BUSINESS SWEDEN
THE SWEDISH TRADE & INVEST COUNCIL

SMART MANUFACTURING IN SINGAPORE

How Singapore is accelerating smart manufacturing and the opportunities for Sweden

SMART MANUFACTURING – AN EXCITING NEW FRONTIER

Smart manufacturing is driving global competitiveness, with Singapore leading through advanced technology, government support, and strategic opportunities. This report highlights how Swedish companies can leverage Industry 4.0 expertise to thrive in this dynamic market.

EXECUTIVE SUMMARY AND INTRODUCTION

The global manufacturing industry has undergone multiple waves of industrial transformation as technological advancements reshape production processes. The rise of Smart Manufacturing is poised to significantly enhance efficiency, productivity, and competitiveness across manufacturing operations. For Singapore, this evolution is particularly crucial as it faces increasing competition from neighbouring countries that are rapidly advancing their production capabilities while maintaining much lower operating costs.

In this report, Business Sweden examines Singapore's emergence and outlook for smart and advanced manufacturing. It highlights key opportunities for Swedish companies to position themselves as solution providers to Singapore's manufacturing industry and as potential investors or partners for smart and advanced manufacturing sites in the region. The goal is to provide readers with a comprehensive overview of the market and actionable recommendations for navigating the opportunities in Singapore's manufacturing landscape.

This report identifies five key takeaways and opportunities for Swedish companies to consider as they explore the possibilities in Singapore's smart and advanced manufacturing sector.

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OPPORTUNITIES IN SINGAPORE'S SMART MANUFACTURING

Key takeaway: 1) Growing awareness and interest in smart manufacturing

In Singapore, awareness of smart manufacturing is rapidly increasing and is poised to become a central focus for the nation's manufacturing sector in the coming years. This growing awareness is driven by several factors, including Singapore's strategic emphasis on advancing its industrial capabilities, the government's proactive support through targeted initiatives and subsidies, and the global shift towards Industry 4.0.

Demand is particularly strong for smart manufacturing solutions provided by companies with a local presence, such as Singapore-based providers, foreign firms with representative offices, or businesses partnered with local stakeholders.

This heightened interest creates a favourable environment for Swedish firms with expertise in Industry 4.0 technologies to expand their presence and influence in Singapore and the region. It is highly recommended that Swedish companies find local partners or establish a representative office in Singapore.

Key takeaway: 2) Competitiveness and support fuel smart manufacturing

The imperative to remain competitive in an increasingly challenging global market, coupled with strong government support, is propelling the adoption of smart manufacturing in Singapore. Facing rising competition from neighbouring countries and shifts in global supply chains, many Singaporean manufacturing companies are turning to advanced technologies to maintain their edge.

The Singapore government has been a catalyst for this transition, offering substantial support through subsidies, grants, and incentive programmes. Initiatives such as the Productivity Solutions Grant (PSG) and the Enterprise Development Grant (EDG) offer financial support to small and medium-sized enterprises (SMEs), helping them overcome cost barriers to adopting smart manufacturing solutions.

Swedish companies intending to sell or co-develop solutions with Singaporean SMEs should ensure their solution is eligible for the subsidies provided.

Key takeaway: 3) Opportunities in high-adoption and younger-led companies

The adoption of smart manufacturing solutions varies significantly across Singapore's industry verticals. Industries such as semiconductors and pharmaceuticals are leading the way with higher adoption rates and more advanced implementations of smart manufacturing technologies. However, opportunities exist across all sectors, with specific pockets of growth potential emerging.

A generational shift in leadership within Singaporean SMEs is further accelerating interest in technology adoption. As younger leaders take the helm, their openness to innovation and understanding of how technology can enhance production lines stands in stark contrast to the traditionally risk-averse mindset of the older generation.

Swedish companies should prioritise the semiconductor and pharmaceutical industry as a first step, given the high adoption rate and understanding of the benefits of smart manufacturing. Similarly, engaging with younger generations of leaders with a higher degree of understanding of smart manufacturing will enable quicker implementation and impact.

Key takeaway: 4) Leveraging Singapore as an advanced manufacturing hub

Singapore offers significant opportunities for companies to establish their advanced manufacturing and sourcing operations. With access to cutting-edge technology, a highly skilled workforce, favourable business conditions, and a strategic geographic location, Singapore stands out as a premier destination for advanced manufacturing.

The government's strong commitment to fostering innovation, quality, and sustainability is further bolstered by a range of financial and non-financial incentives designed to attract businesses. These initiatives make Singapore an ideal hub for companies aiming to enhance their manufacturing capabilities or streamline their sourcing strategies in a competitive global market.

Swedish companies should evaluate partnerships with local smart and advanced manufacturing companies to secure high-quality products and strengthen their supply chains. Larger Swedish companies should also explore the benefits of establishing manufacturing in Singapore, taking full advantage of Singapore's geographical, business, and financial benefits.

Key takeaway: 5) Singapore is a premier R&D market with MNC support

Singapore's combination of strategic government support, advanced research infrastructure, a highly skilled talent pool, and a collaborative ecosystem positions it as an exceptionally attractive market for R&D activities. With strong IP protection, global connectivity, a commitment to innovation, and a high quality of life, the country offers an ideal environment for multinational corporations to drive innovation and research excellence.

The Singapore Twin Model further enhances its appeal, providing attractive funding and incentives for companies looking to establish R&D or advanced manufacturing hubs in Singapore while maintaining light production in neighbouring markets.

Swedish companies seeking to drive innovation and develop cutting-edge technologies should consider establishing a local presence in Singapore.The market offers a compelling and supportive environment for R&D activities.

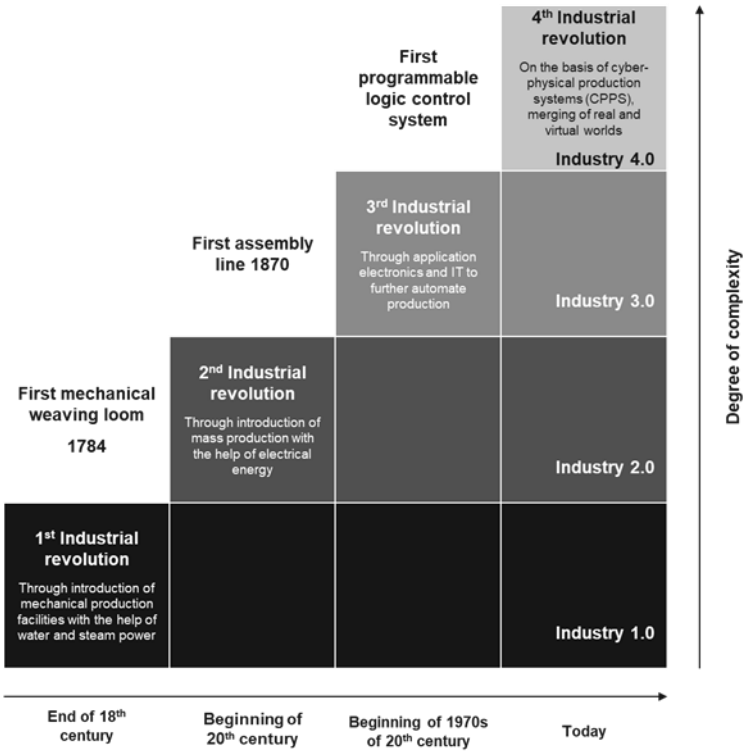
WHAT IS SMART MANUFACTURING?

