

THE FUTURE OF MANUFACTURING WITH ADDITIVE TECHNOLOGY

NAMIC
NATIONAL ADDITIVE MANUFACTURING
INNOVATION CLUSTER

SG



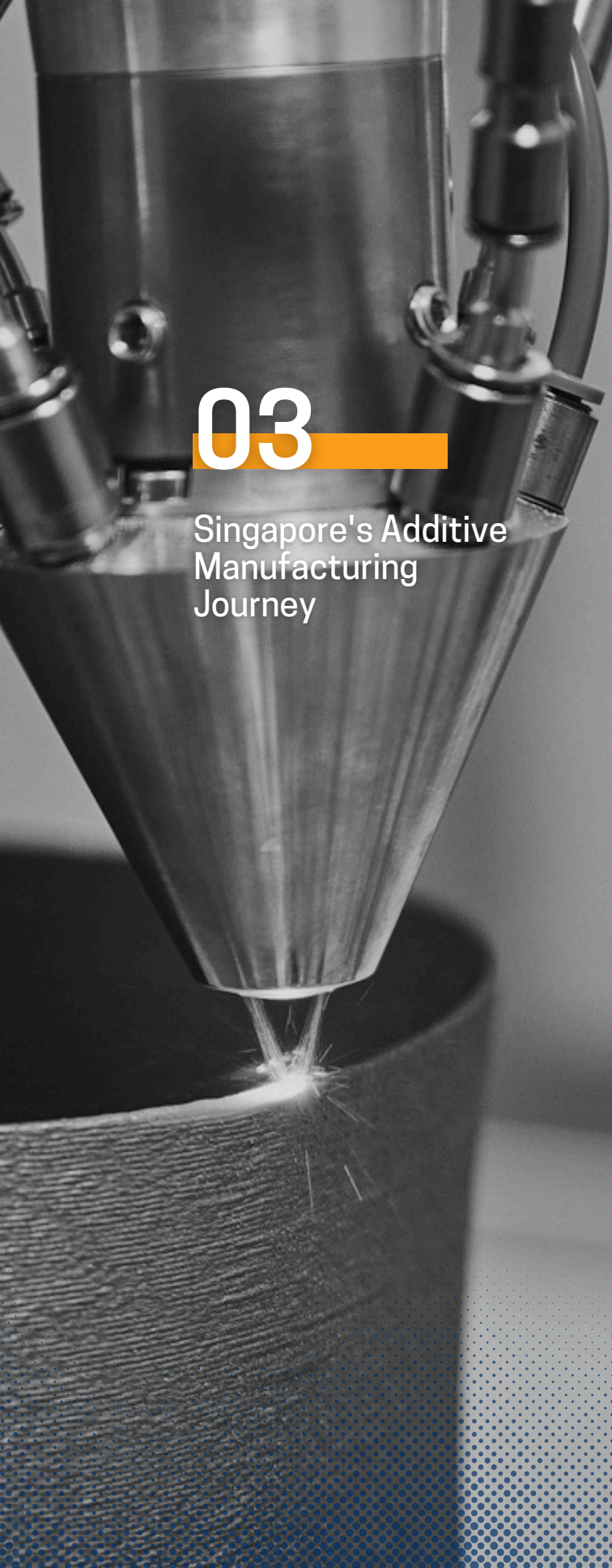
The background of the entire page is a high-contrast, black and white photograph of a 3D printed part. The part is a large, hollow, cylindrical structure with a visible, textured surface that shows the layer-by-layer construction of additive manufacturing. In the upper right corner, a mechanical arm or nozzle is partially visible, suggesting the printing process. The lighting is dramatic, highlighting the edges and texture of the part.

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A close-up, black and white photograph of a 3D printing nozzle. The nozzle is a conical metal structure with multiple internal channels, and a bright, glowing point of light is visible at its tip where it meets a dark, textured surface. The background is a soft, out-of-focus grey.

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10 Years
WITH
NAMIC 
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► Foreword

In an era defined by profound geopolitical shifts, supply chain volatility, and an urgent call for greater sustainability, the need for a new industrial paradigm has never been clearer. For Singapore, this is not only a moment of challenge, but also one of immense opportunity, a chance to leverage our nation's strengths in innovation, technology, and connectivity to lead in the next frontier of advanced manufacturing. It is with this forward-looking perspective that we present this report designed to help us chart our collective path forward.

This report is the culmination of an extensive, ground-up survey, capturing frank and honest perspectives from the very companies and innovators who are shaping our additive manufacturing (AM) landscape. The findings are both encouraging and illuminating. The insights from this report reinforce our mission at NAMIC. We believe that Singapore's future lies in creating defensible niches by embracing innovation and sustainable industrialisation enabled by AM. Our focus must be targeted, deepening capabilities in key sectors while pioneering new frontiers in high-potential and emerging sectors. Our role as a national enabler is to be the interlocutor and catalyst for this transformation: connect innovators with industry, de-risk the arduous journey from R&D to commercialisation, and foster the deep, collaborative partnerships that are essential for sustainable success.

I would like to extend my sincere gratitude to all the industry partners who participated in this survey. Your feedback serves as the foundation of this report and is invaluable to our mission.

This report is more than just an analysis; it is an invitation to a dialogue and a call to action. Let us use these insights to spark new ideas and collaborations, sharpen our strategies, to collectively forge a globally competitive and resilient manufacturing future for Singapore.

Sincerely,



Dr. Chaw Sing Ho,
NAMIC CEO



▶ Executive Summary

Singapore has successfully built a robust, coordinated additive manufacturing (AM) ecosystem, underpinned by strong government support, a vibrant R&D landscape, and established "Peaks of Excellence". A 2025 industry survey reveals a maturing market where the majority of companies are deploying AM for end-use part production, driven by the need for greater design flexibility and on-demand manufacturing. Adopters report tangible benefits in product innovation and supply chain streamlining, fuelling strong optimism for the technology's future role.

However, the report identifies a critical gap between these operational gains and direct financial returns. The majority of adopters have yet to see significant revenue growth or new market expansion from their AM investments. This stems from a cycle of hesitation: adopters are cautious due to high initial costs and uncertain ROI, which in turn suppresses market demand for suppliers. Consequently, the supplier ecosystem is still transitioning from providing commoditised prototyping services to co-developing the validated, high-value solutions that industry requires.

To bridge this gap and unlock the full economic potential of AM, this report advocates for a clear strategic direction. The core principle is to focus Singapore's competitive advantage on a triad of superior capabilities: precision, agility, and circularity.

“

“AM embodies a fundamental shift toward a more resilient, innovative, and sustainable manufacturing paradigm, providing companies with the tools to shift the competitive battlefield from price to a triad of superior advantages: precision, agility, and circularity.”

This strategy operates on two fronts: deepening AM innovation and deployment in established industries like aerospace, semiconductors, and marine & offshore engineering, while simultaneously cultivating new growth frontiers in defence, biomedical applications, the new space economy, and environmental sustainability. Executing this requires a fundamental business pivot—from transactional product sales to consultative, solution-based partnerships, underpinned by deep capabilities in Design for Additive Manufacturing (DfAM). This strategy culminates in a powerful vision that builds upon Singapore's established position as a global manufacturing hub, which continues to see strong output growth. The goal is not merely to grow, but to evolve.

AM will ride on this momentum, enabling Singapore to elevate its value proposition as the trusted central orchestrator for global manufacturing by leveraging its world-class digital infrastructure, robust IP protection, and deep talent pool. This will secure Singapore's geostrategic relevance, drive sustainable economic growth, and establish its leadership in the next industrial era.

The Global Additive Manufacturing Landscape

Charting additive manufacturing's shift from rapid growth to strategic maturity

The global AM market is in a period of sustained growth, having evolved from rapid early adoption to a more strategic phase where companies are focused on refining processes and scaling proven applications.

AMPOWER reported that the overall industrial AM market, which includes metal and polymer equipment, materials, and part manufacturing services, was valued at US\$12.5 billion (EUR10.72 billion) in 2024, with a projected compound annual growth rate (CAGR) of 13.0 percent through 2029¹. Wohlers Associates reported a total AM market worth US\$21.9 billion in 2024, with a projected 10-year CAGR of 18.0%, reaching US\$115 billion by 2034². Despite the variation in reported current market size, there is consensus on the sector's growth trajectory.

Yet the true strategic advantage of AM lies beyond headline market figures. A significant share of the economic value resides in the broader ecosystem, which spans specialised design software and generative design, advanced materials science, sophisticated post-processing technologies, and rigorous part qualification and certification services. Together, these elements enable AM to deliver parts that are not only innovative but also reliable, certifiable, and ready for mission-critical industries.

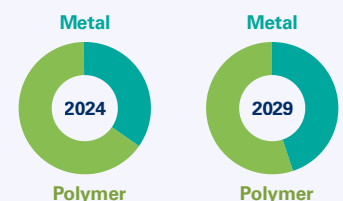
Appreciating this full spectrum is essential for any national strategy that aims to capture long-term value from AM investments and initiatives, as it highlights where innovation, capability building, and global competitiveness are truly forged.

