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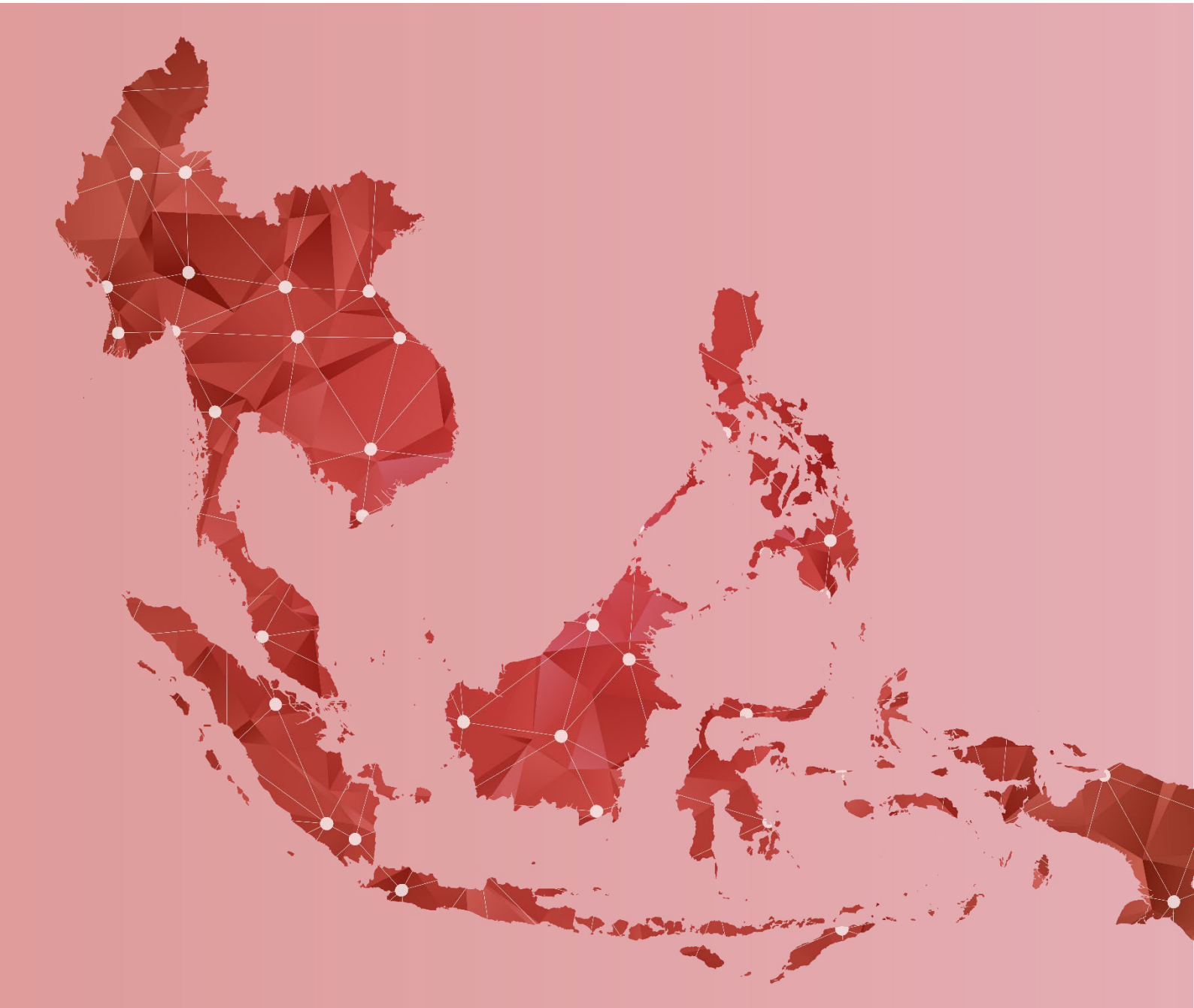
Resilience through industrial policy in Southeast Asia

A POLICY BRIEF DRAWING ON DATA FROM THE LLOYD'S REGISTER FOUNDATION WORLD RISK POLL



How can industrial policies contribute to greater resilience in Southeast Asia?

Southeast Asia is emerging as a global manufacturing powerhouse. Yet supply chains face increasing pressure, posing risks to progress. Industrial policies can help build resilience, protect people, and promote growth.

Manufacturing contributes to country-level resilience in three ways:

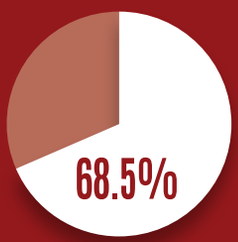
Producing critical goods.