Industry 4.0: key to global competitiveness

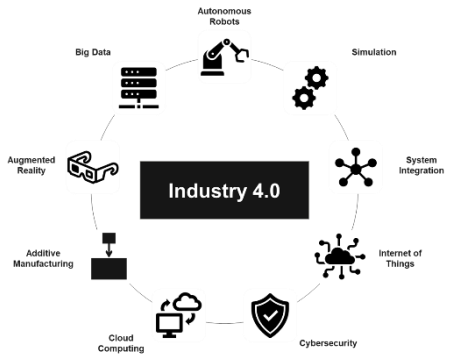
This segment explores the evolution of manufacturing, focusing on the rise of smart manufacturing. Insights are drawn from analysing government policies and interviews with key stakeholders within Singapore's manufacturing ecosystem.

Major trend: 1) The rise of smart manufacturing and its benefits

The manufacturing industry has continually evolved with technological advancements. The first industrial revolution, 250 years ago, introduced steam-powered and mechanised production, marking a transformative era for manufacturing. Today, the industry is undergoing another seismic shift with the advent of Industry 4.0 or smart manufacturing.



This new phase is reshaping the manufacturing landscape, offering companies opportunities to enhance efficiency, productivity, and innovation. However, it also presents decisions for manufacturers: how, what, and when to implement smart manufacturing solutions within their factories or production facilities.



Source: InfoPulse

Smart manufacturing broadly refers to the integration of advanced, connected technologies within factories and production facilities to enhance efficiency, improve decision-making, and increase agility in operations. It encompasses a wide range of disruptive technologies, including additive manufacturing, virtual reality, automation, robotics, cybersecurity, data analytics, IoT, and workforce transformation.

These technologies enable manufacturing companies to embed sensors in machinery to predict and prevent failures before they occur, resulting in significant maintenance cost savings and reducing downtime. Similarly, smart manufacturing solutions can optimise operations by monitoring real-time orders, supply stocks, and the allocation of machines and staff based on current and anticipated production volumes.

Historical trends from industrial revolutions indicate that early adopters of innovative technologies accrue the largest benefits. Companies that quickly assess and implement smart manufacturing solutions will likely gain a competitive edge over their peers.

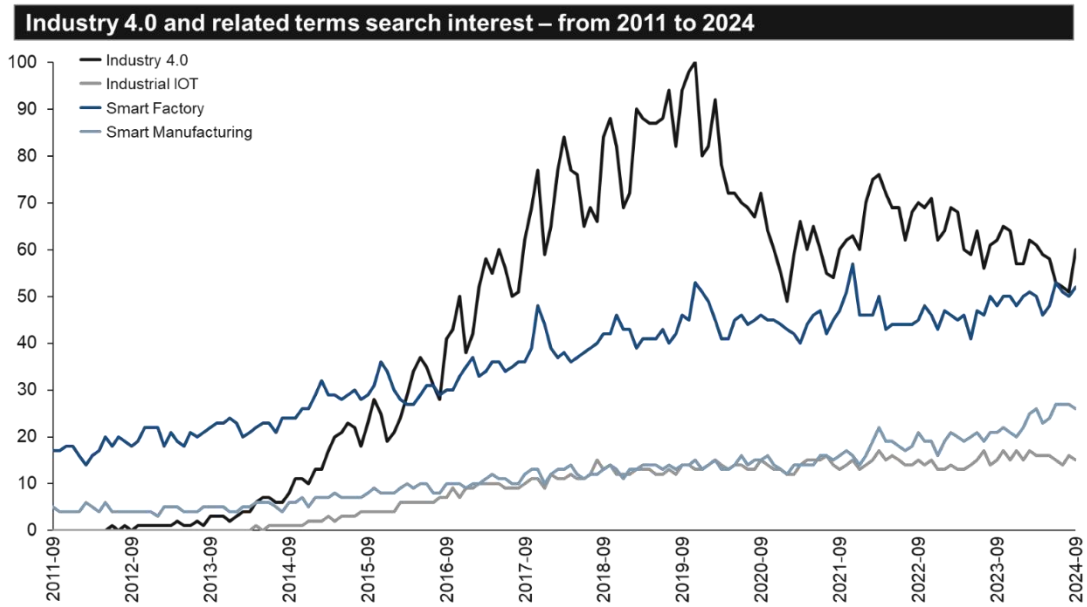
Data underscores the potential impact:

- A 2016 PWC study revealed that 50% of companies implementing or planning to implement Industry 4.0 solutions anticipate double-digit growth within five years.
- A 2017 Deloitte report highlighted that predictive maintenance, a key aspect of Industry 4.0, can increase equipment uptime and availability by 10-20%.

These findings demonstrate the compelling benefits of proactively adopting smart manufacturing solutions, ensuring companies stay competitive and achieve a significant advantage in the evolving industrial landscape.

Major trend: 2) Growing attention toward smart manufacturing

Smart manufacturing was introduced in the mid-2000s in the United States, driven by new technologies such as additive manufacturing and artificial intelligence. However, overall adoption was limited to niche and high-end production facilities. Even by 2014, searches on Google for related terms like “Industry 4.0” were almost non-existent.



Source: Google Trends

This is further evidenced by a 2015 survey conducted by the World Economic Forum, which found that 88% of all polled market leaders did not understand the underlying business models or long-term implications of industrial IoT for their industries.

However, change can be rapid in the manufacturing industry. By 2022, a study by IoT Analytics revealed that of 500 global manufacturing companies, 72% had already initiated activities related to Industry 4.0, such as creating plans or finalising the implementation of solutions. Hence, proactivity is key, as first-mover companies typically benefit the most over their competitors.

Singapore shows a great deal of similarity in the adoption of smart manufacturing solutions in production lines, particularly among SMEs, which form the backbone of the manufacturing sector. Based on interviews, the implementation rate for smart manufacturing solutions is generally low or limited to specific areas within production rather than the entire factory operation. While larger companies report double implementation rates, SMEs in some sectors show rates as low as single digits.

If Singapore follows global trends, adoption rates are set to multiply once awareness, understanding, financing, and market readiness for smart manufacturing solutions are in place.

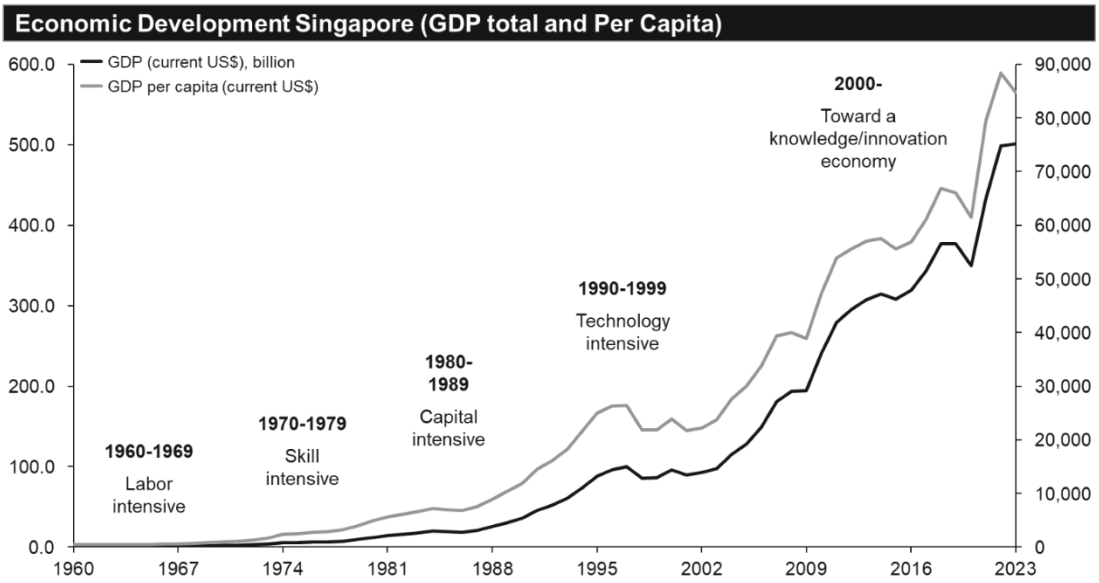
SMART MANUFACTURING IN SINGAPORE

Singapore's manufacturing industry has undergone multiple transformations and now faces the imperative to pivot towards smart and advanced manufacturing to remain competitive.

