-effectiveness.

STAGE 1: AWARENESS AND INITIAL EXPLORATION

In the Awareness and Initial Exploration stage, organisations recognise escalating supply chain costs as a significant challenge and begin exploring potential technological solutions such as AI and robotics. Awareness is limited to understanding the technologies available and their possible benefits. This stage involves initial educational efforts, such as seminars and workshops, to introduce the concept of digital transformation aimed at cost reduction and to identify potential areas for pilot projects.

Example: A medium-sized electronics manufacturer notices a significant increase in logistics and manufacturing costs. To address these challenges, the company hosts a series of workshops with technology providers to understand the potential of AI and robotics in their operations. They identify warehousing and inventory management as potential areas for pilot projects to reduce costs.

STAGE 2: PLANNING AND PILOT IMPLEMENTATION

In the Planning and Pilot Implementation stage, organisations start small-scale trials to evaluate the effectiveness of smart robotics, generative AI, and ML in targeted operations. These projects are selected based on preliminary assessments from the previous stage,

which identify the most promising applications of these emerging technologies. This stage is crucial for testing hypotheses about how these technologies can reduce costs and enhance efficiency. Pilot projects can be specifically designed to measure impact on production times, resource allocation, and cost savings, providing data to justify further investment and scaling. The focus here is on learning and adapting the potential benefits and limitations of each technology before full-scale implementation.

Example: After identifying potential areas for cost reduction, the electronics manufacturer decides to pilot an advanced inventory management system in their warehousing operations. This system uses AI algorithms to automate inventory tracking, predict stock levels, and optimise stock placement, aiming to enhance accuracy and reduce manual inventory checks. The pilot tests the system's capability to provide real-time analytics and decision-making support, assessing its impact on efficiency and error reduction.
The objective is to validate the benefits of AI in streamlining inventory processes before wider implementation across their network.

STAGE 3: SYSTEMATIC INTEGRATION AND INITIAL OPTIMISATION

The Systematic Integration and Initial Optimisation stage marks the shift from experimental pilot projects to the permanent application of AI and robotics within specific parts of the organisation. This stage focuses on embedding these technologies into workflows where they have proven their value in enhancing efficiency and reducing costs. The aim is to achieve deep, systemic changes in these targeted areas, helping ensure that every operation is optimised to make full use of technological capabilities. Efficiencies gained include streamlined processes, reduced manual errors and better resource management – all of which contribute to cost savings. The technology integration at this stage is confined to specific operations rather than the entire supply chain, laying a strong foundation for future expansion.

Example: After successful pilot testing, the company moves to fully integrate AI-powered inventory management systems within their warehouse operations. This technology automates stock level adjustments and ordering processes, significantly reducing manual labour and associated errors. The integration is focused on optimising these specific warehouse operations to establish a model for potential expansion to other parts of the business.

STAGE 4: EXPANSION AND OPTIMISATION THROUGH ITERATION

The Expansion and Optimisation through Iteration stage sees the extended use of AI and robotics across broader areas of the supply chain, aiming to maximise cost efficiency. In this stage, technologies are not only expanded to new processes but are continuously refined

and adapted to meet specific operational needs more precisely. This iterative process involves modifying and optimising systems based on real-time data and feedback, thereby reducing waste and operational redundancy even further. Key Performance Indicators (KPIs) are closely monitored to drive improvements directly influencing the bottom line, helping ensure that the technology adoption aligns with strategic business outcomes.

Example: Encouraged by the successes in the warehouse, the electronics manufacturer expands the use of AI and robotics to their manufacturing lines. They implement AI-driven predictive maintenance tools that schedule repairs and maintenance based on real-time equipment data, reducing downtime.

STAGE 5: ADVANCED AUTOMATION AND SYSTEM-WIDE SYNERGY

In the Advanced Automation and System-Wide Synergy stage, multiple automation technologies, including generative AI, machine learning, and robotics, are mature and optimised across a wide variety of business units within the organisation. This stage focuses on leveraging the full capabilities of these technologies to enable predictive analytics and deliver real-time, adaptive responses throughout the supply chain. Such integrated automation facilitates a deep, systemic ability to anticipate market changes and dynamically adjust operations. This helps ensure that organisations maintain optimal inventory levels and operational flow, reduce costs, and enhance customer satisfaction through consistently improved service levels. The widespread application of these technologies exemplifies a mature digital transformation, setting the stage for industry leadership.

Example: With multiple technologies now mature and optimised, the electronics manufacturer extends the integration of AI and robotics across all major business units, including procurement, production, and customer service. They employ advanced machine learning models that predict market demand changes, adjusting production schedules and inventory levels dynamically. This comprehensive automation helps ensure that the company can maintain optimal operational flow and significantly lower costs.

STAGE 6: INDUSTRY LEADERSHIP

At the Industry Leadership stage, organisations have fully transformed their supply chain operations through advanced technologies. They become industry leaders, setting benchmarks for technology adoption and operational agility. These organisations are the most resilient and agile in the face of disrupted supply chains and unexpected market challenges. They achieve significant reductions in operational costs while simultaneously using technology as a strategic lever to maintain their competitive advantage.

Example: The electronics manufacturer has now achieved full integration of AI and robotics within their supply chain operations. Recognised as a leader in digital supply chain management within the electronics industry, they use machine learning to enhance demand forecasting and inventory management. This capability allows them to adjust production schedules efficiently and manage inventory with minimal waste, leading to significant cost reductions. They have successfully automated critical processes in their manufacturing lines, such as component assembly and quality checks, which has reduced downtime while freeing up their workforce to focus on more productive tasks. Their advanced use of technology not only keeps production costs low but also enables them to respond quickly to changes in consumer demand. The company regularly participates in industry panels and contributes to standards committees, helping to shape best practices in supply chain technology.

LOOKING AHEAD

High-growth organisations are increasingly adopting automation technologies as they recognise their significant contributions to operational efficiency and quick decision-making. These businesses see the potential of these technologies to provide substantial competitive advantages, especially in sectors where operational agility and responsiveness are crucial.

In the context of supply chain management, the primary focus on improving the bottom line makes the integration of automation technologies particularly compelling. Generative AI and ML, for example, deliver the ability to process vast datasets quickly and accurately allow for improved demand forecasting, optimised inventory management, and more efficient procurement strategies, all of which significantly enhance profitability.

Effective communication through user testimonials, case studies, and demonstrations of these technologies as value-adding tools can support this effort. Additionally, training and educational initiatives are essential in helping end-users become comfortable and proficient with integrating automation technologies into core operations. Using a collaborative, cohesive strategy and a forward-looking mindset, businesses can support their workforce while embracing the benefits of innovation.