Driving economic growth and high-quality employment.

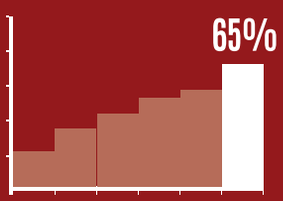
Facilitating emergency response to crises.

Manufacturing also contributes to resilience at the individual level

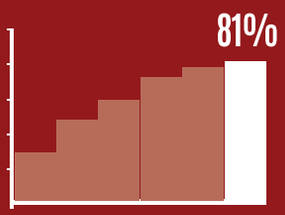
Countries with strong industrial capabilities have greater socio-economic resilience.



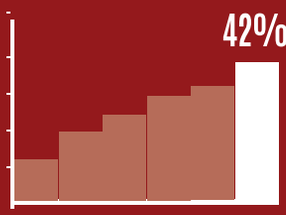
68.5% of manufacturing workers have never experienced or known of anyone experiencing serious harm from work.



In Southeast Asia, **65%** of manufacturing workers report they could cover household basic needs for over three months without income, significantly higher than any other sector.

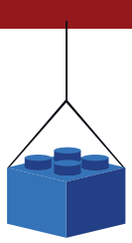


Manufacturing stands out as the sector with the lowest mental health risks and the least discrimination, with **81%** of workers never having experienced discrimination.

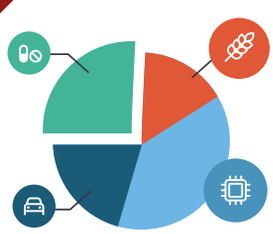


The manufacturing sector has the highest share of workers who feel safer now than they did five years ago, highlighting its strong commitment to improved safety over time.

POLICY RECOMMENDATIONS



1. Develop policies to grow and strengthen the manufacturing sector, to support its role in ensuring socio-economic resilience.



2. Promote localisation, redundancy, and industrial diversification to mitigate disruption risks.

3. Promote industrial safety to ensure that manufacturing delivers high-quality, safe jobs, even in the face of technological changes.

4. Spur manufacturers towards greener production.

POLICY RECOMMENDATIONS

About this policy brief

This policy brief uses data from the World Risk Poll (WRP) to examine the role of manufacturing and industrial policy in socio-economic resilience, focusing on Southeast Asia. It forms part of a broader series exploring evidence-based policy options to reduce risk and enhance health and safety outcomes across Southeast Asia. The brief is part of the project titled “Policymaking for a more resilient world: Leveraging the World Risk Poll for more effective digital, labour, and industrial policies”, funded by Lloyd’s Register Foundation.

Contributors

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Acknowledgements

The work presented in this report would not have been possible without the generous support of many people who facilitated and took part in the interviews and workshop. We thank, in particular, Dr Zurina Moktar, Assistant Director and Head of the Science and Technology Division at the ASEAN Secretariat, and Mr James Correia, Research and Capacity Building Associate at the Asian Development Bank Institute, for their helpful comments.

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List of abbreviations

AI – artificial intelligence

AIPBI – ASEAN Industrial Projects-Based Initiative

ASEAN – Association of Southeast Asian Nations

CIP Index – UNIDO's Competitive Industrial Performance Index

DENR – Philippines' Department of Environment and Natural Resources

EIP – eco-industrial park

EV – electric vehicle

FDI – foreign direct investment

GDP – gross domestic product

GHG – greenhouse gas

IIoT – industrial internet of things

IRA – Inflation Reduction Act

MSMEs – micro, small, and medium enterprises

MWh – megawatt hour

SFA – Singapore Food Agency

TJ – terajoule

UNIDO – United Nations Industrial Development Organization

WRP – World Risk Poll

Executive summary

This policy brief examines the critical role that industrial capabilities, particularly in manufacturing, play in bolstering socio-economic resilience in an era of overlapping global shocks. Our analysis integrates data from the Lloyd's Register Foundation World Risk Poll (WRP) with complementary quantitative indicators (e.g. UNIDO's Competitive Industrial Performance (CIP) Index, ASEAN disaster frequency statistics) and case studies of six Southeast Asian industrial policies. By combining quantitative resilience profiling with concrete policy examples, we identify pathways for governments to safeguard livelihoods, secure supply chains, and sustain growth.