This section examines the rise of manufacturing in Singapore, drawing insights from analysing government policies and interviews with key stakeholders within the country's manufacturing landscape.

Major trend: 1) Government support and FDI drive Singapore's industrial growth

Today, Singapore boasts one of Asia's most competitive and advanced manufacturing industries. This achievement has been shaped through multiple development cycles, leveraging a combination of pro-market forces, substantial foreign investments, and active government support to guide and foster the sector's expansion.



Source: World Bank

In the 1960s, agencies such as the Economic Development Board (EDB) and Jurong Town Corporation spearheaded Singapore's transformation from a trade-based economy to one focused on labour-intensive manufacturing. These government bodies played a pivotal role in converting areas like the Jurong Industrial Estate from

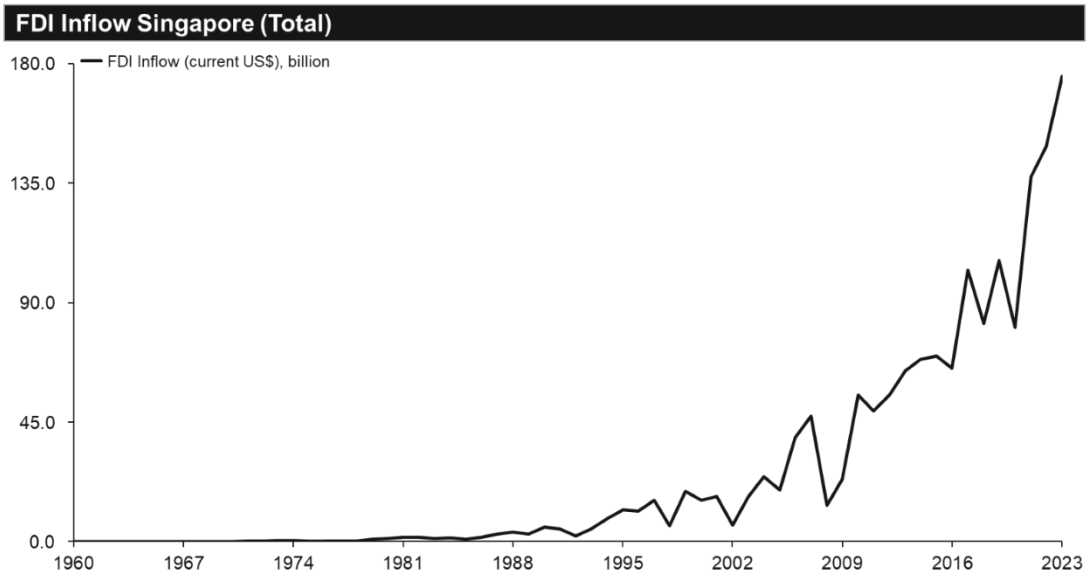
mangrove swamps into factory land, facilitating the production of goods such as garments, textiles, and toys.

As industrialisation progressed, Singapore transitioned to higher-value-added sectors by developing technical and business expertise and positioning itself as a regional business hub. The government introduced extensive training programmes for technicians, engineers, and managers, supported by institutions like the Singapore Institute of Management.

By the 1980s, the Second Industrial Revolution strategy focused on leveraging globalisation and addressing land scarcity through capital-intensive operations and high-value industries. During this period, sectors such as electronics and precision engineering were prioritised in factory space and land allocation.

In the 1990s, the Strategic Economic Plan set Singapore on a path to becoming a developed nation. Key initiatives included the establishment of the National Science and Technology Board (later A*STAR) to drive R&D and human capital development. This era saw Singapore attract top global manufacturing companies, cementing its dominance in hard drive production, accounting for 62% of global output.

Foreign Direct Investment surged during this time, with electronics manufacturing becoming a significant driver of economic growth.



Source: MacroTrends

Major trend: 2) Singapore's transformation into an advanced manufacturing hub

Today, Singapore is recognised not as a low-cost, labour-intensive production hub but an advanced manufacturing powerhouse. Companies are drawn to Singapore for its leading talent, robust research and development capabilities, and favourable business and political environment. Its strategic position as a gateway to Asia and key global markets further solidifies its appeal.

The manufacturing sector currently contributes approximately 21% to Singapore's GDP and employs more than 450,000 people across electronics, chemicals, biomedical sciences, and precision engineering. The industry produces a wide range of advanced, high-quality, and sophisticated products. This represents a dramatic shift from the low-cost, labour-intensive industrial era following Singapore's independence in 1965.

ELECTRONICS INDUSTRY

The electronics industry is a key pillar of Singapore's manufacturing sector, employing over 70,000 workers and contributing approximately 7% to the nation's GDP. Renowned for its high-tech production capabilities, Singapore is a global leader in semiconductor and electronics manufacturing, ranking as the world's 5th largest exporter of high-tech goods.

Chemicals industry

The chemicals industry is another cornerstone of Singapore's manufacturing sector, employing approximately 25,000 workers and accounting for roughly 5% of the nation's GDP. Jurong Island, a world-class chemicals hub, supports a wide range of activities from refining to speciality chemical production, establishing Singapore as a key player in the global chemicals market.

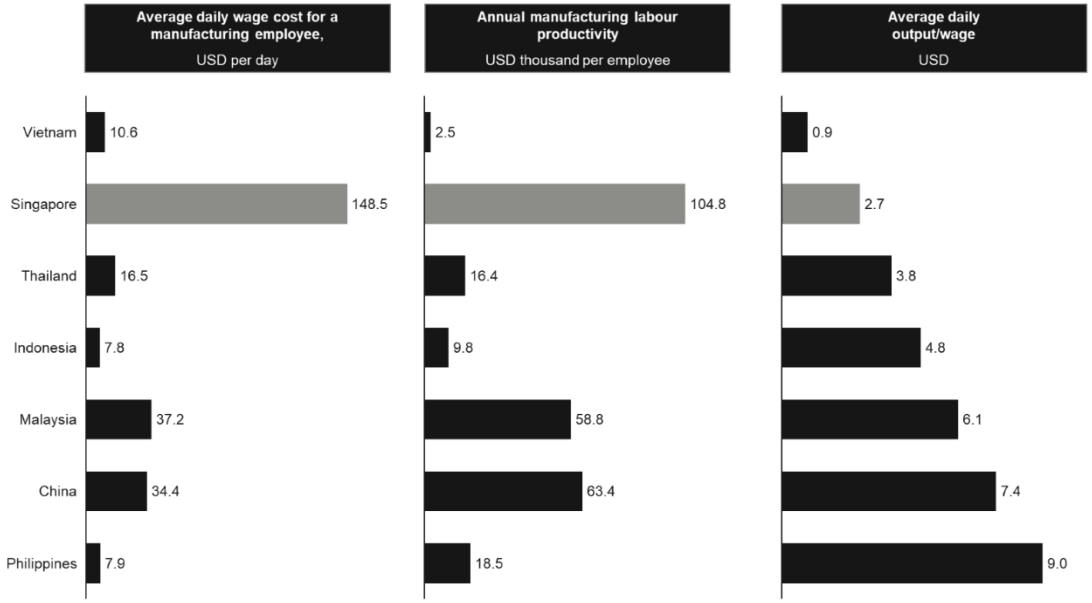
Biomedical sciences sector

Singapore's biomedical sciences sector is a fast-growing manufacturing industry segment, employing around 24,000 workers and contributing nearly 4% to the nation's GDP. This sector focuses on pharmaceuticals, biotechnology, and medical technology, with Singapore producing 4 out of the top 10 medicines globally, underscoring its reputation as a leader in this field.

