



INDUSTRY INSIGHT

Manufacturing in New Zealand.



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Connecting for prosperity

Digital technologies are transforming the manufacturing sector in many countries. New Zealand's manufacturers have room to adopt these technologies and boost the contribution of the manufacturing sector to New Zealand's GDP.

- The adoption of digital technologies by New Zealand's manufacturers is lagging global peers. Where technology is used, it is typically focused on specific applications and on eking out additional efficiency gains from existing operating models. Globally, the trend is to use digital technologies to transform existing operating models that deliver more substantive gains.
- Manufacturers in New Zealand should invest in digital technologies that make their supply chains smarter, faster, and more resilient. Data is key. Accurate, reliable, and consistent data not only allows manufacturers to better communicate and deepen their relationships with suppliers and customers, it also ensures end-to-end visibility of supply chains and enables a shift towards highly flexible multi-dimensional supplier networks.
- They should also be adopting technologies that make their operations more resilient. That means investing in smart connected machinery, moving to micro-factories for products that have short production runs, and embracing digital twinning (virtual prototyping) to speed development times, reduce costs, and minimise adverse impacts on the environment, while at the same time delivering products hyper personalised to customer requirements.
- The advanced manufacturing industry transformation plan is a welcome initiative aimed at helping manufacturers overcome barriers to technology adoption. Education, financial support measures and digital workforce development initiatives are key in this regard.
- Many manufacturers in New Zealand may struggle to keep up with new digital technologies and are likely to find themselves at a growing competitive disadvantage. They could be consumed by more tech savvy competitors.

Context.

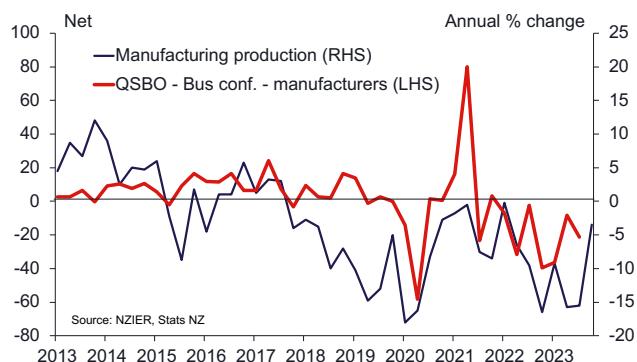
After having got through Covid, New Zealand's manufacturers are now grappling with the longer-term economic consequences flowing from that pandemic. That includes the impact of higher interest rates, which are helping to slow demand for manufactured products, not just at home, but also in key export markets, such as Australia, where monetary policy tightening has also been a feature.

Then there are the challenges of selling into markets that run to a different beat. The Chinese economy continues to struggle post Covid, with weakness in residential housing and an ongoing lack of consumer confidence adversely affecting demand for many products manufactured in New Zealand.

Against this backdrop, it's not surprising that manufacturing output in New Zealand has fallen.

Excluding petroleum production that was discontinued in April 2022 following the closure of the Marsden Point oil refinery, manufacturing sales, adjusted for inflation, fell 6.4% in the 2023 September quarter compared to the same period in the previous year - a fourth successive quarter of decline. The NZIER's latest Quarterly Survey of Business Opinion (QSBO) also suggests that manufacturers remain overwhelmingly pessimistic about general business conditions.

Figure 1: QSBO – general business conditions vs manufacturing production



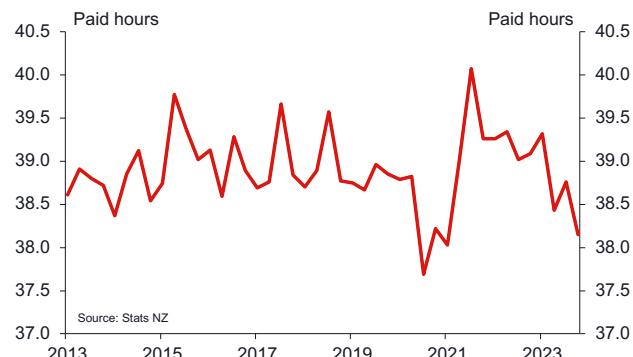
That's unlikely to have changed materially in recent months. The Performance of Manufacturing Index continues to point to a contraction in the manufacturing sector. Liquidations in the sector are rising.