Over the past 5 years, a convergence of crises – most notably the COVID-19 pandemic, ongoing armed conflicts, accelerating climate impacts, and renewed geopolitical tensions such as the China–US trade war and fresh tariff hikes – has exposed profound vulnerabilities in global value chains and domestic economies. The pandemic triggered unprecedented supply chain breakdowns and financial stress, particularly for micro, small, and medium enterprises (MSMEs). Armed conflicts disrupted energy and food markets, driving inflation and compounding economic instability in import-dependent nations. Meanwhile, intensifying climate extremes – typhoons, floods, droughts – have repeatedly damaged infrastructure, derailed production, and forced costly rebuilding efforts. Geopolitical frictions have further injected uncertainty into international trade, prompting businesses to re-evaluate sourcing strategies.

Key messages

1. The manufacturing sector can be both a shock absorber and an engine of transformation

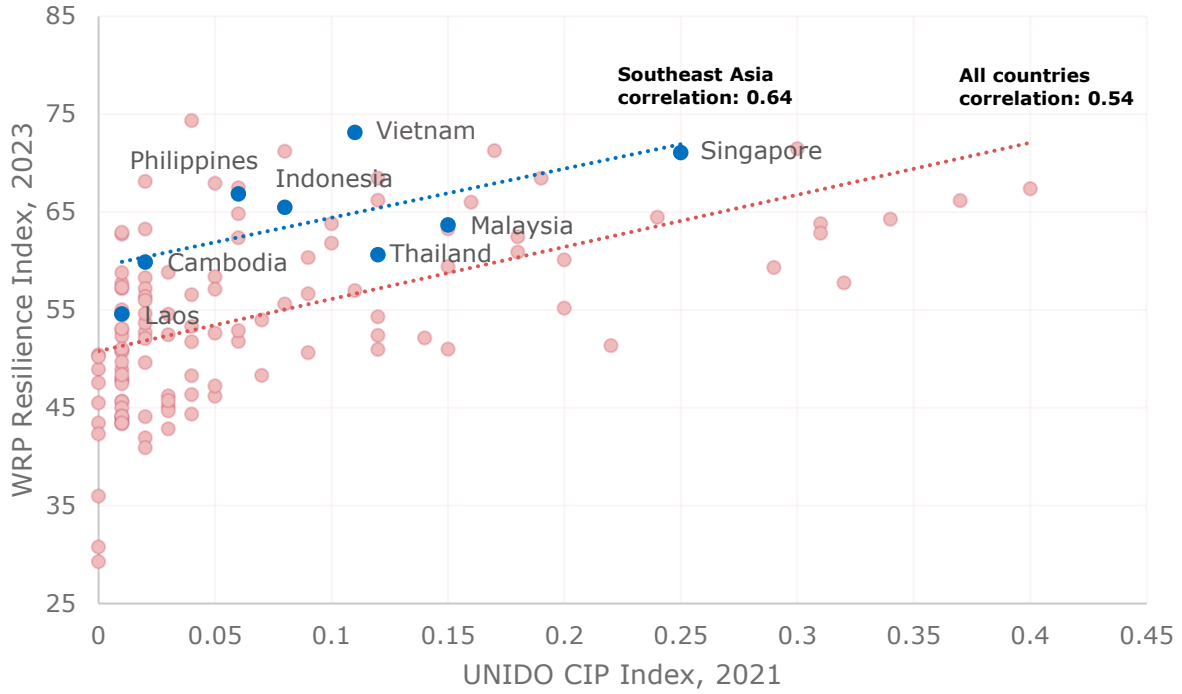
Manufacturing underpins resilience through three primary channels:

- **Critical goods production:** Ensuring local availability of essentials (food, medicines, fuel, clothing) and infrastructural assets (machinery, components, and engineering services vital for transportation, energy, and communications networks) when imports are disrupted.
- **Emergency tackling:** Producing specialised items – such as field hospitals, water-purification units, personal protective equipment (PPE), vaccines and treatments – to address specific crisis needs. For example, during COVID-19, nations with strong domestic manufacturing infrastructures rapidly retooled production lines to supply PPE, ventilators, and critical medical inputs, bridging global shortages.
- **Recovery and growth:** In addition to historically being a key sector for economic growth and high-quality job creation, some manufacturing industries have endured economic crises and offered "pockets of resilience" for national economies.

2. Industrial performance is correlated with resilience levels

The WRP Resilience Index combines four dimensions – individual, household, community, and societal – to measure a population's capacity to withstand, adapt to, and recover from shocks. UNIDO's CIP Index measures countries' capacity to produce and export goods, technological sophistication, and overall impact on global industries. As shown in Figure E1, there is a positive correlation between these indices, which highlights the link between industrial performance and resilience.