Global AM Market:

US\$12.5B
Market size in 2024

13% CAGR
Projected growth
(2024-2029)

Market Share: Polymer AM vs. Metal AM

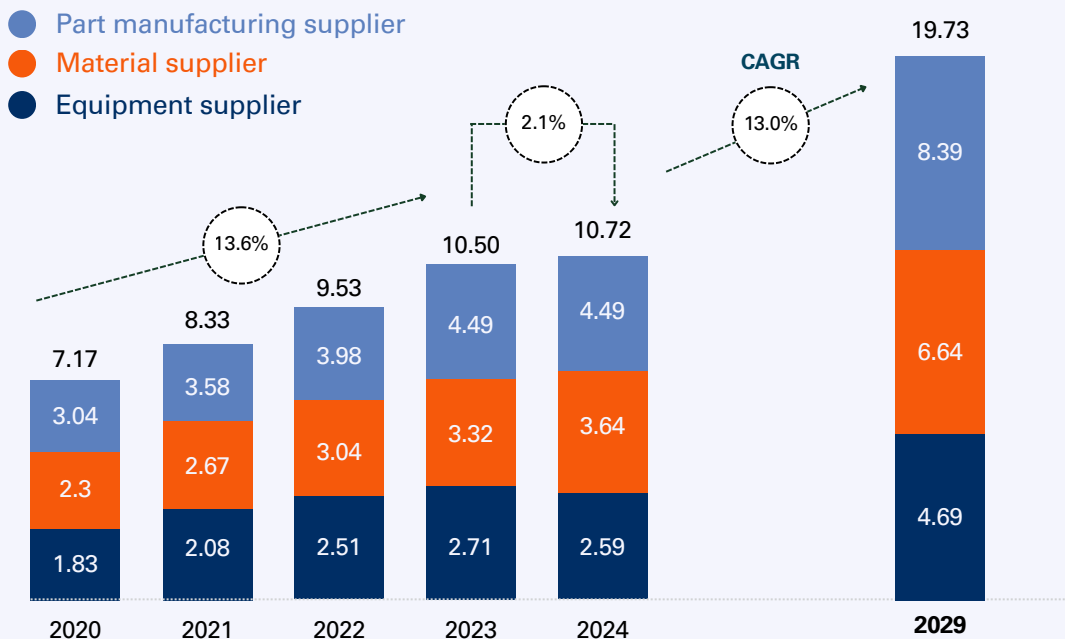




“AM has undergone a remarkable transformation over the past decade, evolving from a technology confined to prototyping into a critical enabler of industrial innovation. This shift has been driven by advancements in materials, processes, and applications, as well as by organisations that recognise the potential of AM to reshape industries and value chains.”

Matthias Schmidt-Lehr,
Managing Partner, AMPOWER

Global metal and polymer additive manufacturing market 2020 to 2024 and forecast 2029 [EUR billion]



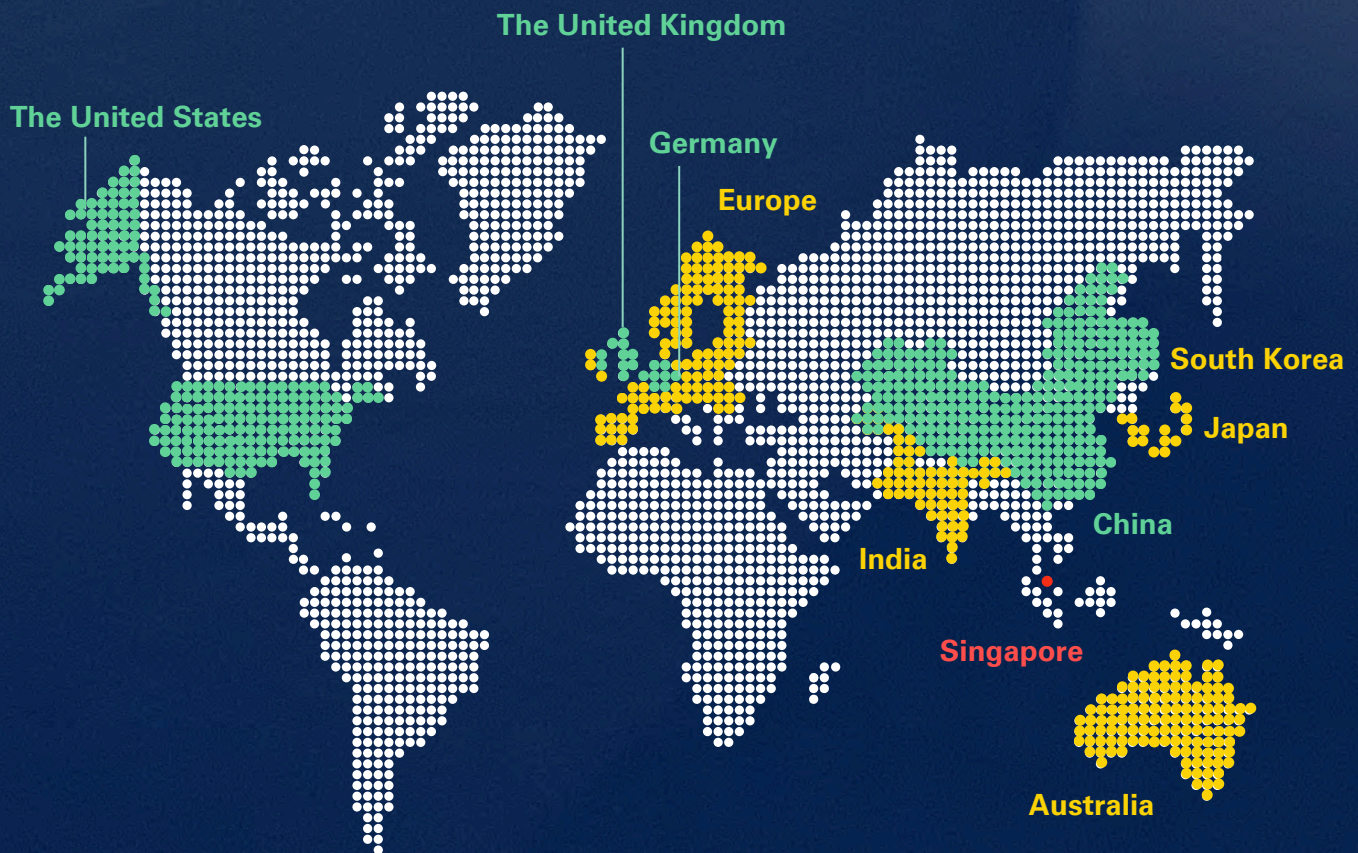
Data source: AMPOWER Report 2025
Source: AMPOWER

Source: additive-manufacturing-report.com
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Key Global Additive Manufacturing Hubs

● Key Global AM hubs

● Emerging AM hubs



“Singapore’s role as an entry point to the regional market is unique. The nation also builds on its strong traditions in maintenance, repair, and overhaul (MRO), as well as precision engineering, which are natural adopters of AM and stand to benefit greatly from the technology.” — **Matthias, AMPOWER**



► Key Global Additive Manufacturing Hubs

The United States

The United States has taken a proactive role in advancing its AM ecosystem through a demand-pull strategy designed to strengthen national supply chains. By leveraging its vast industrial base and R&D network, the U.S. continues to lead globally in AM system installations and machine sales.

Central to this leadership is the public-private partnership model. *America Makes* (est. 2012) has become the national hub, bringing together industry, academia, and government to advance AM technologies, expand workforce training, and manage a broad portfolio of projects aligned with national priorities. Building on this, the *AM Forward* initiative launched in 2022 to connect large OEMs with smaller suppliers. Companies such as GE Aviation, Lockheed Martin, Honeywell, and Boeing have committed to purchasing AM parts from local U.S. SMEs and suppliers, while also providing technical support and driving common industry standards to reduce adoption risks³.

The Department of Defense has further underscored AM's strategic importance. Its official AM Strategy (DoDI 5000.93) seeks to integrate the technology across the defence industrial base, enabling on-demand spare parts, mitigating obsolescence, and fostering innovative, field-ready solutions⁴.

Germany

Germany has established itself as Europe's powerhouse in AM by deliberately embedding the technology into its renowned industrial engineering base. Backed by strong government initiatives such as the High-Tech Strategy 2025 and Industrie 4.0, the country has prioritised R&D commercialisation and the integration of AM into fully digitalised industrial production systems.

This effort is supported by Germany's world-class research and innovation ecosystem, led by institutions such as the Fraunhofer institutes and regional clusters including Bavaria Makes and the Industrialised Additive Manufacturing Hub Hamburg (IAMHH).

A prominent example is the Industrialisation and Digitalisation of Additive Manufacturing (IDAM) project, a consortium comprising the Fraunhofer Institute, BMW, and twelve German SMEs. The project successfully established two digitally networked, fully automated AM production lines, capable of producing at least 50,000 components and 10,000 spare parts annually using cost-efficient laser powder bed fusion technology⁵.

The industrialisation of AM in Germany is also reflected in the automotive sector. In 2023 alone, the BMW Group produced more than 300,000 parts at its dedicated Additive Manufacturing Campus, with a further 100,000 parts manufactured across its global production network⁶.

The United Kingdom

The UK government recognises the importance of AM in the context of reducing dependence on foreign imports and boosting domestic manufacturing capacity.

The UK Modern Industrial Strategy 2025, launched in June, allocates £4.3 billion in investment across sectors such as aerospace, automotive, and agricultural technology, with particular focus on AM to support the government's wider aim of reducing reliance on international supply chains.

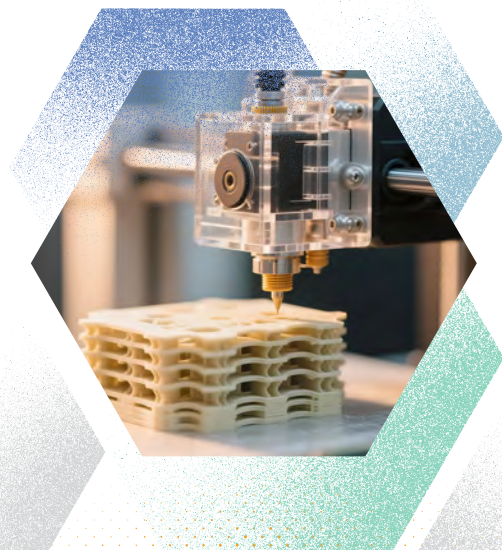
Business investment in advanced manufacturing, including 3D printing, is expected to nearly double, reaching £39 billion annually by 2035, up from £20 billion in 2025. The Made Smarter Innovation (MSI) programme, with government investment of £29 million annually through 2030, delivers collaborative R&D projects in Industrial Digital Technologies, explicitly including 3D printing, to develop novel digital solutions and enhance supply chain resilience⁷.

This national focus is echoed in defence. The UK Ministry of Defence's first *Defence Advanced Manufacturing Strategy*, released in March 2025, underscores the growing role of AM in building supply chain resilience. Key benefits include dispersed supply networks, faster response times, shorter lead times, access to previously obsolete parts, and improved environmental and operational sustainability⁸.