Precision engineering

The precision engineering sector is vital for supporting Singapore's high-tech manufacturing landscape, employing over 20,000 workers, and contributing approximately 2.5% to GDP. This industry provides critical components and advanced machinery to support sectors such as aerospace, electronics, and medical devices.

Despite the impressive growth and diversification of Singapore's industrial sectors, the manufacturing landscape faces mounting challenges. High labour and land costs, limited space, and lack of natural resources have driven most light manufacturing operations to neighbouring countries. However, these countries are now climbing the value chain, moving into more complex and advanced manufacturing areas, posing a competitive challenge for Singapore's manufacturing hub status.



Source: IHS

Smart manufacturing and Industry 4.0 technologies offer Singapore's manufacturing companies a renewed edge over regional competitors, helping to mitigate challenges such as high labour costs and the decline of light manufacturing.

Major trend: 3) Singapore targets manufacturing advancement

Given the increasingly competitive nature of manufacturing in Southeast Asia, where markets such as Malaysia and Thailand are steadily climbing the value chain, Singapore must boost its technological sophistication to maintain its competitive edge.

Singapore's government has introduced several impactful initiatives to propel the sector forward. For instance, between 2014 and 2018, more than USD 350 million was invested in advanced manufacturing incentives. Additionally, the Singapore 2030 Manufacturing Plan, released in 2021, sets a specific target to grow the country's manufacturing sector by 50% by 2030. A key focus of this plan is enhancing the sophistication of the manufacturing sector and embracing Industry 4.0 technologies.

KEY GOVERNMENT INITIATIVES

Industry Transformation Maps (ITMs)

The Industry Transformation Maps (ITMs) aim to promote and encourage the adoption of advanced manufacturing technologies, enhance workforce development to equip workers for advanced manufacturing roles and provide additional support through R&D grants, incentives, and enterprise platforms.

Research, Innovation, and Enterprise (RIE) 2025 Plan

The RIE 2025 Plan, an SGD 25 billion initiative, focuses on four key areas, one of which is the manufacturing sector. This plan is designed to strengthen Singapore's position as a manufacturing hub by investing in industry-led research and fostering public-private partnerships. It helps companies transition into advanced manufacturing by supporting cutting-edge technologies.

As part of the RIE 2025 plan, A*STAR launched the "Model Factory Initiative", which has supported over 100 companies deploying nearly 2,600 technologies to improve productivity and efficiency. A*Star also established the Advanced Remanufacturing and Technology Centre (ARTC) to help companies implement advanced manufacturing solutions, ensuring they remain competitive and continue to grow in Singapore. Another key ARTC initiative is the "Tech Depot", where companies can obtain plug-and-play technologies. To date, this initiative has supported more than 800 digital adoptions by 635 companies.

The Smart Industry Readiness Index (SIRI), created by EDB, helps manufacturing companies assess their readiness for advanced manufacturing. This assessment evaluates three core elements of Industry 4.0: process, technology, and organisation. The government provides advisory services through EDB and Enterprise Singapore to guide companies in initiating their Industry 4.0 transformation. SIRI has gained recognition as a global standard and practical framework for Industry 4.0 transformation, with endorsements from prominent stakeholders such as the World Economic Forum.

Altogether, these initiatives showcase the Singaporean government's strong commitment to supporting the manufacturing sector. Given Singapore's track record in developing its manufacturing landscape, this strong government backing is expected to drive a shift towards smarter and more advanced manufacturing. For Swedish companies, this presents significant opportunities to play a larger role as solution and expertise providers in smart manufacturing, as well as to explore sourcing and production opportunities in Singapore's expanding smart manufacturing ecosystem.

OPPORTUNITIES FOR SWEDISH COMPANIES IN SINGAPORE

Singapore offers opportunities in smart manufacturing

This segment evaluates the potential for Swedish companies to offer solutions and expertise to manufacturing companies in Singapore. The assessment is based on the broader development of smart manufacturing in Singapore, complemented by insights obtained from interviews with stakeholders in the smart manufacturing sector.

Major trend: 1) Pharmaceutical and semiconductor lead smart manufacturing

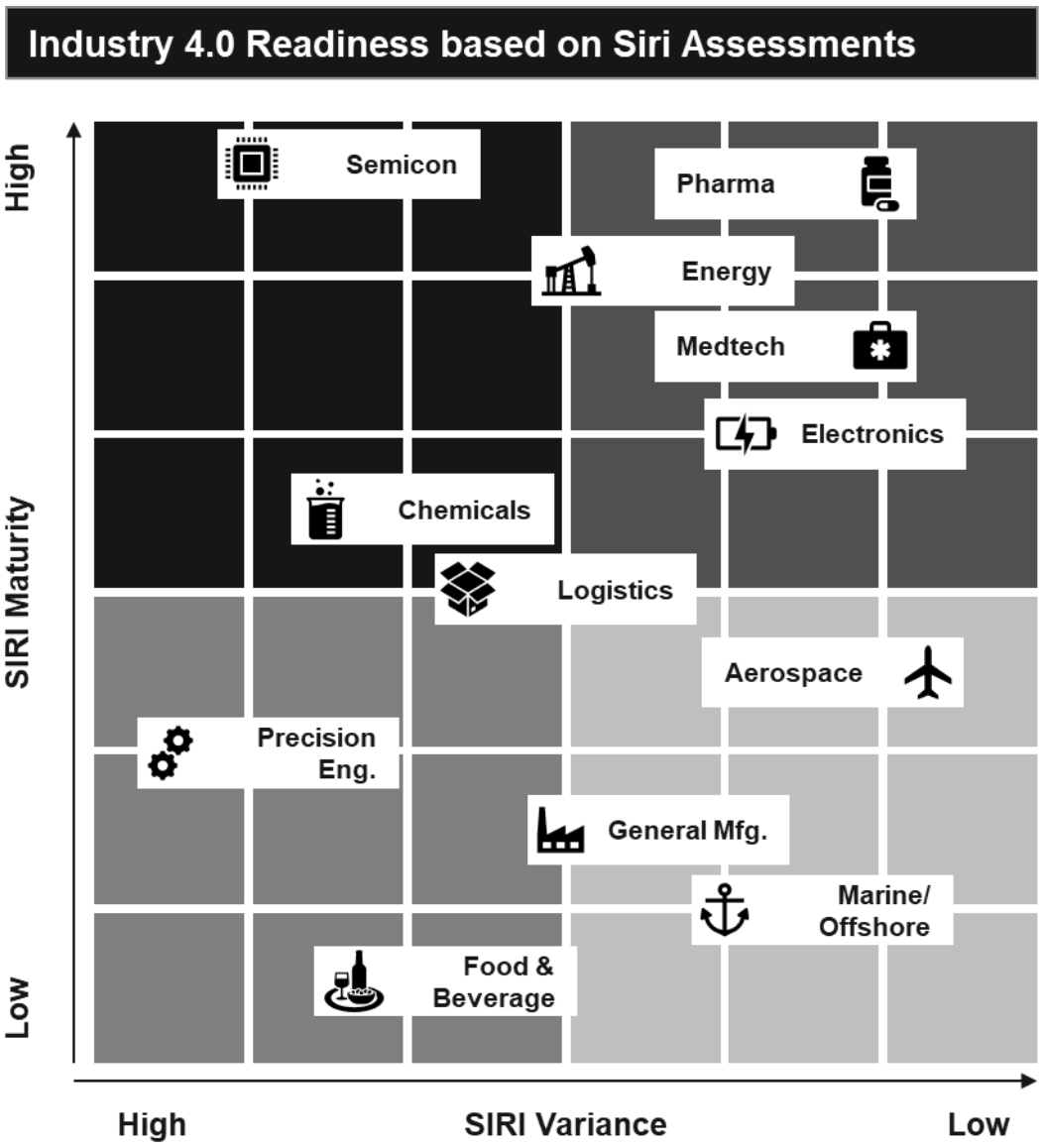
While the Singaporean government advocates for all industry verticals to transition towards Industry 4.0 and adopt smart manufacturing solutions, specific industries are ahead.