FIGURE E1. CORRELATION BETWEEN THE WRP RESILIENCE INDEX AND UNIDO'S CIP INDEX



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023 – Resilience Index, and UNIDO (2024). CIP Index.

3. Workers in Southeast Asia and abroad see the manufacturing sector as a source of social and financial resilience

A thriving manufacturing sector delivers not only macroeconomic stability but also tangible social and financial gains at the individual level:

- **Workplace safety:** Global WRP data shows manufacturing workers report some of the lowest rates of serious physical harm among sectors. Strict occupational health regulations and investments in automation have reduced accident rates, contributing to safer work environments.
- **Continuous safety improvements:** Over 40% of manufacturing employees now feel safer than they did 5 years ago. This is partly due to new technologies – autonomous vehicles for heavy transport, drones for hazardous inspections, and advanced monitoring systems – that automate high-risk tasks and enforce safety protocols.
- **Non-discrimination:** Manufacturing firms, bound by rigorous labour standards, exhibit lower incidences of reported discrimination than sectors such as education, healthcare, or public administration. Inclusive recruitment and standardised safety training promote equitable workplaces.
- **Mental health:** The stability, formal contracts, and clear career pathways offered by manufacturing roles correlate with a reduced share of workers reporting serious mental health issues, compared to utilities or non-market services sectors, where informal work and high stress levels are more prevalent.
- **Financial security:** With higher wages and formal benefits, manufacturing employees are better positioned to weather income shocks. In Southeast Asia, 64.7% of manufacturing workers reported that they could cover their household's basic needs for over 3 months

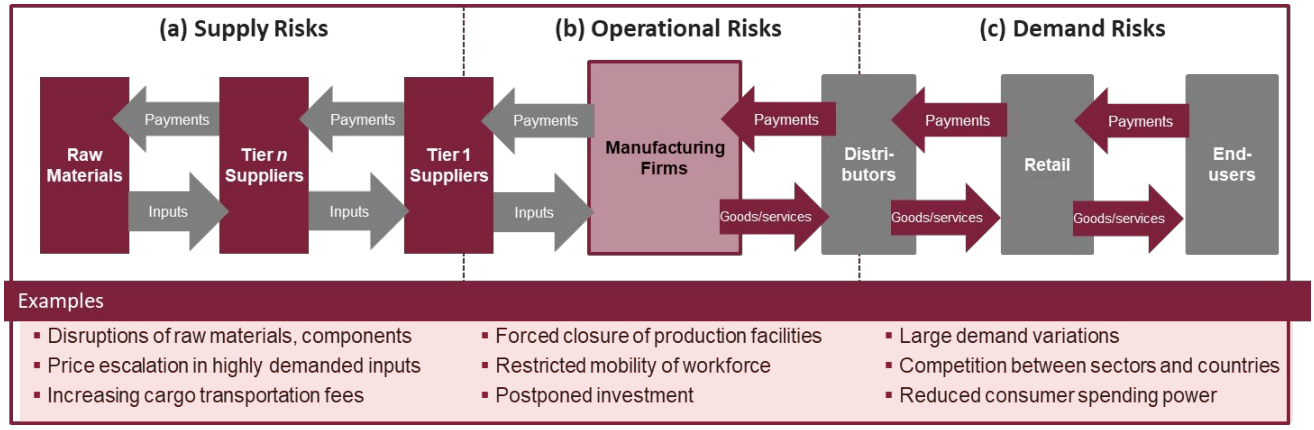
without income, a rate significantly higher than most other sectors, and much higher than agriculture and construction.

4. The manufacturing sector faces mounting disruptions and technological risks

Despite these strengths, the manufacturing sector faces a variety of mounting risks (Figure E2). In particular, it faces challenges related to:

- **Supply chain disruptions:** The rising incidence of extreme weather events in Southeast Asia – for example, typhoons increasing by over 20% since 2012 – threatens complex, multi-tier supply networks, resulting in production delays and cost spikes.
- **Technological risks:** The adoption of AI, the industrial internet of things (IIoT), additive manufacturing, and smart robotics boosts productivity but also introduces new risks – from cybersecurity threats to worker mental health risks. WRP data shows mixed public perceptions of AI: 36.7% believe it will help, while 30.2% fear harm.

FIGURE E2. DIAGRAM OF MANUFACTURING RISKS



Source: Diagram adapted from Manuj, I. and Mentzer, J.T. (2008). Global Supply Chain Risk Management. *Journal of Business Logistics*, Vol. 29, No. 1.