The outlook doesn't look particularly good either. Our own forecasts suggest that tight monetary policy will further slow the New Zealand economy over the coming year, with growth only expected to pick up in the back half of 2025. Much of that is likely to be driven by weaker domestic demand conditions, with an improvement in export demand from China to provide limited relief at best. Even then there is much uncertainty about how fast China's weak household sector can recover from recent setbacks.

Short-term response.

Manufacturers, of course, know this because they are living it. And they are taking steps. Several industry sources confirmed that they are focusing on controlling costs, which typically means cutting jobs, cutting hours, freezing new hirings, clamping down on overheads, curtailing product lines and canned projects. Some are also looking at how to retain their best customers, who themselves are under pressure, and coming up with ways to hold on and motivate critical talent. Some may even be looking to take corporate action, disposing of assets/capabilities that are deemed to be non-core, while also taking advantage of lower valuations to strategically position themselves for growth through mergers and acquisitions activity. One industry source suggested they were looking to retire their long-term debt.

Figure 2: Average weekly hours paid - manufacturing



Most of these measures though are of a short-term nature. They are about getting through the current downturn. That of course is important, but it's not the only thing. Indeed, we think that manufacturers should also be looking at ways to reduce their vulnerability to downturns.

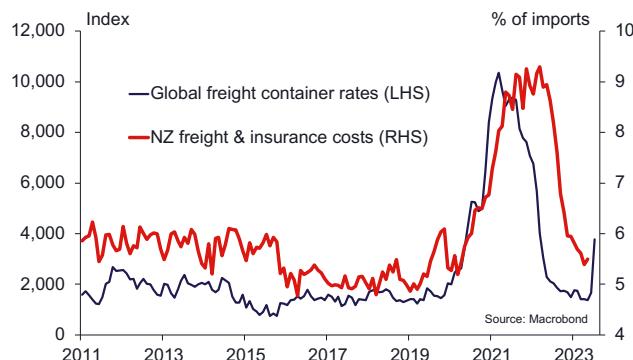
To that end, we think that manufacturers should be looking to increase their agility. That will allow them to not only limit the negative impacts of a slowing economy in the future, but also position them to take early advantage of an economic turnaround, ultimately increasing their resilience. Put slightly differently, class-leading manufacturers should not only be defending against disruption, but they should also be looking to strengthen their offensive capability.

Long-term structural response.

We see two key areas where increasing resilience is important. The first is in supply chains – if they stop working or are significantly disrupted as happened during Covid, manufacturers are in big trouble. The second is in physical operations. Customers are becoming much more demanding, not just in terms of the products that they want, but also the negative externalities that are created during the production process. Ignore environmental, social and governance issues, and there is a good chance of losing out to competitors that don't.

Make supply chains more resilient by making them smarter.

Figure 3: Supply chain vulnerability – impact on freight costs



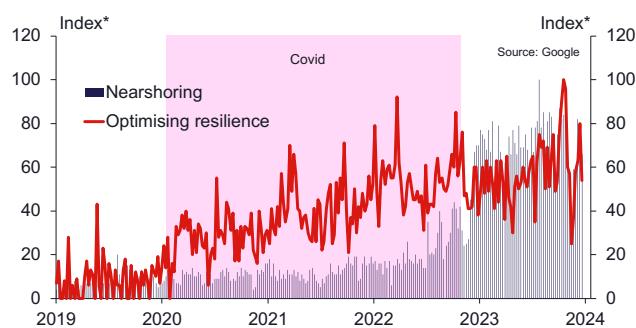
For many years, manufacturers, have focused heavily on minimising cost. Common practices prior to Covid, such as keeping stock levels low, concentrating production in specific geographies and rationalising suppliers were all designed to drive up supply chain efficiencies and keep costs down.

However, as many manufacturers found out during Covid, such practices made them highly vulnerable to anything that disrupts the movement of goods. It was not uncommon, for example, for manufacturers to find themselves unable to fulfil orders during the pandemic because they didn't have adequate stock or raw materials on hand. Post-Covid many found themselves saddled with the wrong stock, which they then needed to liquidate.

Many manufacturers that didn't go bust during Covid have been implementing changes to make them more resilient.

Covid is only one source of supply chain vulnerability. According to New Zealand's Productivity Commission,¹ geopolitical events such as the war in Ukraine and Israel's war with Hamas, as well as weather-related events, like cyclone Gabrielle earlier last year, are also key sources of vulnerability. The importance of keeping supply chains intact is perhaps best underlined by recent US and UK military strikes on Houthi rebels in Yemen aimed at keeping the Red Sea trade route open for business.