The graph below, adapted from an assessment conducted by EDB in 2019, analyses data from 200 SIRI assessments conducted across 12 manufacturing industries in Singapore. It highlights two key metrics:

1. **SIRI maturity**: This metric reflects the relative progress of industries in adopting Industry 4.0 solutions. A higher score indicates that the industry is more advanced in its transformation.

2. **SIRI variance**: This metric measures the consistency of adoption levels within an industry. A higher score indicates greater variability, meaning some companies have progressed significantly while others lag.

The pharmaceutical and semiconductor industries stand out as leaders in smart manufacturing adoption, showcasing both the opportunities and challenges within the broader manufacturing landscape.



Source: EDB

The graph shows that the semiconductor, pharmaceutical, energy, and medical technology industries are among Singapore's most prepared for Industry 4.0 solutions. While the semiconductor sector scored highest on the maturity index, it lags in the variance index. This discrepancy arises from significant differences within the industry – front-end wafer fabrication plants are highly advanced, while back-end assembly and testing companies remain far less technologically sophisticated.

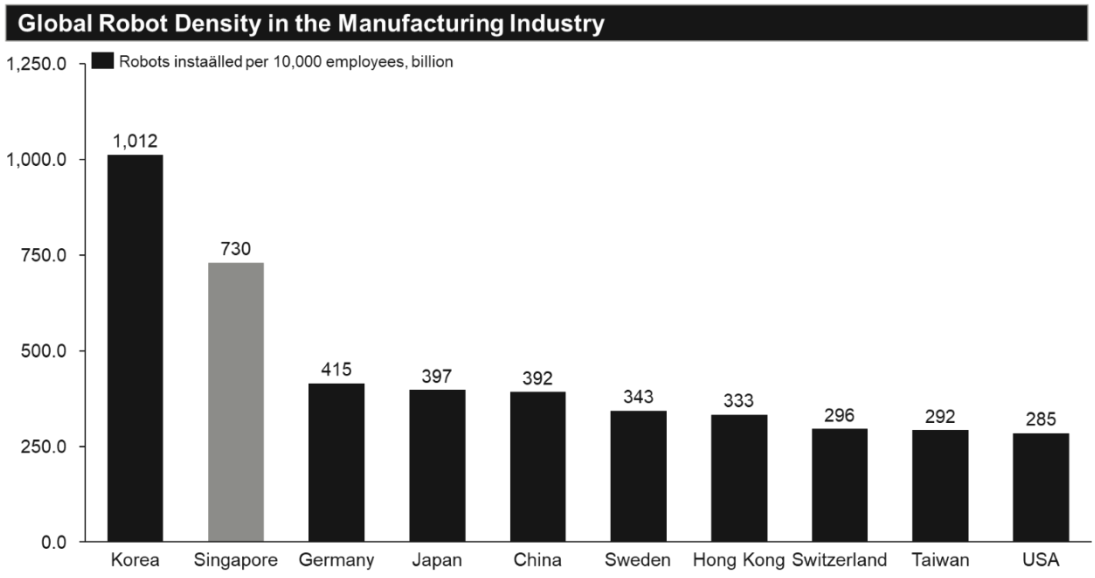
International linkages are also critical in determining the companies' progress in adopting Industry 4.0 solutions. Interview insights reveal that companies with a strong global presence – whether through customers or partners – are more likely to have been exposed to Industry 4.0 technologies and motivated to upgrade their operations to remain attractive as partners or suppliers. It is, therefore, no surprise that industries such as semiconductors, pharmaceuticals, and medical technologies

score highly, as their customers and collaborators are often internationally based. Conversely, sectors such as food and beverage primarily serve the domestic market and tend to lag in adoption.

Major trend: 2) Singapore's leads in robotics and additive manufacturing

Singapore's manufacturing industry has significantly benefited from adopting robotics, enhancing efficiency, precision, and productivity. Advanced robotic systems are deployed for various tasks, including assembly, welding, material handling, and quality inspection. The government's strong focus on robotics is evident in initiatives such as the National Robotics Programme (NRP), launched in 2016. This programme has received over SGD 500 million in government funding to support local companies in developing robotics solutions and assisting businesses in manufacturing and other sectors with robot system implementation.

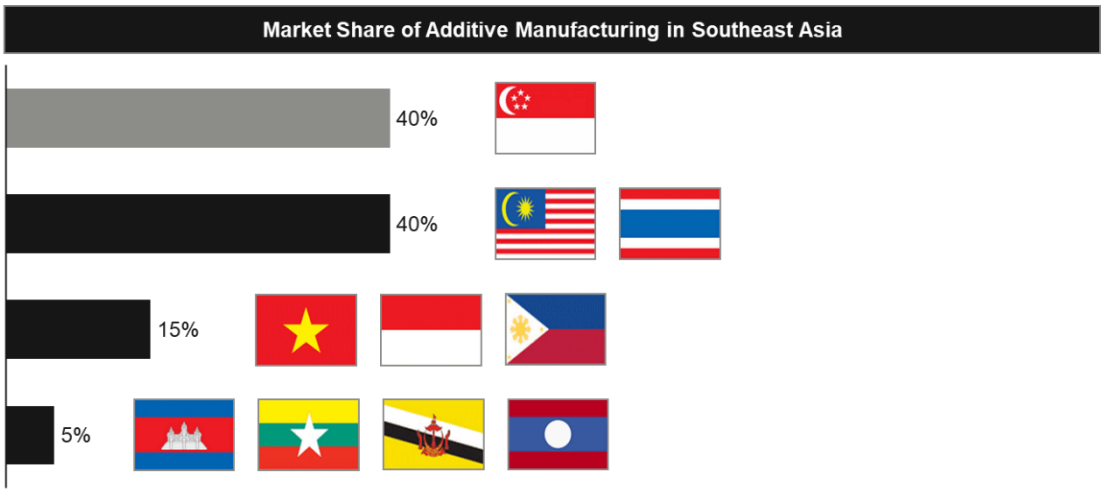
Robots are particularly well-suited to Singapore's manufacturing landscape, given the nation's high labour costs. Singapore ranks second globally in robot density, with 730 robots per 10,000 workers in the manufacturing industry – a testament to the nation's advanced integration of robotics in industrial processes.