Europe

Beyond national strategies, significant pan-European efforts actively coordinate and advance AM adoption. The European Commission robustly supports AM through substantial funding programs like Horizon Europe and partnerships including "Made in Europe" and "Factories of the Future." Initiatives like the targeted "3DoP" (3D Printing Optimised Production) project specifically help SMEs access cutting-edge 3D printing technologies to test and validate their innovations.

The European Association of Manufacturing Technologies (CECIMO), representing ten national associations, has launched a manifesto calling for a unified European AM strategy. Its recommendations include creating a dedicated public-private body for coordination, aligning public investment to reduce duplication, integrating AM into emergency response infrastructure, and strengthening workforce development⁹.





Mega 3D printing service bureau in Shenzhen, China

China

China's approach to AM sits firmly within its wider and highly ambitious "Made in China 2025" (MIC2025) industrial strategy.

At its core, MIC2025 seeks technological self-sufficiency and reduced reliance on foreign technologies. To achieve this, the plan sets explicit milestones for boosting the domestic content of core components and materials: 40% by 2020 and 70% by 2025.

Nearly a decade on, independent analyses suggest these ambitions have largely borne fruit. Research by Bloomberg Economics and Bloomberg Intelligence highlights China's strong gains in electric vehicles (EVs), automotive software, and lithium battery technology, making remarkable progress across several advanced industries. AM has been no exception. Since the launch of MIC2025 in 2015, China's share of global 3D printer exports has climbed from just under 15% to more than 20% in 2023, alongside other high-tech goods¹⁰.

According to the AMPOWER Report 2025, over 50 Chinese AM companies each generated revenues exceeding RMB100 million in 2024; clear evidence of the commercial scale and growing global relevance in the AM market.

Alongside the leading AM hubs, several countries are strengthening their positions by tailoring AM to their specific industrial priorities.

In **Japan**, the technology is making a gradual shift from research into practical applications for production in niche areas. Under its 2024 Space Strategy Fund, the Japan Aerospace Exploration Agency (JAXA) selected Nikon SLM Solutions to develop large-scale metal 3D printing for next-generation rockets. Building on this momentum, Nikon opened a dedicated AM Technology Centre in 2025, equipped with state-of-the-art metal printers to support aerospace and defence R&D.

South Korea has also emerged as a leader, holding the third-largest installed base of AM systems in the Asia-Pacific region. By 2022, it accounted for about 4.1% of all systems worldwide, and became the first country in Asia to officially validate and deploy metal AM technology within its military logistics operations^{11,12}.

India is executing its National Strategy for AM through government-backed pilots in aerospace, space, and healthcare, laying the groundwork for a broader national ecosystem.

Australia recent investment in dedicated research centres like the Additive Manufacturing Cooperative Research Centre (AMCRC) has attracted support from major companies and local SMEs. The AMCRC is a AU\$270 million partnership between universities, industry, and government, focused on leveraging AM to transform the nation's manufacturing sector.



“We believe that Singapore’s future lies in creating defensible niches by embracing innovation and sustainable industrialisation enabled by AM. Our focus must be targeted, deepening capabilities in key sectors while pioneering new frontiers in high-potential and emerging sectors. Our role as a national enabler is to be the interlocutor and catalyst for this transformation: connect innovators with industry, de-risk the arduous journey from R&D to commercialisation, and foster the deep, collaborative partnerships that are essential for sustainable success.” — **Dr. Ho Chaw Sing, NAMIC CEO**



Singapore’s Additive Manufacturing Journey

Singapore's Additive Manufacturing Journey

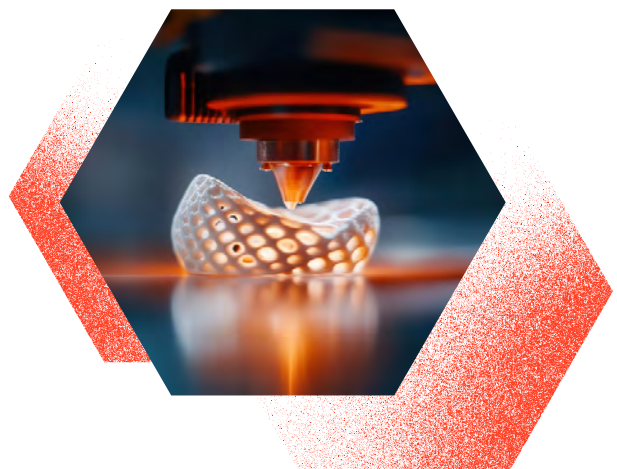
Singapore has long recognised advanced manufacturing as a cornerstone of its industrial growth, vital for boosting productivity and maintaining the nation's competitive edge amid shifting global supply chain dynamics. In 2024, Singapore's manufacturing output rose by 3.0%, from S\$411.2 billion in 2023 to S\$423.6 billion¹³. To establish its position as a global manufacturing hub, the government has committed to harnessing advanced technologies to digitally transform and automate factory operations. This strategic focus enables manufacturers to optimise entire value chains, achieving higher productivity, greater yields, and enhanced resilience.

Within this framework, AM stands out as a key horizontal technology. Together with Artificial Intelligence (AI), the Internet of Things (IoT), robotics, and data analytics, it is reshaping production and supply chains through intelligent, connected, and agile systems: driving efficiency, flexibility, and sustainability across industries.

Singapore's AM journey began with a clear strategic vision. Recognising the disruptive potential of 3D printing early on, the government and institutions invested heavily in building a vibrant ecosystem from the ground up. In 2013, Singapore committed S\$500 million under its "Future of Manufacturing" scheme, a move that led to the creation of the National Additive Manufacturing Innovation Cluster (NAMIC)¹⁴.

Over the past decade, Singapore's commitment to AM has continued to evolve, characterised by a dynamic interplay of government policies, a thriving Research, Innovation, and Enterprise (RIE) ecosystem, and responsive alignment with both regional and global technological trends. It has sustained its investments in RIE at about 1% of Singapore's GDP.

"NAMIC has been central to Singapore's journey in this field. By fostering collaboration between research, industry, and government, it has positioned Singapore as a dynamic hub for AM in Asia and beyond. Its efforts in supporting research, building ecosystems, and enabling commercialisation ensure that innovation translates into industrial impact." — **Matthias, AMPOWER**





AM innovation in Singapore and Peaks of Excellence

Singapore has cultivated a leading regional hub for AM through a unified national framework anchored by world-class research, focused industrial deployment, and strong government backing for commercialisation. Within this tightly woven ecosystem, NAMIC serves as the connector between academia and industry, funding more than 400 translational projects and advise the development of standards that guide the field. This coordinated approach lowers the risks associated with innovation, builds national cohesion, and strengthens competitiveness. Underpinning it all are research institutions with distinct yet complementary strengths: Singapore’s “Peaks of Excellence” in AM innovation – interconnected pillars that are continuously validated by a strong record of published high-impact scientific articles, successful industry adoption, driven by over 60 Singapore-based scientists who rank among Stanford University’s list of the World’s Top 2% Scientists. The table below highlights these core competencies, partner institutions, and application areas.

Singapore’s AM Innovation Peaks of Excellence

Additive Manufacturing Design Methodologies		
Partner Institution	Key Capability / Technology	Key Application Area
A*STAR, NUS	Development of Design for Additive Manufacturing (DfAM) methodologies & tools	Lightweighting, parts consolidation, enhanced functionality
NUS	Software-generated additive manufacturing lattice design	Medical implants, heat exchangers
A*STAR	Methods for 4D additive manufacturing	Smart devices, medical devices

Materials for Additive Manufacturing		
Partner Institution	Key Capability / Technology	Key Application Area
NTU, A*STAR	Material development for high-value applications (e.g. crack-free aluminium 6061, high-entropy alloys, etc.)	Aerospace, marine, energy, defence
NTU	Printed complex-shaped transparent spinel ceramics	Optics, defence
SUTD	Freeform printed silicones	Soft robotics, medical devices

Integrated Digital Solutions		
Partner Institution	Key Capability / Technology	Key Application Area
A*STAR	Digital and AI-driven manufacturing solutions (e.g. iTwin: AI-embedded knowledge-based monitoring)	Process control, qualification, real-time quality assurance for metal additive manufacturing
A*STAR	Additive manufacturing process simulation (PBF, DED, DLP)	Design validation, defect prediction
NUS, NTU	AI for bioprinting process optimisation	Regenerative medicine

Additive Manufacturing Process		
Partner Institution	Key Capability / Technology	Key Application Area
A*STAR, NTU, SUTD	Large format printing (AI-hybrid WAAM, DED)	Marine and offshore parts, MRO, defence
A*STAR, NTU, SUTD	Micro/Nano-scale high precision additive manufacturing (Micro-SLM, femtosecond laser)	Photonics, micro-optics, electronics

3D Printing for Biotech and Medtech		
Partner Institution	Key Capability / Technology	Key Application Area
NUS, NTU, A*STAR	Biomedical products & bioprinting processes	Tissue engineering, implants, drug testing
A*STAR, NTU, NUS	Patented 3D printed bioscaffolds and novel bio-inks	Regenerative medicine

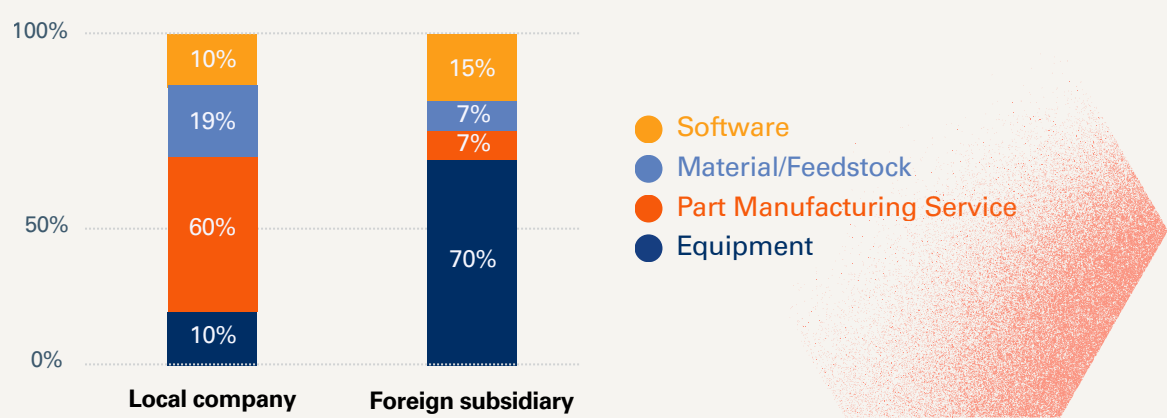
3D Printing for Sustainable Built Environment		
Partner Institution	Key Capability / Technology	Key Application Area
NTU, NUS	Concrete 3D printing process and material development	Sustainable construction
NTU	Use of recycled materials and CO ₂ injection	Green buildings, decarbonisation

Singapore serves as a hub for AM activities in the Southeast Asian region. According to the AMPOWER study, Singapore acts as an Asian hub for one-third of all AM equipment manufacturers from the US and Europe. This strong position presents high potential for further growth of AM activities and ensures local access to technology and expertise. Five of the world's top ten AM players have established local subsidiaries in Singapore. Their presence reflects the country's broad AM ecosystem, which spans equipment suppliers, part manufacturing services, materials, and software, and signals that Singapore's comprehensive landscape and growth opportunities make it an attractive base for leading AM players.