Figure 4: Google searches on improving supply chain resilience



These types of disruptive events have not only become more complex, they've also become more frequent, making it increasingly difficult for firms to manage impacts, particularly on their supply chains. That has prompted many to look at how they might make their supply chains more agile and thus more resilient. A 2021 Gartner² survey of supply chain professionals globally taken at the height of the pandemic showed that 87% of respondents planned to invest in supply chain resiliency, while 89% wanted to invest in agility.

The supply chain of the future needs to be agile, flexible, efficient, resilient, and digitally networked for improved visibility.

A lot of that has to do with adopting new digital technologies. That includes everything from state-of-the-art software that facilitates better communication with suppliers and customers to cloud computing for more efficient data storage (including data integration), artificial intelligence (AI) tools that help make better decisions, and robotics for automating processes. Data is now the fuel that drives these manufacturers.

Benefits of digital technologies for supply chains.

- Improved accuracy.
- Better predictive analytics.
- Increased operating efficiencies.
- Better visibility.
- Superior customer service.

Source: New Zealand couriers

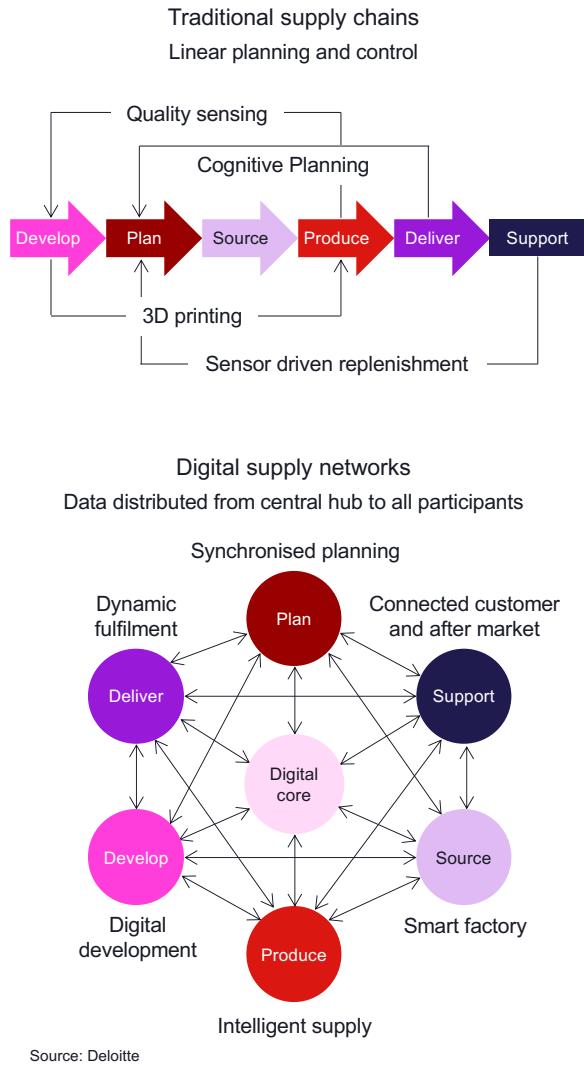
It also includes technologies such as Industry Internet of Things (IIoT) enabled devices and sensors that allow firms to see every part of the supply chain, and track products as they progress along the value chain in real time. It's no longer enough for manufacturers to have visibility into the actions of their suppliers and customers. Today, that visibility needs to extend to their suppliers' suppliers and their customers' customers. Insights generated are vital for manufacturers that are looking to maximise throughput and plan for the unexpected. According to several industry sources, what is important here is for manufacturers to have a clear understanding of all partners through the supply chain, and that includes the inter-reliance that might exist between these partners.

Manufacturers are also looking to these technologies to increase supplier diversification in existing markets and reduce concentration risk. The trend in international markets is away from the linear supply chains towards new tech-driven supplier networks that incorporate an ever-increasing number of supplier partners. That in turn is facilitating a shift away from "just-in-time" to "just-in-case" supply models, with predictive analytics that enable the detection of weak signals and better demand sensing to inform how much inventory should be held. While holding inventory will make shortages less likely, this change in practice comes at a cost as it can lead to a lot of excess stock and products becoming obsolete before they're sold.