Source: IFR

Another critical focus area for Singapore is additive manufacturing. With much of its light manufacturing having shifted to other countries, additive manufacturing enables local companies to rapidly produce parts and components domestically, reducing reliance on imports. This technology is especially advantageous in industries like aviation and maritime, which require highly specialised parts. Additive manufacturing offers a cost-efficient solution for producing a low volume of such parts.

Singapore has been proactive in advancing this sector. In 2015, the government established the National Additive Manufacturing Innovation Cluster (NAMIC) to accelerate the adoption of additive manufacturing nationwide. NAMIC works with businesses and research institutions to support R&D, foster workforce development, and promote industry standards, strengthening Singapore's position in additive and advanced manufacturing.



Source: Asia Briefing

In 2019, Singapore held a 40% market share of additive manufacturing in Southeast Asia. Over 30% of the region's industrial additive manufacturing printers were in Singapore, underscoring its leadership in this rapidly evolving field.

Major trend: 3) Silo-based approach to smart manufacturing in Singapore

Manufacturing companies in Singapore are implementing smart manufacturing solutions in targeted areas rather than deploying them across the entire business, supply chain, or production floor. This selective approach allows companies to concentrate on areas with the most significant potential for immediate impact and return on investment. For instance, companies often prioritise implementing advanced automation and robotics for high-volume, repetitive tasks to boost efficiency and reduce labour costs. Similarly, sensors and IoT devices are commonly used in critical production lines to enable real-time monitoring and predictive maintenance, minimise downtime, and optimise equipment utilisation. These selective implementations provide quick wins and generate valuable insights that can be scaled to other parts of the operation over time.

However, the comprehensive deployment of smart manufacturing across entire organisations and supply chains remains a complex challenge. Full-scale implementation requires substantial investment, robust IT infrastructure, and a

workforce with advanced technological skills. This level of integration is typically seen only among leading SMEs and multinational corporations (MNCs) in Singapore.

Many companies are still in the experimental or pilot phase, testing the viability of Industry 4.0 solutions within controlled environments before rolling them out more broadly. This phased approach enables businesses to address technical and operational issues on a smaller scale, mitigating the risks of widespread implementation. Consequently, while smart manufacturing advances in Singapore, its application is predominantly concentrated in specific, high-impact areas.

Major trend: 4) MNCs lead SMEs in smart manufacturing adoption

In Singapore, multinational corporations (MNCs) are significantly ahead of small and medium-sized enterprises (SMEs) in adopting smart manufacturing solutions. MNCs possess the financial resources to invest heavily in cutting-edge technologies such as robotics, IoT, AI, and big data analytics. These investments enable them to optimise production processes, enhance supply chain efficiency, and improve product quality on a large scale.

Moreover, MNCs benefit from access to global innovation hubs and technological expertise, allowing them to implement and integrate Industry 4.0 solutions more seamlessly. Their large-scale operations often yield a substantial and justifiable return on investment, further incentivising adoption.

In contrast, SMEs face several barriers to adopting smart manufacturing solutions. Limited financial capacity makes the high upfront costs of advanced manufacturing technologies prohibitive. Additionally, SMEs often lack the technical expertise and skilled workforce to implement and manage these systems effectively. The complexity and perceived risk of disrupting existing operations further deter SMEs from fully embracing smart manufacturing. While government initiatives and support programmes aim to bridge this gap, the disparity in adoption rates remains evident. As a result, MNCs continue to lead the way in digital transformation and smart manufacturing advancements, leaving SMEs to lag.

Major trend: 5) Local presence for manufacturing solutions providers

Singaporean companies often prefer to source smart manufacturing solutions from providers based locally or those with a local presence, such as an office or a local partner. This preference stems from the critical need for robust service and support, particularly for businesses new to smart manufacturing. Implementing advanced technologies involves a steep learning curve, with ongoing technical assistance, maintenance, and troubleshooting often required. A local presence enables providers to deliver timely, practical support, minimising downtime and ensuring seamless operations. Additionally, local providers are typically more attuned to the

unique needs and regulatory requirements of the Singaporean market, allowing them to offer tailored solutions and services.

Another key factor influencing this preference is the availability of government subsidies and grants, which frequently stipulate that solutions must be sourced from providers with a local presence. These financial incentives stimulate local economic activity while ensuring companies receive reliable and accountable service.

However, it should be noted that larger international companies often have pre-approved solutions mandated by their head offices or must use certain providers across their global operations.

Major trend: 6) Generational shift drives tech adoption

Interviews reveal that companies with older leadership tend to be more hesitant to invest in new technologies like smart manufacturing. This reluctance often stems from a preference for traditional methods and a cautious approach to risk, shaped by years of established practices. However, this trend is not uniform across all industries; high-tech sectors, for example, are generally more inclined to embrace new technologies due to their emphasis on innovation and staying at the forefront of advancements.

The ongoing generational shift in Singapore, with younger leaders gradually assuming key roles, is expected to foster greater openness to technologies like smart manufacturing. Younger leaders are typically more tech-savvy and comfortable with digital transformation, recognising the long-term benefits of integrating advanced technologies into business operations. As these leaders prioritise innovation, efficiency, and competitiveness, their influence will likely accelerate the adoption of smart manufacturing solutions. The evolution in leadership dynamics will play a pivotal role in shaping the future trajectory of Singapore’s manufacturing industry.

Major trend: 7) Leveraging subsidies to secure customers in Singapore

Singaporean companies, particularly SMEs, are actively seeking smart manufacturing solutions that qualify for government subsidies and grants. These financial incentives play a crucial role in their decision-making process, helping to offset the significant costs of implementing advanced technologies. Companies prioritise solutions that align with government support programmes, ensuring they maximise their return on investment while modernising operations.

KEY SUBSIDIES AVAILABLE INCLUDE:

- **The Productivity Solutions Grant (PSG):** The PSG offers funding support of up to 80% of qualifying costs, capped at a maximum of SGD 30,000 per company per year. This initiative is designed to help SMEs defray the expenses of adopting pre-approved productivity solutions across various sectors, including smart manufacturing.
- **Enterprise Development Grant (EDG):** The EDG supports businesses in upgrading capabilities, innovating, and internationalising. For projects related to smart manufacturing, it covers a variety of costs aimed at enhancing productivity and competitiveness.

SMEs can receive up to 70% of qualifying project costs, while non-SMEs are eligible for up to 50%. Unlike the PSG, the EDG has no fixed maximum grant amount; funding is assessed case-by-case, considering the project's scope, complexity, and potential benefits. This flexibility allows companies to pursue larger-scale smart manufacturing project initiatives with substantial financial backing, facilitating sustainable growth and transformation within the manufacturing sector.

Many Singaporean companies also engage Industry 4.0 consultants to guide their digital transformation journeys. These consultants provide expert recommendations for smart manufacturing solutions, focusing on options that qualify for subsidies and grants. This ensures that companies can fully leverage available financial support while implementing cutting-edge technologies. By integrating expert guidance with economic feasibility, companies can cost-effectively adopt the most suitable technologies. Consequently, the involvement of Industry 4.0 consultants is becoming a standard practice, facilitating smoother and more financially accessible transitions to smart manufacturing.