Presence of Top 20 AM Equipment Suppliers in Singapore



Singapore AM Landscape



The AMPOWER study also reveals Singapore's broad AM landscape, comprising approximately 150 entities that span equipment, part manufacturing services, materials, and software suppliers. Most local AM players concentrate on providing part manufacturing services (AM service bureaus) to adopters. Local subsidiaries of foreign AM entities are primarily hardware-focused, supplying equipment to domestic adopters while leveraging Singapore as a hub to expand sales across the Asia Pacific region.

The State of Additive Manufacturing in Singapore: Additive Manufacturing Industry Outlook 2025

As Singapore solidifies its position as a global hub for advanced manufacturing, AM has emerged as a key technology driving innovation, resilience, and competitiveness across industries. The Additive Manufacturing Industry Outlook 2025 survey was conducted to move beyond anecdotal evidence and capture a precise, data-driven snapshot of the current state of the AM activities in Singapore. The survey's detailed objectives and methodology are outlined in Annexe A.

This survey gathered insights from 75 companies within the Singapore AM ecosystem, with more than 70% of the companies surveyed having over five years of experience in AM.



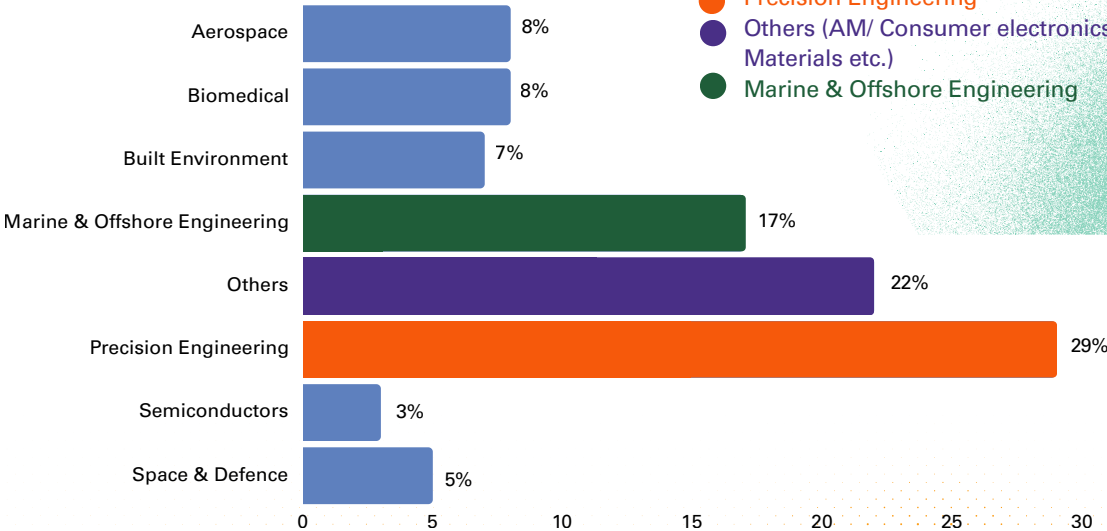
Respondent Demographics

- 37% AM adopters
- 63% AM suppliers



- 39% MNCs
- 33% SMEs
- 17% Startups
- 11% LLCs

Primary Industries



Top 3 Industries:

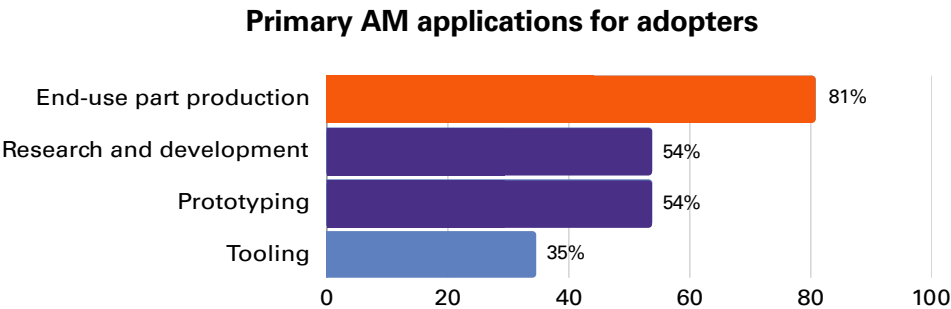
- Precision Engineering
- Others (AM/ Consumer electronics/ Materials etc.)
- Marine & Offshore Engineering



The Additive Manufacturing Adopter’s Perspective: From Prototypes to Production

AM adoption in Singapore has progressed from early exploration to more strategic deployment, driven by three main factors: the need for greater design flexibility and complexity, the pursuit of cost reduction, and the demand for on-demand, low-volume production. These drivers consistently shape how companies are applying the technology today.

End-use part production is at the forefront, particularly in applications where AM delivers clear advantages over conventional methods. This includes high-value uses such as complex geometries that are difficult to machine or mould, opportunities for mass customisation, and part consolidation. AM is also increasingly viewed as a way to strengthen supply chains, enabling resilience through digital inventories and localised production.



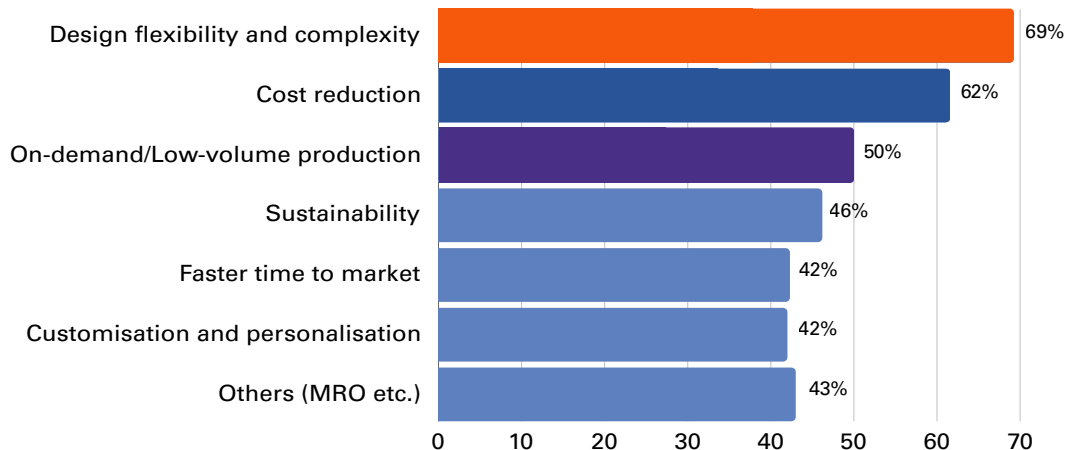
Survey data reinforces these priorities. Over 80% of Singapore-based adopters cited end-use part production as their primary application, underscoring its role in enabling product innovation and differentiation. More than half also reported using AM for research, development, and prototyping, reflecting its dual role as both a practical manufacturing solution and an innovation platform.

For AM to scale further, however, economic viability is critical. The push for cost reduction reflects a clear demand for tangible benefits—whether by eliminating expensive tooling, minimising material waste, or lowering inventory costs. Taken together, this balance of innovation, efficiency, and agility explains why 75% of adopters believe AM holds strong potential as a solution to ongoing supply chain challenges, anchoring its place in Singapore’s manufacturing strategy.



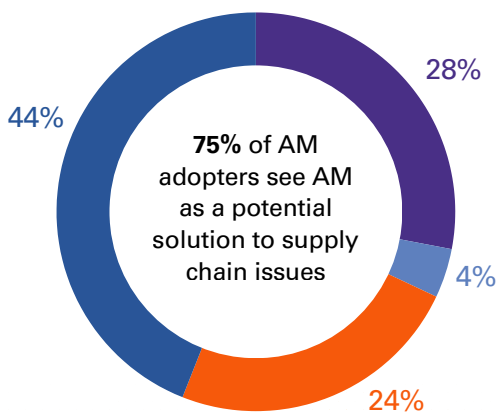
Left: Large Format Printing Platform Solution—Hybrid Wire Arc Additive Manufacturing (WAAM) system at SUTD

Key Drivers for AM adoption



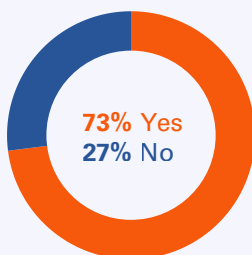
Does the organisation see AM as a potential supply chain solution?