¹ [Improving-New-Zealand-resilience-to-trade-shocks.pdf \(mfat.govt.nz\)](#)

² [Gartner Survey Finds 87% of Supply Chain Professionals Plan to Invest in Resilience Within the Next 2 Years](#)

Figure 5: Traditional supply chains vs digital supply networks



These new technologies have also enabled a shift away from the once dominant global procurement model, with consumer demands for more responsive service encouraging the regionalisation of supply chains. The shift towards near-, friend – and onshoring has also been spurred on by rising wages in what were previously low wage economies and higher transportation costs globally.

This trend is also evident in New Zealand. Geographically remote with relatively weak international connections, manufacturers here have started to onshore production capacity as well as near-shore to neighbouring Australia. According to a 2023 report by Sense Partners,³ 23% of the nearly 100 New Zealand firms they surveyed were preparing for shocks by diversifying their supply base, while 14% were in the process of onshoring and near-shoring.

The shift of manufacturing capacity from overseas back to New Zealand or nearby Australia is gathering pace, but only in areas where it is cost effective.

In addition to diversifying and regionalising, manufacturing firms are also looking to simplify some aspects of their supply chains. Eliminating less profitable inventory items (defined by their stock keeping unit code) and those that are surplus to requirements is becoming increasingly common. Rationalising inventory items will often bring inventory management into balance and improve operating efficiencies.

Manufacturers are also employing digital technologies to make their supply chains smarter and faster. The focus is on automation driven by AI and robotics. According to EY, 45% of supply chains will be mostly autonomous (e.g., robots in warehouses and stores, driverless forklifts and trucks, delivery drones and fully automated planning) by 2035. Simply using digital technologies, however, does not equate to creating a digitised, autonomous supply chain that connects across planning, procurement, manufacturing and logistics functions.

Supply chain efficiency will always be a focus, even in the face of building out additional resiliency.

Maximise operational responsiveness.

Supply chain resilience by itself though isn't enough. To position themselves for success, manufacturing operations also need to be able to adapt more readily to changes in their operating environment. For many manufacturers, that means implementing new operating models built around the customer and supported by appropriate processes and governance frameworks. To be clear, this is not about merely acquiring new technologies; rather it represents a comprehensive transformation of manufacturing operations, culture, and strategy.

Benefits of smart factories.

- Increased quality
- Increased flexibility
- Lower operating costs
- Lower fixed costs
- Sharper customer focus
- Enhanced productivity
- Greater employee satisfaction
- Increased energy efficiency

Source: Oracle

³ [Improving-New-Zealand-resilience-to-trade-shocks.pdf \(mfat.govt.nz\)](https://www.mfat.govt.nz/assets/reports-and-publications/improving-new-zealand-resilience-to-trade-shocks.pdf)

Ideally, that's about moving away from machine-based assembly lines of the past towards "smart factories" that use digital technologies to automate the production process.

In a smart factory, it's not really the technologies themselves that are important. What counts is how they work together to reduce costs, improve product quality, and deliver products that customers want, when they want. Smart factories are about connected machinery and equipment that use data analytics and sensors to work at optimum efficiency. Downtime is minimised thanks to predictive maintenance, where spare parts for repairs can be automatically dispatched to where the system knows they will be needed. AI technologies such as computer vision together with sensors can carry out automated quality control, monitoring the quality of finished products and making automatic adjustments to the manufacturing process to fine tune results.

Embracing digitalisation is imperative for manufacturers to be competitive, agile, and sustainable in today's fast-evolving markets.

AI algorithms can also monitor the distribution of energy at operating plants to maximise efficiency and reduce waste, pollution, and emissions. That's important because manufacturers are under growing pressure from customers, investors, government, and other stakeholders to minimise their carbon footprint. Indeed, the need to address environmental concerns and comply with regulatory requirements has made sustainability an imperative for all manufacturers, including those in New Zealand. Connected systems empower manufacturers to think about sustainability in a holistic way, providing tools and insights to make informed decisions and minimise negative impacts.

To maximise the benefits of digitalisation requires the interconnectedness of different digital technologies.