Major trend: 8) Strong value proposition with case studies

Interviews with industry leaders and extensive desktop research underscore the critical importance of presenting a tailored message to customers when entering the market and promoting smart manufacturing solutions. A customised marketing pitch that addresses each industry's unique challenges, requirements, and operational nuances is beneficial. For companies taking their first steps into smart manufacturing, it is crucial to highlight the tangible benefits of these technologies – whether that's reducing costs, enhancing process efficiency, or improving quality. This tailored approach builds credibility, and fosters trust by demonstrating a deep understanding of the local industry landscape and its challenges.

Equally important are relevant case studies showcasing successful implementations in Asia or other advanced markets. Singaporean companies, particularly SMEs, value real-world examples that showcase measurable benefits and a clear return on investment. Case studies from advanced economies can serve as powerful

motivators, illustrating how similar companies have successfully leveraged smart manufacturing technologies to achieve transformation and growth. Another effective strategy is to conduct a local pilot or trial with Singapore-based customers, leveraging partnerships with organisations such as the Singapore Institute of Technology, which frequently hosts and showcases smart manufacturing solutions.

CAPTURING OPPORTUNITIES IN SINGAPORE

Tap into the smart and advanced manufacturing opportunities in Singapore

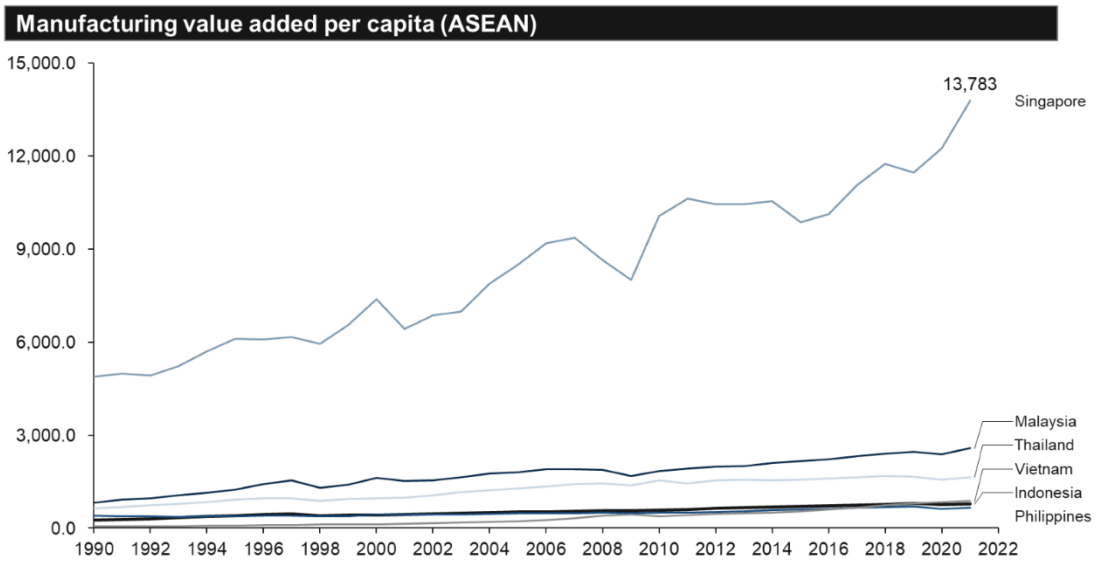
This portion explores the opportunities for Swedish companies to set up smart and advanced manufacturing or source from local manufacturers in Singapore. The analysis is based on an assessment of government policies and insights gathered from interviews with key stakeholders in Singapore's manufacturing landscape.

Major trend: 1) Singapore leads the region in advanced manufacturing

Singapore has established itself as a leading hub for advanced manufacturing in the region through its strategic focus on innovation, technology adoption, and robust infrastructure by a highly skilled workforce.

The nation is home to several Lighthouse Factories, a designation by the World Economic Forum recognising manufacturing sites at the forefront of adopting Industry 4.0 technologies. With five such factories, Singapore ranks first in Southeast Asia and fifth globally.

Additionally, Singapore boasts a world-class infrastructure tailored to advanced and smart manufacturing. Notable examples include the Jurong Innovation District, envisioned as Asia's advanced manufacturing hub, along with six other high-tech industrial parks designed to support companies producing cutting-edge products.



Singapore is also a leader in high-value goods production in the region and, in some segments, a key global player. The nation consistently achieves a significantly higher value-add per capita from manufacturing than its neighbours. In 2021, Singapore's manufacturing output per capita was USD 13,783, far surpassing its closest competitor, Malaysia, which stood at USD 2,572. This substantial difference underscores the advanced and sophisticated manufacturing activities in Singapore.

Major trend: 2) MNCs leverage Singapore for global access

Singapore hosts more than 37,000 international companies, including 7,000 multinational corporations. Many companies have established advanced production facilities in Singapore to leverage its extensive network of 27 Free Trade Agreements (FTAs). These agreements provide preferential access to numerous regional and global markets, reducing tariffs and easing trade barriers. By manufacturing in Singapore, MNCs optimise their supply chains, reduce costs, and gain a competitive edge in international markets. The strategic benefits of these FTAs streamline export processes, enabling companies to efficiently access key markets such as ASEAN, China, Japan, and the European Union.

Singapore's FTAs are comprehensive, covering a wide range of sectors and services, including advanced manufacturing. Beyond the movement of goods, these agreements enhance the flow of services, investments, and intellectual property, creating a conducive environment for high-tech manufacturing operations.

In addition to the benefits of trade agreements, Singapore's world-class logistical infrastructure is a significant draw for manufacturing companies. Singapore's port, one of the busiest globally, provides seamless connectivity to over 600 international ports, ensuring efficient maritime trade. Changi Airport, a top-ranked cargo hub, facilitates swift air freight connections to major cities worldwide. With streamlined customs processes and a business-friendly environment, Singapore offers a robust

platform for manufacturers seeking efficient global distribution and access to key markets.

Major trend: 3) Foreign companies tap Singapore's R&D for smart manufacturing

Foreign companies are increasingly leveraging Singapore's robust R&D ecosystem to develop and implement smart manufacturing solutions. These collaborations can be broken down into five key areas:

1. Collaborations with research institutions and Industry 4.0 centres

Foreign firms partner with Singapore's leading research institutions, including the Agency for Science, Technology and Research (A*STAR), Nanyang Technological University (NTU), and the National University of Singapore (NUS). These institutions offer cutting-edge research capabilities and expertise in advanced manufacturing technologies. Additionally, organisations such as the Advanced Remanufacturing and Technology Centre (ARTC) are critical partners in developing and deploying innovative solutions.

2. Establishing R&D centres

Many multinational corporations (MNCs) set up their R&D centres in Singapore to take advantage of its favourable business environment, skilled workforce, and advanced infrastructure. Companies like Siemens, Rolls-Royce, and Procter & Gamble have established significant R&D facilities in Singapore, focusing on smart manufacturing and digitalisation.

3. Participation in government initiatives

Foreign companies actively engage in government-led initiatives to foster innovation and R&D in smart manufacturing. The Singaporean government offers substantial support through grants, tax incentives, and programmes like the Research, Innovation and Enterprise (RIE) 2025 Plan, which allocates significant funding for technological advancements.

4. Talent development and knowledge exchange

Singapore's focus on talent development and continuous education creates opportunities for foreign firms to benefit from knowledge exchange programmes, workforce training, and development initiatives. Their efforts ensure a steady pipeline of skilled professionals with expertise in the latest manufacturing technologies.