- 24% Yes, significantly
- 44% Yes, moderately
- 28% No, not significantly
- 4% No, not at all

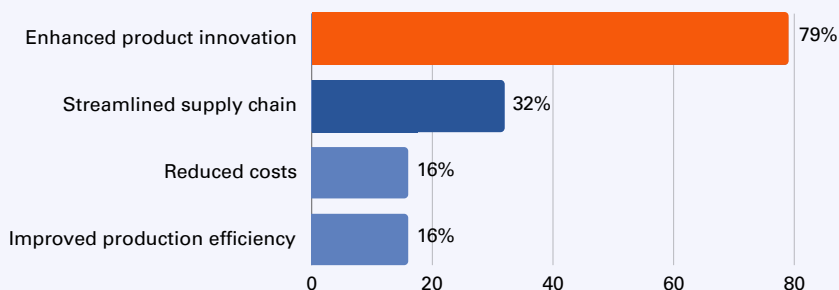


The adoption of AM in Singapore is delivering clear and significant value, where a compelling 73% of adopters confirm that the adoption has already made a tangible impact on their organisations.

Has AM adoption made an impact in your organisation?



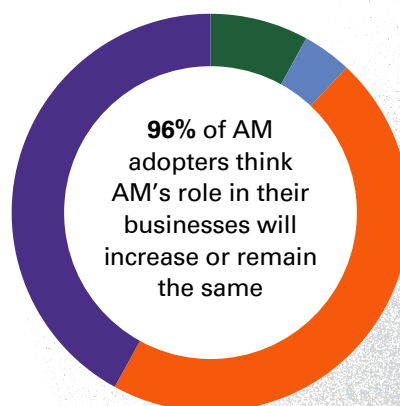
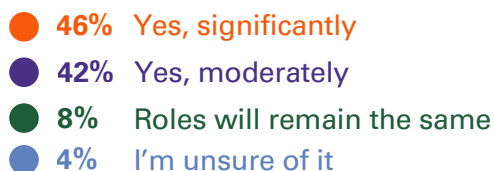
If yes, what are the significant impacts of AM adoption?



The most significant benefit, cited by nearly 80% of adopters, is enhanced product innovation, which demonstrates AM's ability to unlock novel designs and accelerate development cycles. Another 32% highlighted its role in streamlining supply chains, a critical advantage in today's volatile global landscape. These impacts are not only delivering immediate value but also shaping strong confidence in AM's future.

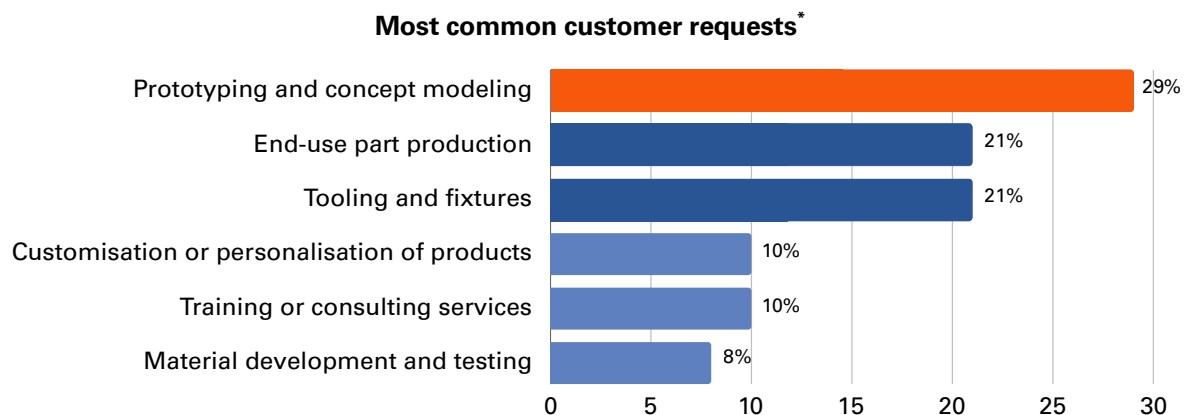
Looking ahead, 46% of adopters expect AM's role within their organisations to increase significantly over the next three to five years, while another 42% anticipate a moderate rise. Together, these figures reflect a technology that has clearly moved beyond the experimental stage and is now embedding itself as a core driver of both innovation and operational strategy.

In the next 3-5 years, do you foresee AM playing an increased role in your organisation?



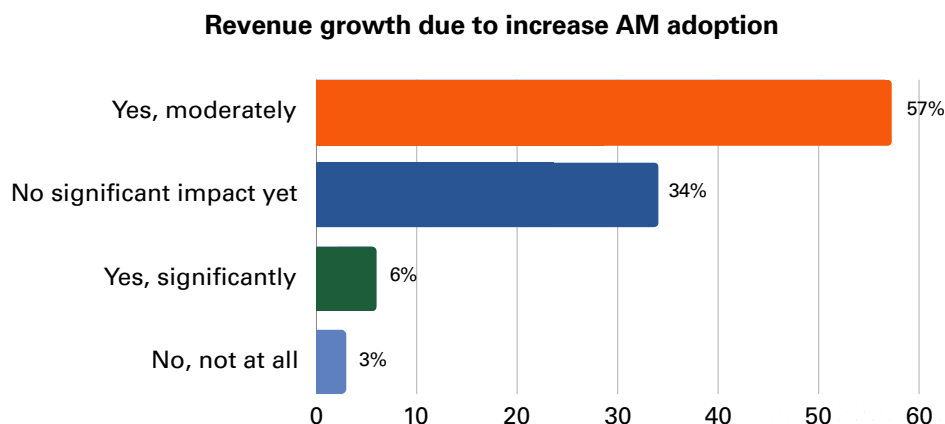
The Supplier's Perspective: A Market in Transition

The service and technology supplier landscape in Singapore reflects a market in transition, balancing foundational applications with rising demand for industrial-grade solutions. Prototyping and concept modelling continue to serve as the primary entry point for many customers, with nearly 30% of suppliers citing it as the most common service request. Meanwhile, end-use part production and the creation of tooling and fixtures were each reported by 21% of suppliers as frequent areas of demand.



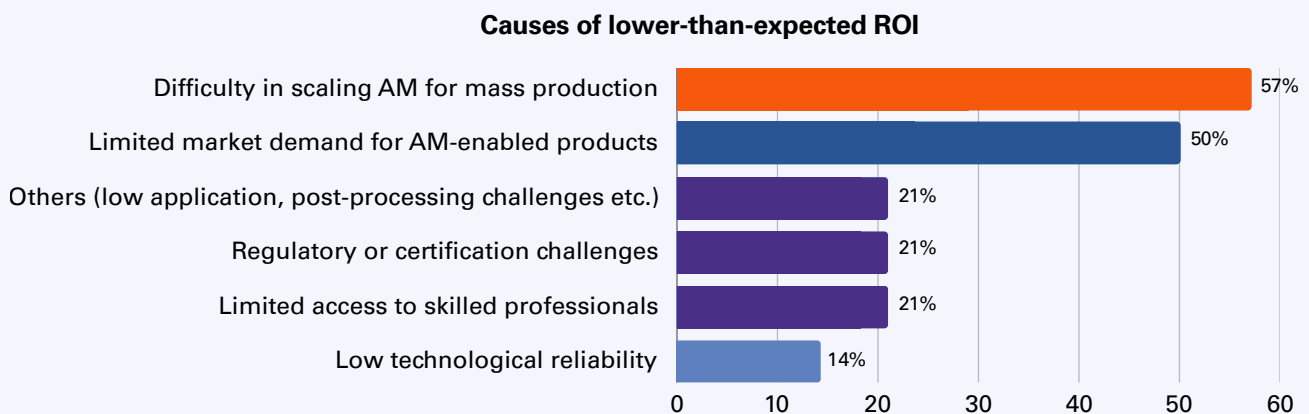
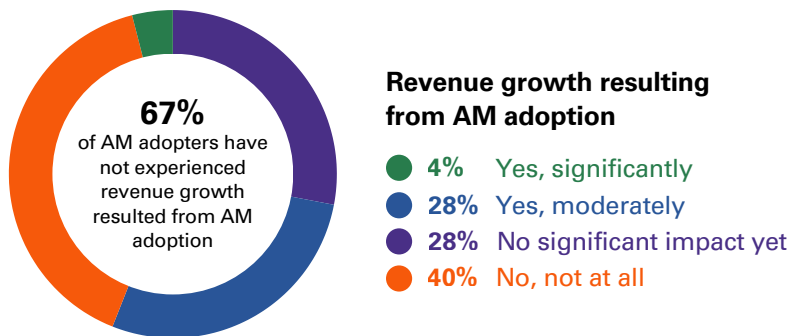
**Figures do not sum to 100%, because of rounding*

This evolving demand is already translating into business growth, with a majority of suppliers (57%) reporting a moderate rise in revenue as AM adoption expands across the market. Although the service sector is on a healthy growth trajectory, the path to sustained and substantial revenue acceleration remains a work in progress for many suppliers.



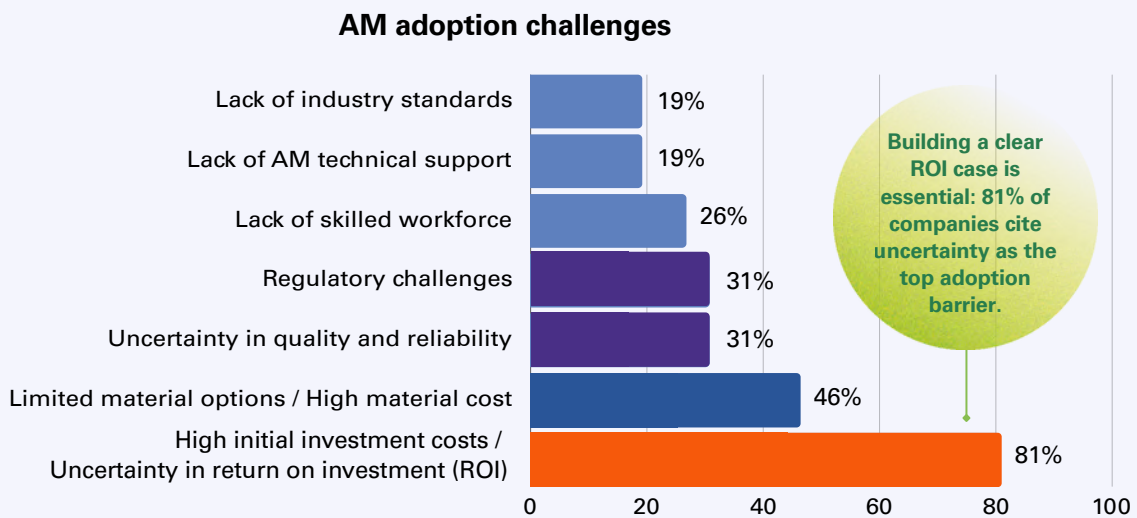
Key Challenges in Additive Manufacturing

Despite adopters reporting positive outcomes and strong optimism for AM, only slightly over 30% indicated measurable revenue growth of 10% or more as a result of adoption. This underscores a critical gap between operational improvements and direct financial returns. Nearly 60% of adopters have not seen notable gains from new market expansion or business opportunities linked to AM. In response, many cited difficulties in scaling AM for mass production and limited market demand for AM-enabled products as the main reasons for lower-than-expected ROI.