Connectivity also allows for "digital twinning" – effectively virtual prototyping. That's where information from sensors and IoT is used together with AI and other technologies like cloud computing to create a virtual simulation of real-world physical objects or systems. That might be anything from an assembly line to individual machines on that assembly line, product parts and even final products. In this virtual world, objects can be measured, analysed, and experimented with far more cheaply and quickly than doing so in the physical world. That makes them particularly useful in product development. Other examples include using a digital twin to simulate the impact of supply and demand fluctuations on assembly line output, the dimensions of a new product, or the effects that operations might have on the

natural environment. Insights gained can then be used to optimise the performance of real-world manufacturing processes, machines, and equipment.

Benefits of digital twins.

- Increased quality
- Improved product quality
- Enables products as a service
- Reduced time to market
- Greater operational efficiencies
- Enhanced supply chain agility and resilience
- Sharper customer focus

Source: PTC

This is not science fiction. According to ITBrief,⁴ 29% of manufacturers globally have fully implemented or are implementing a digital twin strategy for a portion of their operational assets. A further 63% are currently developing or have already developed their own digital twin strategy.

Digital twinning in New Zealand is not new either – it's been used in construction, engineering, healthcare and even horticulture. Wellington city council, for example, has created a digital twin of the city to allow its residents, local government, city planners, and engineers to see the impacts of climate change.

The use of digital twins in the manufacturing sector, however, seems to be somewhat limited. There are sawmills in New Zealand, for example, that use it to identify the most efficient way to produce cut-to-order boards. None of the industry sources we talked to were using digital twinning, although several mentioned the use of Solidworks to create production ready 2D and 3D engineering drawings and advanced 3D models for analysis and simulation purposes.

Digital twinning is key to the "fail fast" approach - iterating fast failures supports agility by delivering the desired result faster than perfecting the solution.

These connected technologies have also led to the growth of the micro-factory – a highly automated setup that allows manufacturers to produce high-mix, low volume products tailored to customer requirements. First conceived in the early 1990s, micro-factories have gained momentum recently as digital technologies have come to the fore, making them a more affordable alternative to traditional manufacturing setups. High-tech automated processes not only require less energy but also a smaller workforce.

⁴ Digital twin market yet to reach full potential - report (itbrief.co.nz)

Unlike traditional factories, that achieve cost efficiencies by producing large quantities of the same product and distributing through a wide network, micro-factories have low capital requirements (and thus lower barriers to entry) and are typically located close to the customer, running small production runs that deliver tailored products on an on-demand basis to a small number of customers. This highly personalised production model is, in many ways, the opposite of the one-size-fits-all traditional production model.

Benefits of the micro-factory.

- Low-cost innovations
- Agile tech adoption
- Hyper-scalability
- Hyper customisation
- Improved supply chain resilience

Source: Launchpad

These types of decentralised manufacturing processes located close to the customer often involve additive manufacturing or 3D printing, where products are manufactured by building them layer by layer. This is often more efficient and thus less costly in terms of raw material use than the traditional subtractive manufacturing processes which involve products being cut from raw materials. Pop-up factories have been used to manufacture prefabricated parts for buildings close to construction sites, as well as in retail, where they used to create personalised products to individual customers.

Micro-factories use flexible, short-run production cycles to supply high-value global niches

Greater connectivity has also made it easier for practices such as providing equipment as a service (EaaS). This is where a manufacturer sells the use of a product/equipment they have manufactured rather than the product itself, for which they charge a fixed or usage-based price. Car manufacturers, for example, have long experimented with vehicles as a service, offering customers use of recent models for an up-front enrolment fee and a monthly subscription. Under this arrangement, physical ownership of the product/equipment remains with the manufacturer, who then leverages off digital technologies such as sensors, IoT and AI to ensure that service levels are maintained.

The key benefit for the manufacturers is that EaaS provides a recurring revenue stream and can help build stronger relationships and increase customer loyalty. Also referred to as servitisation, EaaS allows manufacturers to differentiate themselves from competitors by offering value-added services that improve the customer

experience. They can also gain valuable insights into their customers' needs and preferences, which can inform product development and improve customer satisfaction.

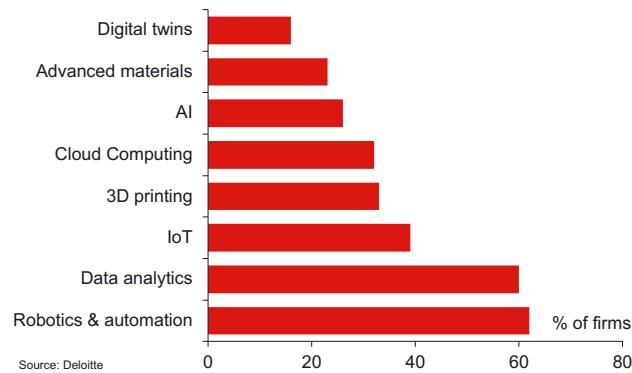
Digital transformation has enabled a world where physical products can become conduits for valuable digital services and outcomes-based solutions.