5. Innovation hubs and accelerators

Singapore acts as a testbed for innovations within Industry 4.0 and hosts several innovation hubs and accelerators that facilitate the development of smart manufacturing technologies. Foreign companies often sponsor or actively participate in hubs such as JTC LaunchPad and the Singapore Innovation Hub, where startups and MNCs collaborate on innovative projects.

Examples of foreign companies in Singapore's R&D ecosystem

- **Siemens**: Siemens established its first fully integrated digital factory in Singapore, leveraging local R&D capabilities to drive innovation in smart manufacturing.
- **Rolls-Royce**: Rolls-Royce collaborates with A*STAR and other local institutions on advanced manufacturing and materials science initiatives.
- **Procter & Gamble (P&G)**: P&G's Singapore Innovation Centre focuses on integrating smart manufacturing technologies to enhance productivity and efficiency in consumer and industrial products.

Major trend: 4) The SG Twin Model – advanced manufacturing in Singapore, light production nearby

To address rising costs in Singapore while maintaining access to its world-class ecosystem, many companies are adopting the "Singapore Twin Model". This strategy involves establishing or retaining advanced manufacturing operations, R&D centres, and small-scale test production facilities in Singapore while shifting light production to neighbouring countries to take advantage of cost savings.

This model allows companies to continue leveraging Singapore as a regional hub for high-end R&D activities and producing technically sophisticated products. At the same time, lower-tier manufacturing can be conducted in countries with more favourable land, labour, and utilities costs. Singapore's advantages, including its leading connectivity, extensive Free Trade Agreement (FTA) network, export financing options, and strong intellectual property protection, remain integral to the model. Advocated by the Economic Development Board (EDB), this approach ensures Singapore retains its position as a leader in advanced manufacturing.

The Southeast Asia Manufacturing Alliance (SMA)

Supporting the Twin Model, EDB and Enterprise Singapore (ESG) have partnered with private sector leaders to establish the Southeast Asia Manufacturing Alliance. This initiative promotes selected industrial parks to companies that want to invest in

Singapore and Southeast Asia. These selected industrial parks attract investments that align with the Two Model strategy.

These industrial parks are operated by companies such as CapitaLand, Sembcorp Development, Gallant Venture, and Panbil Group, with the first two companies being Singaporean owned, further enhancing Singapore's role in regional economic development.

Key benefits for companies:

Companies establishing a regional headquarters or R&D centre in Singapore and investing in industrial activities at one of the selected industrial parks gain access to tailored incentives, including:

- Grants covering eligible R&D and innovation activities in Singapore, with up to SGD 1.5 million in funding.
- Differentiated pricing and services provided by strategic partners, such as regulatory support, reduced administration, recruitment fees, and additional business services.

Major trend: 5) Incentives boost investment in advanced manufacturing

To attract international companies to establish production in Singapore, the government, through agencies such as EDB and Enterprise Singapore, has developed a robust series of incentives. These measures have effectively positioned Singapore as a leading business and manufacturing hub, both regionally and globally.

Since the 1960s, Singapore has leveraged tax breaks, grants, and other financial incentives to draw foreign investment. These initiatives have evolved to focus on high-value industries such as electronics and pharmaceuticals rather than light or less sophisticated manufacturing.

Today, international companies looking to establish advanced or smart manufacturing facilities in Singapore can benefit from a range of subsidy and incentive programmes. These lower establishment costs and help reduce operational costs during the critical early years of operation.

Tax incentives and financial grants in Singapore

1. Tax incentives

- Pioneer Certificate Incentive (PC) and Development and Expansion Incentive (DEI): These incentives offer tax exemptions or significantly reduced tax rates

for up to 15 years to companies engaging in substantial economic activities in Singapore, encouraging long-term investments and innovation.

- Investment Allowance (IA): Provides an additional tax deduction on top of standard capital allowances for qualifying capital expenditures on productive equipment, fostering investment in advanced manufacturing technologies.

2. Financial grants and subsidies

- Capability Development Grant (CDG): Support companies in building capabilities across productivity enhancement, product development, and internationalisation, helping businesses scale and compete globally.

- Research Incentive Scheme for Companies (RISC): Co-funds R&D initiatives that drive the development of new products, processes, and technologies, enabling companies to stay at the forefront of industry advancements.

- Training Grants: Facilitates workforce training and upskilling through Workforce Singapore (WSG) and SkillsFuture initiatives, ensuring a steady pipeline of skilled talent for businesses.

RECOMMENDATIONS

In the preceding sections, this report examined the rapidly evolving landscape of smart manufacturing in Singapore, highlighting key trends and sectors where Swedish companies can potentially make a significant impact. As Singapore continues to position itself as a smart and advanced manufacturing leader, Swedish firms have an excellent opportunity to leverage their expertise and innovative solutions.

RECOMMENDATIONS FOR SWEDISH COMPANIES AIMING TO PROVIDE SMART MANUFACTURING SOLUTIONS AND KNOWLEDGE TO SINGAPORE:

Target high-readiness industries: Focus on sectors like pharmaceuticals and semiconductors, where smart manufacturing and Industry 4.0 technologies are widely adopted and offer substantial growth potential.

Leverage robotics and additive manufacturing: Explore robotics and additive manufacturing opportunities by engaging with stakeholders like the National Robotics Programme and NAMIC.

Address silo-based implementation: Tailor solutions for areas like automation and predictive maintenance, addressing specific pain points where smart manufacturing is implemented selectively.

Engage with MNCs and larger companies: Prioritise partnerships with multinational corporations (MNCs) and large companies with the resources to invest in advanced smart manufacturing solutions.

Establish a local presence: Establish a regional office or partner with a Singapore-based entity to offer timely support, strengthen relationships, and align with government incentives.

Capitalise on subsidies and incentives: Highlight how your solutions can help companies benefit from financial incentives like the Productivity Solutions Grant (PSG) and Enterprise Development Grant (EDG), reducing costs and accelerating adoption.

Provide case studies and tailored solutions: Present case studies of successful implementations and tailor your pitch to address specific challenges faced by Singaporean companies.

Prepare for generational shifts: Align your solutions with the increasing openness to new technologies as younger leaders take over leadership roles in SMEs.

RECOMMENDATIONS FOR SWEDISH COMPANIES SEEKING TO LEVERAGE SINGAPORE'S ADVANCED MANUFACTURING CAPABILITIES:

Capitalise on Singapore as a hub: Set up operations or source from Singapore's advanced manufacturing hub, utilising its infrastructure and talent.

Leverage FTAs: Use Singapore's 27 FTAs to access global markets, reduce tariffs, and streamline your supply chain.

Engage in R&D: Partner with local research institutions and set up R&D centres to benefit from Singapore's business environment and skilled workforce.

Participate in government programmes: Take advantage of the RIE 2025 Plan for grants, tax incentives, and technological support.

Leverage innovation hubs: Collaborate with hubs like JTC LaunchPad and Singapore Innovation Hub to stay ahead in smart manufacturing.

Adopt the Singapore Twin Model: Maintain advanced manufacturing in Singapore while moving light production to neighbouring countries for cost savings.

Utilise the Southeast Asia Manufacturing Alliance: Explore grants and benefits for R&D centres or industrial activities in selected parks.

Leverage financial incentives: Use incentives like the Pioneer Certificate Incentive (PC), Development and Expansion Incentive (DEI), and Capability Development Grant (CDG) to lower costs.

Consider long-term investment: Position your company to benefit from Singapore's high-value manufacturing focus and support systems for international investments.

We help Swedish companies grow global sales and international companies invest and expand in Sweden.

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