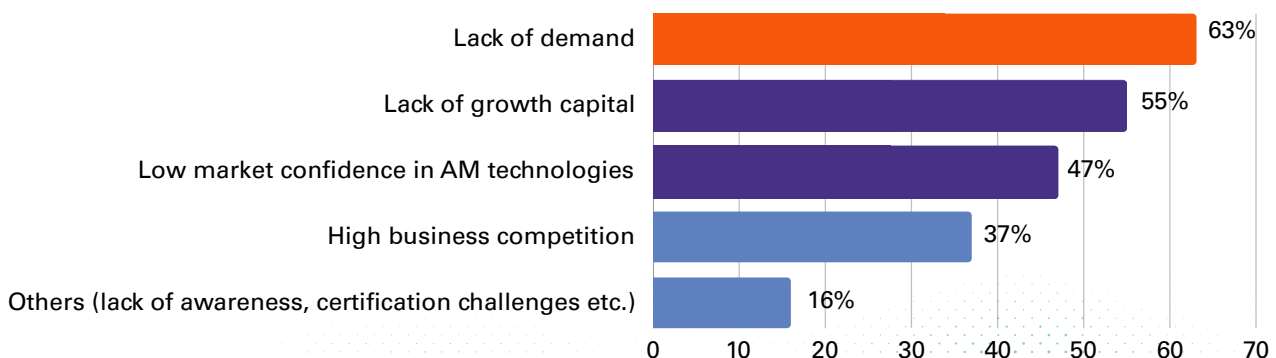
While AM is enabling new design possibilities and efficiencies, widespread monetisation of these gains, through new products, markets, or cost savings that translate into revenue, is still in its early stages. Bridging this gap will be essential for accelerating adoption at scale and demonstrating the full economic value of AM to Singapore's industries.

When asked about the challenges of AM adoption, an overwhelming majority of respondents (over 80%) pointed to high initial investment costs and uncertainty around return on investment (ROI) as the primary hurdles. This financial pressure is compounded by material constraints, with 46% citing limited and high-cost material options as barriers to adoption and scaling. Around 30% of adopters also expressed concerns about quality and reliability, while many highlighted regulatory requirements as a key obstacle, underscoring that certifying and deploying production-ready parts remains a significant challenge.



Conversely, AM suppliers face a critical market-side challenge, with over 60% citing weak demand as the main obstacle to expansion, followed by limited growth capital (55%). This creates a challenging feedback loop: adopters' caution over uncertain ROI limits uptake, which in turn suppresses demand for suppliers.

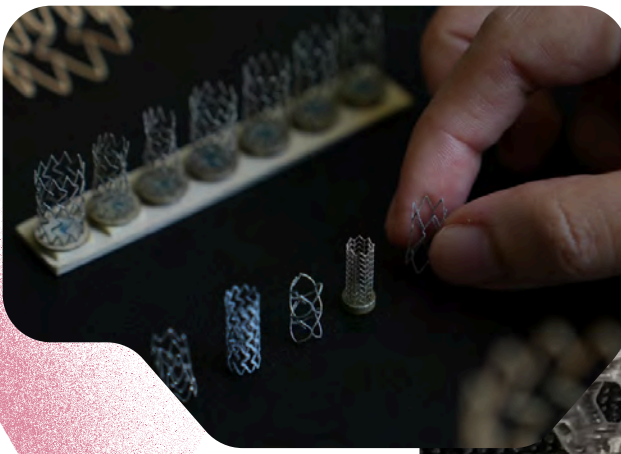
AM suppliers' challenges in expanding their business with AM



The data reveals a significant opportunity: while most adopters intend to additively manufacture end-use parts, fewer than 30% of suppliers reported this as the most common customer request.

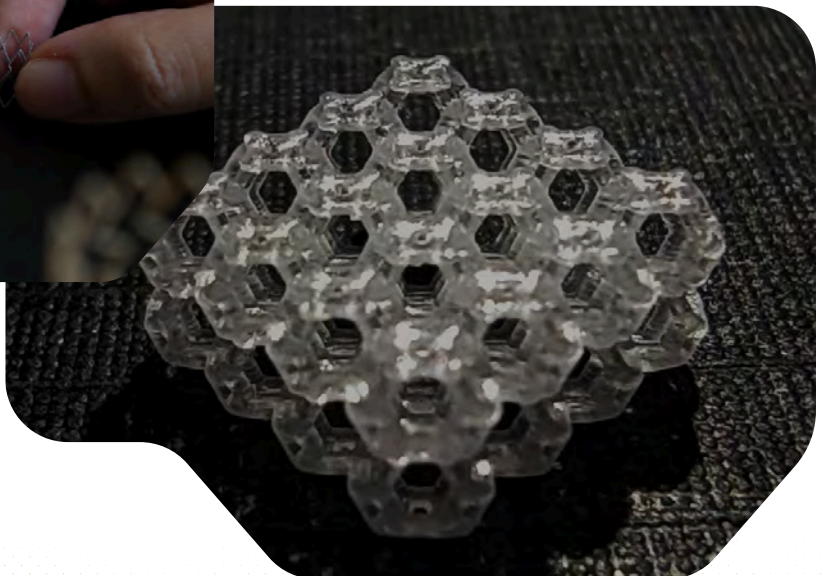
Unlocking substantial business growth will require suppliers to move beyond being passive service providers and become proactive solution partners who directly address customer challenges. **To overcome concerns about uncertain ROI, suppliers must shift their sales approach from quoting price-per-part to presenting a comprehensive business case. This includes engaging customers to identify high-value applications where AM's unique benefits deliver measurable cost savings or performance improvements.** With adopters also citing a lack of confidence in quality and reliability, suppliers need to invest in and promote their quality assurance capabilities, underpinned by robust validation processes that meet stringent industrial standards.

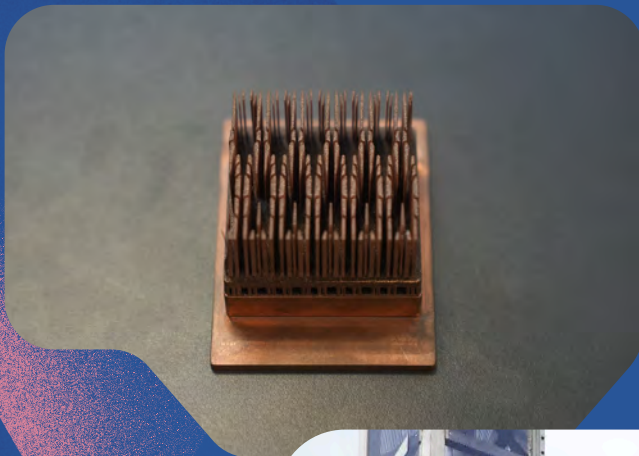
For AM to truly scale in Singapore, the ecosystem must collectively lower the barriers to entry, build market confidence, and stimulate demand to create a self-sustaining cycle of investment and growth. By shifting from a transactional model centred on prototyping to a solution-oriented approach that tackles customers' most pressing financial and technical challenges, suppliers can unlock latent demand for end-use parts and achieve the revenue acceleration they are seeking.



Above: 3D Printing for Biotech and Medtech—AM-enabled heart stent design with shape-memory function developed by AM.NUS

Below: 3D-printed spinel ceramic structure by NTU, measuring just 5 mm across.





*Left: AM Design Methodologies
—AM lattice design for a hybrid
heat sink by AM.NUS*



*Right: Concrete Printing-
First on-site 3D concrete
printing (3DCP) in
Singapore by Woh Hup
(Private) Limited*



*Left: AM Process-Printed
parts using A*STAR SIMTech
developed micro-LPBF*

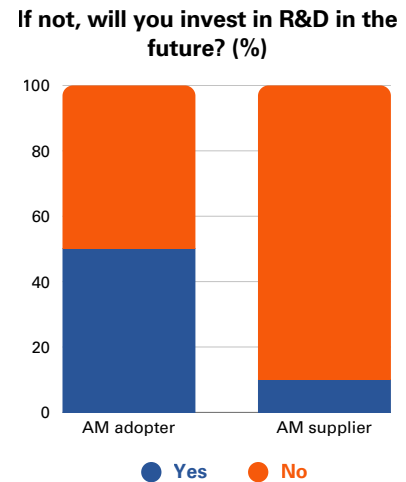
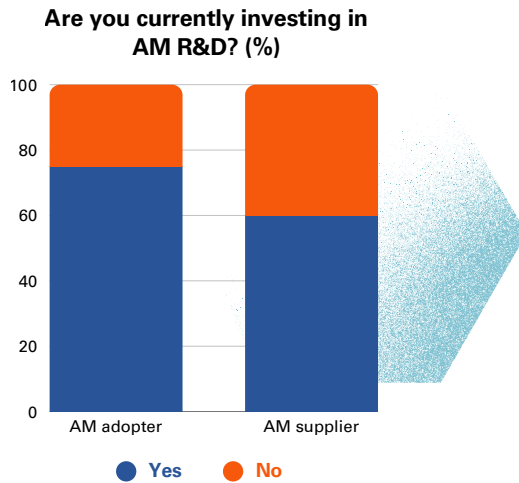
Business R&D Activities in Additive Manufacturing and Ecosystem Support

For both adopters and suppliers to fully unlock the value of AM, a strong commitment to innovation is essential. Accelerating AM, a central mission for ecosystem enablers like NAMIC, requires companies to reinforce innovation with tangible financial investments in R&D. To measure the scale of this commitment, the survey examined both current and projected R&D spending, providing a clear picture of how organisations are investing today to power the next wave of AM-enabled growth.