Reality on the ground.

These shifts are already underway. Smart factories are increasingly common in the US and the Asia Pacific regions. Europe follows some way behind. According to Markets and Markets, turnover globally from smart manufacturing was close to US\$110bn in 2021, while Fortune Business insights suggest a figure of US\$280bn. That is quite a difference, and probably relates to the definition of what is considered "smart". Both sources, however, agree that turnover from smart manufacturing will grow strongly in coming years as manufacturers look to improve operating efficiencies, shore up their resilience and enhance product quality.

By contrast, there are very few smart factories in New Zealand. Nautech Electronics, which has integrated the latest connected technologies in all aspects of their processes is an often-cited example. Callaghan Innovation in collaboration with BECA, has developed the Industry 4.0 Demonstration Network, which helps manufacturers to better understand the benefits of introducing new digital technology. Callaghan Innovation is also funding EMA and LMAC Consulting to assess the digital readiness of individual manufacturers (using the Smart Industry Readiness Index,⁵ which is the global standard) and establish a plan to achieve full digital transformation.

Figure 6: Digital focus in 2023



⁵ <https://siri.incit.org/>

Table 1: Digital technology investment intentions by New Zealand's top ranked manufacturers

Revenue Band	Firms	IoT	Agile Supply Chain	Robots & Auto	Data Analytics	Comp. Model	3D Printing	AI
>\$200m	73	83%	67%	67%	67%	50%	17%	33%
\$50m to \$200m	124	60%	30%	35%	30%	15%	10%	15%
\$20m to \$50m	122	53%	27%	33%	13%	27%	13%	0%
<\$20m	81	50%	20%	10%	0%	5%	5%	0%
Total	400	57%	30%	30%	20%	18%	10%	3%

Source: Technology Investment Network

According to Deloitte's manufacturing outlook for 2023, US manufacturers are focusing investment in three key areas in their pursuit of smart factories: robotics automation to speed up manufacturing, reduce costs, and alleviate labour shortages; data analytics, to improve demand forecasting and to spot supply shortages; and IoT to collect and analyse data from sensors on the factory floor and embedded in industrial equipment to improve manufacturing, supply chain tracking, and product maintenance.

Smart factories leverage the power of AI, robotics automation, IoT, and digital twins to drive more efficient operations.

According to Technology Investment Network's (TIN) Manufacturing Report for 2023, most of New Zealand's larger manufacturers are also investing in these technologies. Adoption rates tend to correlate with revenue. The top 100 firms, for example, are likely to invest more in digital technology than businesses that sit among the top 300 to 400 firms.

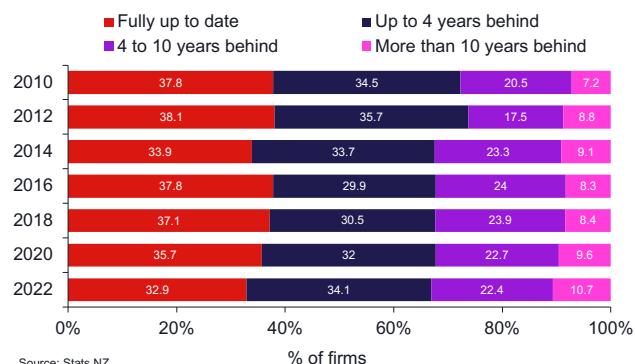
However, even then it's not about moving to a smart factory setup. For most, investment in technology is focused on specific applications in support of existing operating models. Put simply, such investment is made to increase operational efficiencies rather than fully leverage the power of digital technologies by embodying it in completely new operating models. In most cases, technology is used to complement workers and make them more productive. In others, it's used to replace workers – that is particularly true for those that undertake rules based repetitive tasks. One industry source suggested that they invest in systems/machinery/processes that can be integrated with new digital technologies in the future. To that end, they invest in what might be termed "appropriate" rather than the very latest technology.