The results are encouraging on the adopter side, with more than 85% already investing, or planning to invest, in R&D. This demonstrates a growing readiness among end-users to push technological boundaries. On the supplier side, however, a significant share are not yet engaging in R&D and have no immediate plans to do so. Over 80% of these suppliers cited limited funds and uncertainty around ROI as their main barriers.

This gap presents both a challenge and an opportunity. R&D is the critical pathway for suppliers to evolve from providing products and services to becoming trusted solution partners. Without innovation, suppliers risk commoditisation and competing primarily on price. Yet those that embrace R&D will be well-positioned to capture greater value, particularly as adopters increasingly demand sophisticated and validated solutions for end-use parts. As Singapore's AM ecosystem continues to mature, addressing this R&D gap will be crucial. By encouraging more suppliers to invest in innovation, the ecosystem can strengthen its long-term competitiveness, foster deeper collaborations, and accelerate the industrialisation of AM.

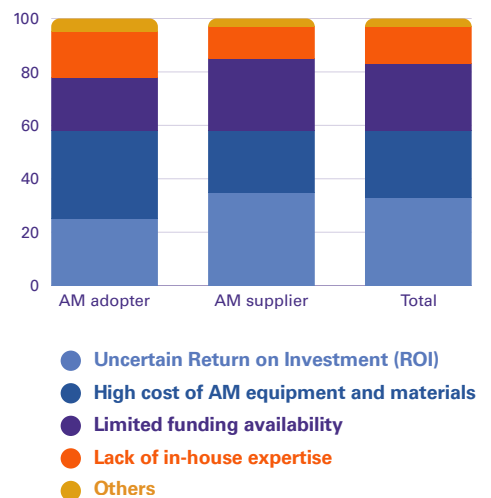




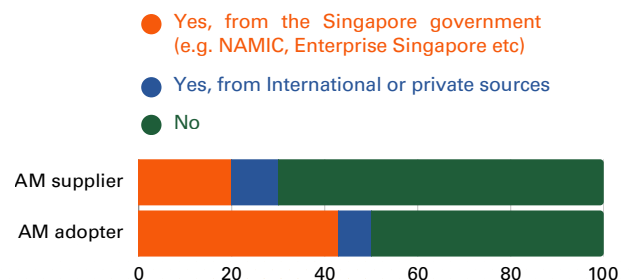
R&D investment in Singapore's AM ecosystem reflects a clear priority: companies are leveraging the technology as a driver of innovation and value creation. New product development is the main focus, cited by 39% of respondents, with firms using AM to create products beyond the reach of traditional methods. Process optimisation follows at 16%, signalling a shift toward industrialisation. As companies succeed in developing novel products, the next challenge is producing them reliably, repeatedly, and cost-effectively at the required scale. Barriers to R&D differ between adopters and suppliers. For adopters, the main hurdle is the high cost of equipment and materials (over 30%), creating a capital barrier to accessing industrial-grade machinery and advanced materials. For suppliers, the greater concern is uncertainty in ROI (nearly 40%), reflecting the risk of investing in R&D without clear market demand.

This disparity is also seen in funding: nearly 70% of suppliers have not received external R&D support, compared with 50% of adopters. While these challenges are real, they also highlight where targeted support, partnerships, and policy intervention can make the greatest difference—reducing capital barriers for adopters and de-risking innovation for suppliers. Addressing these gaps will broaden R&D participation and accelerate Singapore's journey from innovation to industrialisation.

Challenge in resource allocation in R&D



Did you receive AM-related R&D funding?



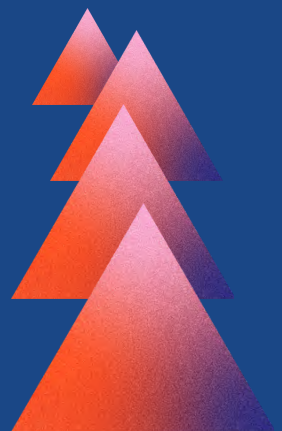
Navigating the Macro Environment and Future Outlook



“AM is a powerful technology that de-risks supply chains and fosters high-value economic growth by facilitating a shift from fragile, cost-optimised global networks to resilient, risk-mitigated local production.”

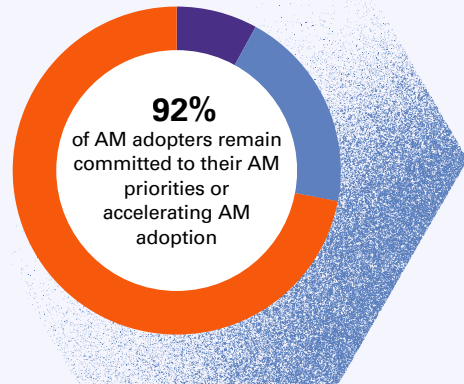
The global economic environment of 2025 is marked by deceleration and heightened uncertainty, driven by escalating trade barriers and geopolitical frictions. The World Bank projects global GDP growth to slow to 2.3% in 2025, a significant downgrade from earlier estimates, with risks tilted to the downside. The International Monetary Fund (IMF) offers a similarly cautious view, forecasting growth at 3.0% while citing persistent risks from higher tariffs, prolonged uncertainty, and ongoing geopolitical tensions^{15,16}. In this environment, the pursuit of economic resilience has become a paramount objective for nations worldwide.

Amid these headwinds, Singapore's economy has shown notable resilience, particularly in the first half of 2025. GDP expanded by 4.4% year-on-year in the second quarter, building on 4.1% growth in the previous quarter¹⁷. Within this context, the AM ecosystem reveals a more complex picture: companies are contending with operational challenges yet remain optimistic about AM's unique potential to address them. When asked about the impact of current economic and geopolitical conditions, respondents most frequently cited rising costs. Inflation, tariffs, and trade restrictions are pushing up expenses for raw materials, energy, and equipment, directly fuelling capital investment hesitancy. Companies and their customers are becoming more cautious, with some reporting that clients are “cutting back on R&D budgets” and adopting a “wait-and-see approach.” Respondents also highlighted intensified competition from Chinese OEMs and the widening price gap, which is putting significant pressure on local suppliers to stay cost-competitive despite higher domestic operating costs.



Effects of geopolitical and economy situations on AM priorities (AM adopters)

- **72%** No, priorities remain unchanged
- **20%** Yes, accelerating AM adoption to improve resilience
- **8%** Yes, shifting away from AM adoption to focus on cost-saving measures



Despite the looming uncertainty and challenges, a resounding 92% of adopters remain firmly committed to AM, reflecting a long-term belief in the technology.

In the context of the prevailing macroeconomic environment, the collective feedback from Singapore's AM ecosystem, as indicated by the survey, highlights the importance of DfAM skills, which are crucial for developing innovative, high-value products that justify the investment. Furthermore, there is a strong and consistent call for deeper collaboration and ecosystem engagement for knowledge sharing, adoption derisking, and solution co-development. There is a collective understanding that the path to widespread AM adoption requires a realistic focus on commercially viable use cases to bridge the persistent gap between advanced R&D and impactful industrial implementation.

When asked about the most relevant emerging trends, the industry's focus is clear. The data shows a primary ambition to scale AM technology for broader industry use, amplified by parallel advancements in AI and materials science. There is a growing demand to make AM a viable technology for large-scale industrial applications and mass production, driven by hardware and software advancements in technologies like robotic wire arc additive manufacturing (WAAM) and high-speed, multi-material printing.

The industry expects these innovations to deliver faster printing speeds, larger build volumes, and higher throughput, which will bring down the cost-per-part. There is also a notable optimism regarding the integration of AI and automation into the AM workflow, encompassing AI-driven generative design, adaptive toolpath generation, and predictive failure analysis.

Strategic Focus Areas for Singapore's Additive Manufacturing Ecosystem

Singapore's AM strategy is not a broad, untargeted effort but a focused drive in high-value industries where the technology's unique strengths can deliver defensible global leadership. To maximise impact, Singapore is concentrating on industries where it already holds a competitive edge and where AM can directly address critical challenges. This approach aims to deepen strengths in established economic pillars while cultivating new frontiers in emerging, high-potential industries.

Aerospace illustrates this clearly. As a top-tier hub for aircraft maintenance, repair, and overhaul (MRO)—contributing 10% of global output and recording 16% year-on-year growth¹⁸—Singapore is well positioned to lead in AM adoption. Long lead times and high inventory costs for aircraft spare parts are persistent hurdles for MRO providers. AM offers the potential to produce certified, flight-worthy components locally, helping to mitigate supply chain vulnerabilities, reduce aircraft-on-ground (AOG) time, and design lighter components that improve fuel efficiency.

Semiconductors form another strategic pillar. Singapore is a critical node in the global semiconductor industry, with capital-intensive fabrication plants operating 24/7 and accounting for about 6% of GDP¹⁹.

Here, AM strengthens resilience by enabling on-demand and localised production of new or replacement equipment parts. It also improves system performance and functionality through DfAM.

The maritime industry has also been a priority, reflecting Singapore's position as the world's busiest transshipment hub, with priorities in enhancing port efficiency, digitalisation, and decarbonisation²⁰. AM initiatives began in 2019 with the Joint Industry Programme (JIP) between NAMIC and the Maritime and Port Authority of Singapore (MPA), which tested the feasibility of AM for marine components.

Now in Phase 3, the programme is scaling the digitalisation of designs and parts, accelerating qualification and certification of additively manufactured components, and applying DfAM to support the transition to electric vessels²¹. These initiatives position Singapore to evolve from a transshipment hub into a digitally enabled, high-value maritime services hub.