And that's about as good as it gets. The majority of the 23,000 manufacturers that operate in New Zealand, most of whom are small operators, are reluctant adopters of digital technology. Indeed, according to Callaghan Innovation, New Zealand's manufacturing sector is at least a decade behind many European countries, which is concerning given that Europe generally trails the Asia

Pacific and the US. Consider the fact that there are only 55 robots per 10,000 manufacturing workers in New Zealand. In Germany there are 371, while Sweden and Denmark have 289 and 246, respectively. In South Korea there are a whopping 934 robots.

This reluctance is clearly reflected in the Stats NZ Business Operations survey. According to this survey, the percentage of New Zealand manufacturers that use equipment with the latest technology has trended lower over time, while those that use equipment with older technology has increased. That is particularly true for firms that use equipment with technology that is more than a decade old. It's also noteworthy that the manufacturing sector uses older equipment than in other sectors in the New Zealand economy. About 55% of firms in the economy use up-to-date equipment while just 3% use equipment with technology that is more than a decade old.

Figure 7: Age profile of technology in use



There are many reasons why New Zealand manufacturers are off the pace. Finance is one. Many firms in this sector lack the financial resources needed to invest in new digital technologies and re-engineer existing business processes. Adopting new technologies is also disruptive, especially if it involves a new operating model. A lack of wherewithal is another factor, with digital skills and capabilities in perennial short supply. Other manufacturers are just reluctant to ditch what has worked for them in the past, preferring instead to cling to the tried and trusted. That's especially true for independent family-owned manufacturing operations.

What can be done?

So, what can be done to boost uptake? The advanced manufacturing industry transformation plan, a cross-sector initiative involving a wide range of public and private sector stakeholders published last year, identifies several key steps aimed at accelerating transformative change.

The first relates to education. That's about broadening the understanding of the benefits and potential opportunities that new digital technologies and smart factories can bring across all facets of manufacturing, from procurement and warehouse management to better understanding the nature of demand for products, operations, and delivery.

That can be achieved in many ways. Callaghan Innovation's industry 4.0 Demonstration Network is one approach. Assessing digital readiness and coming up with a transformation plan is another. Alternatively, manufacturers can partner with other firms that are already using smart manufacturing. That can help them learn from the experiences of others and get advice on how to implement smart manufacturing in their own operations.

From the perspective of the firm, this understanding should form the basis for developing a smart manufacturing strategy, which at its core is about creating a more competitive and profitable business.

The second is to support investment in digital technologies. As mentioned, that can be quite an obstacle, not just in terms of the actual cost of new machinery, but also the cost of output lost between its commissioning and putting it into production – a key reason why firms might resist investing in the first place. According to MBIE that can range from 9 to as much as 18 months. Then of course there is the availability of finance, the costs associated with financing, and the impact that this has on cashflow.

There are things that can be done. From a policy perspective, introducing an accelerated depreciation allowance that allows firms to deduct the cost of depreciating assets from tax liabilities is one way to encourage investment. Another possibility is to establish an investment fund, like the Government Investment in Decarbonising Industry (GIDI) fund that co-invests with business in high impact industrial and commercial decarbonisation projects. Other options include investment grants that provide targeted assistance for firms looking to invest in new equipment and/or the provision of low interest loans.

The third refers to the development of the workforce that can operate within a highly digital smart environment. The future of work will be defined by automation and technology. The pandemic made sure that employees across all manufacturing functions learned how to

complete tasks remotely using digital communication and collaboration tools. In an operational sense, future requirements are likely to be a lot more significant, with the accelerated decline in manual and repetitive tasks and a consequential rise in the need for analytical and technical support. This shift will call for substantial investment in workforce engagement and training in new skills, much of it delivered using digital tools.

This is what should be done to facilitate a transition to smart manufacturing. However, the reality is that despite the best efforts of policy makers and stakeholders, many that operate today will not make the jump across the digital Rubicon. Unable or unwilling to make the investment in digital technologies these firms will continue to operate on much the same basis as they always have, losing competitiveness to manufacturers that are able to do so. That includes new digitally savvy entrants, unencumbered by older machinery. Eventually they will fall by the wayside or be consumed by others seeking to add new competencies, skills, and capabilities to their existing repertoires.

There will be others of course, that will change tact. For those that focus on providing a differentiated product offering, the option of a high-mix, low volume micro-factory requiring limited investment in digital technology and located close to customers might be the way to go.

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