In land transport, AM applications extend to producing obsolete or customised parts for Singapore's extensive public transport infrastructure, enhancing maintenance, efficiency, and operational readiness.



Beyond reinforcing core industries, it is equally important to cultivate new growth areas where demand for AM is rising. Such demand is driven by AM's unique ability to create value where traditional manufacturing cannot: enabling mass personalisation and customisation, producing highly complex geometries with advanced materials, and supporting the shift toward sustainability and circularity.

Singapore is leveraging AM to advance personalised medicine and precision therapy, strengthening its position as the region's foremost biomedical hub. High-value applications include patient-specific surgical guides, 3D bioprinting for tissue engineering, and advanced implants made from biocompatible or bioresorbable materials. A transformative opportunity lies in Point-of-Care (POC) centres, where hospitals can print customised medical devices on-site, improving patient outcomes and streamlining procedures.

The global space economy is another high-potential arena. AM's capabilities in producing lightweight, high-performance components make it ideally suited for this sector.



Singapore's AM strategy is twofold: deepening existing strengths in core industries, such as aerospace, semiconductors, and maritime, while cultivating new growth frontiers in emerging sectors, including biomedical, space, and defence.

For Singapore's growing space industry, AM enables agile development of parts for small satellites, such as efficient propulsion systems, antennas, and optimised structural brackets. This lowers launch costs, accelerates development cycles, and strengthens Singapore's role in the high-tech space economy.

AM's design flexibility also supports the development of clean technologies. In nuclear fusion, for instance, the extreme conditions and complexity of reactors present challenges beyond the reach of conventional manufacturing—making AM an ideal solution. Similarly, the technology is being explored in sustainable construction, with 3D concrete printing paving the way for innovative building methods.

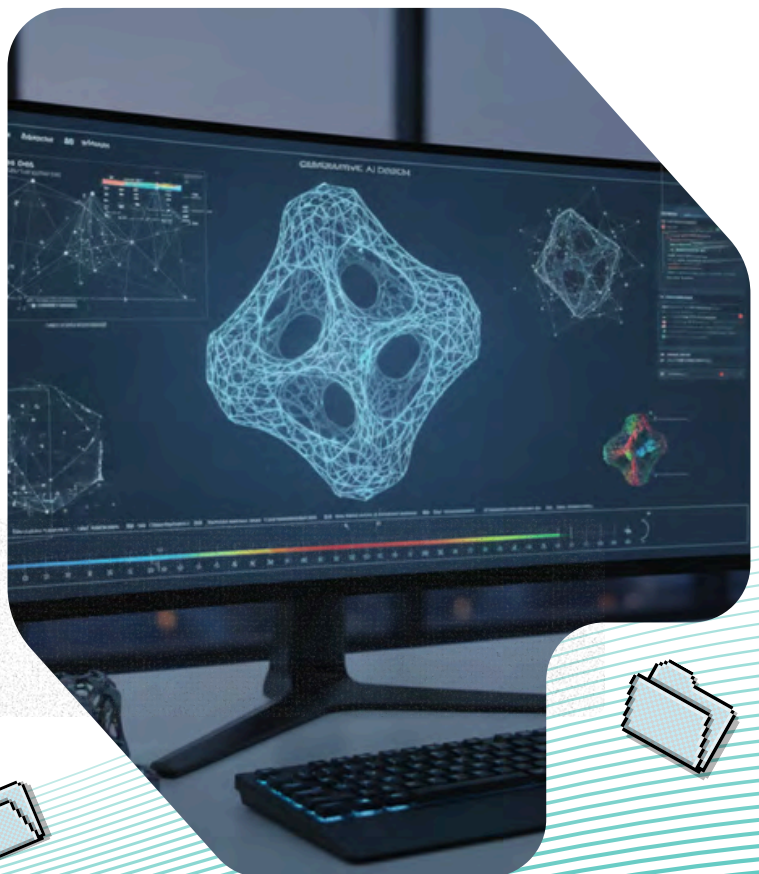
It is worth noting that AM adoption in defence is accelerating globally. The AMPOWER Report 2025 recorded a 39% rise in AM equipment revenue for defence in 2024, despite an overall slowdown in the AM market. This rapid integration reflects AM's ability to address supply chain fragility, enhance operational readiness, and accelerate system modernisation. Singapore's defence sector can tap into mature AM technologies such as Directed Energy Deposition (DED) and WAAM to meet specific operational and logistical needs.

For businesses operating in Singapore, the reality is clear: competing on the basis of cost is an untenable long-term strategy. The nation's value proposition is anchored in different strengths: a stable political and business environment, a highly skilled workforce, robust IP protection, and a deep ecosystem for high-value, knowledge-intensive manufacturing. AM is the technological embodiment of this value proposition, providing companies with the tools to shift the competitive battlefield from price to a triad of superior advantages: precision, agility, and circularity. The fundamental pivot required is to move from selling a commoditised "product" to delivering an integrated "solution." An AM-enabled company can offer a fundamentally different value proposition customised to the customers' performance requirements. The conversation is no longer about the unit price but about the total value delivered to the customer's business, justifying a significant price premium.

To successfully execute this pivot, businesses must undergo an internal transformation. Investment must be directed towards building deep capabilities in DfAM, as the full potential of the technology is unlocked not in the printing process itself, but in the initial design phase. Furthermore, the sales and business development process must evolve from being transactional to consultative. The goal is to proactively identify customer pain points—such as supply chain risk, equipment downtime, performance limitations, or the burden of obsolete inventory—and to architect AM-based solutions that directly address them. By focusing on these higher-order benefits, Singaporean businesses can carve out a defensible and profitable niche that is insulated from direct price competition.

Multinational corporations can choose to manufacture their critical and high-value components in Singapore to guarantee stability and business continuity. This role reinforces Singapore's indispensability as a key node in the reconfigured trade flows of a more fragmented global economy, ensuring its relevance and value in a world where resilience is prized as highly as efficiency.

"By embracing design-led innovation, Singaporean businesses can carve out a future beyond cost competition."

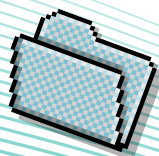


Closing Note

Beyond propelling advanced manufacturing toward a more agile and circular model, AM enhances competitiveness by enabling the creation of higher-performing, complex, and customised products. This opens new possibilities for companies in Singapore to pioneer innovative solutions and reshape markets long defined by mass production.

Together, these strategic focus areas converge into a bold vision: positioning Singapore as the central hub of a digital and distributed hybrid manufacturing network. This vision is anchored in the nation's world-class connectivity, robust infrastructure, strong IP protection, pro-business environment, trusted governance, respect for the rule of law, and deep talent pool.

By becoming the indispensable node where the digital and physical worlds of production unite, Singapore secures its leadership in the next industrial era and offers the world not just participation in, but a blueprint for, a more resilient, agile, and sustainable manufacturing future.



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Annexe A – Objectives and Methodology of Additive Manufacturing Industry Outlook 2025 Survey

Objectives

To gain a comprehensive, data-driven understanding of Singapore's additive manufacturing (AM) landscape, an industry-wide survey was conducted. The primary objectives were to:

- **Assess the state of AM adoption:** Determine the maturity, applications, and key drivers of AM technology among Singapore-based organisations, moving beyond anecdotal evidence to establish a clear baseline.
- **Identify key challenges and opportunities:** Systematically uncover the most significant barriers hindering AM adoption and business growth—ranging from financial and technical hurdles to market and regulatory challenges—as well as highlight emerging opportunities.
- **Analyse economic and geopolitical impact:** Examine how macroeconomic trends such as inflation and supply chain disruptions are shaping strategic decisions, investment priorities, and the perceived value of AM in enhancing operational resilience.
- **Evaluate business and R&D investment trends:** Quantify levels of investment directed toward AM-related activities, including capital expenditure, R&D, and talent development, while capturing future investment intentions.
- **Gauge ecosystem support and future outlook:** Measure industry perceptions of existing support from government and ecosystem enablers like NAMIC, and gather forward-looking perspectives on the collaborations needed to propel AM adoption and growth.

Methodology

The "Additive Manufacturing Industry Outlook 2025" survey was designed to capture a multi-faceted view of the ecosystem by gathering insights from a diverse range of key industry stakeholders. The survey was administered electronically through a structured questionnaire, segmented to address different roles within the AM value chain. Core respondent categories included:

- **AM adopters:** Organisations currently using or exploring the use of AM technologies in their operations.
- **AM suppliers:** Companies that supply AM hardware, software, materials, or provide related consulting and manufacturing services.

The questionnaire employed a mix of quantitative and qualitative questions. Quantitative questions included multiple-choice, ranking, and Likert scale formats to gather measurable data on topics such as primary applications, adoption drivers, investment levels, and the impact of government initiatives. Qualitative, open-ended questions were included to capture nuanced insights, specific examples of value creation, and detailed perspectives on future challenges and opportunities.

This dual approach allowed for the statistical analysis of industry-wide trends while also collecting rich, contextual feedback to provide a deeper understanding of the dynamics shaping Singapore's AM ecosystem. The survey was distributed to a targeted list of companies and organisations known to be active in the Singaporean additive manufacturing ecosystem to ensure a high-quality and relevant dataset for analysis.

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About NAMIC

The National Additive Manufacturing Innovation Cluster (NAMIC) is a national platform hosted by the Agency for Science, Technology and Research (A*STAR), supported by the National Research Foundation under the Prime Minister's Office and the Ministry of Trade and Industry, together with Enterprise Singapore and the Singapore Economic Development Board. NAMIC aims to accelerate the adoption of hybrid and digital additive manufacturing technologies under Singapore's Manufacturing and Economy 2030 Vision, helping industries transform towards innovation and high value-added manufacturing using sustainably sourced, nature-based designs and cradle-to-cradle on-demand manufacturing. NAMIC achieves this by focusing on value capture and creation through an industry sectoral engagement approach, leveraging public-private partnerships and R&D investments, supporting translational research, and accelerating industry test-bedding towards commercial scale-up. NAMIC continues to grow its international outreach, identifying and supporting deep-tech companies incorporating AM technologies seeking capital injection either through project joint-funding or its investor networks.