5. Industrial policies can enhance resilience by fostering localisation, resource efficiency, and the green transition

Six Southeast Asian examples illustrate how targeted industrial policies can translate resilience theory into practice.

TABLE E1. INDUSTRIAL POLICIES PROMOTING RESILIENCE IN SOUTHEAST ASIA

Policy goals	Examples from Southeast Asia
Policies seeking to localise industrial production	**Indonesia's nickel export controls:** A comprehensive ban on raw ore exports (2014, reinstated 2020) propelled domestic smelting capacity from 2 to 29 facilities, attracted foreign direct investment (FDI), particularly from China, and generated new downstream industries (ferronickel, stainless steel), boosting employment and foreign exchange earnings. **Singapore's "30×30" food vision:** By 2030, the city state aims to produce 30% of its nutritional needs locally through vertical farms, indoor hydroponics, and alternative proteins. The Singapore Food Agency's R&D grants, certification schemes ("SG Fresh Produce"), and talent-development programmes foster innovation despite high land and energy costs.
Policies seeking to make more efficient and sustainable use of industrial resources	**Philippines' e-waste management:** Pilot centres, launched in 2017 and expanded in 2024 by UNIDO and the Philippines' Department of Environment and Natural Resources (DENR), have formalised recycling, equipped informal workers with safety equipment, and created cooperatives that recover valuable metals, reducing environmental hazards and feeding a nascent circular economy. **Vietnam's eco-industrial parks:** Since 2015, nine parks have achieved annual savings of 22,000 MWh electricity, 140 TJ fuel, 600,000 m^3 water, and 32 kt CO_2 emissions, through shared utilities, waste symbiosis, and green infrastructure, proving the model's environmental and economic dividends.
Policies seeking to adapt the production base to the green transition	**Malaysia's EV transition:** With the 2021 Low-Carbon Mobility Blueprint and 2023 Energy Transition Roadmap, Malaysia is leveraging its electrical–electronics base to host Chinese automaker BYD's assembly plants and Proton's e.MAS 7 launch, while Tenaga Nasional Berhad (TNB) and private partners are scaling charging networks towards 10,000 stations by 2025. **Thailand's low-emission rice NAMA:** Supported by German IKI funds, the programme combines laser land levelling, site-specific nutrient management, and Good Agricultural Practices standards to lower rice sector GHG emissions by over 30%, while smallholder outreach and financial incentives are tackling adoption barriers.

Policy recommendations

Effective industrial policy can help Southeast Asian governments to build dynamic, adaptive economies capable of withstanding future shocks. Building on the findings presented in this policy brief, a few policy recommendations can be made:

1. *Owing to the manufacturing sector's role in ensuring socio-economic resilience, policymakers should develop policies to grow and strengthen the sector*
   Manufacturing is often overlooked in national strategies and tends to have a public image that does not accurately reflect the benefits it offers to workers and the economy. As this policy brief has highlighted, the manufacturing sector generates high-paid, safe, non-discriminatory jobs, and continuously seeks to improve itself. Promoting the growth of the manufacturing sector should be a priority for governments around the world, including in Southeast Asia.

2. *Promote localisation, redundancy, and industrial diversification to mitigate disruption risks*
   Owing to the increasing risk of supply chain disruptions, policymakers should consider a range of mitigation approaches. These can include incentivising localisation, redundancy, stockpiling, trusted partnerships, sourcing from nearby countries, and international collaboration. As the risks continue to evolve, supply chain risks should be periodically reviewed and risks in critical sectors and products should be continuously monitored.

   Governments should also pursue industrial diversification strategies. This includes diversifying the supply chain, ensuring a diverse set of suppliers of key products, components, and raw materials, and diversifying the country's production structure, reducing the concentration of activities in a limited number of economic sectors.

3. *Promote industrial safety to ensure that manufacturing delivers high-quality, safe jobs, even in the face of technological changes*
   Manufacturing practices can vary: the WRP shows that in high-income countries it is mostly done safely, while in low- and middle-income countries safety issues remain a concern. The enforcement of strong regulations is therefore crucial to ensuring that the sector delivers high-paying, safe, and fulfilling jobs.

   With the advent of new technologies, risks will continue to change. Policymakers should be aware of these new risks and develop appropriate policies to ensure new technologies are introduced for the benefit of all. For example, there is a need for robust regulation and worker training in digital security protocols.

4. *Encourage manufacturers to adopt greener production*
   Greening practices, such as implementing circular economy models or investing in energy efficiency, not only bring financial benefits but also potentially increase resilience, as they reduce input needs and localise their provision. Incentivising manufacturers to adopt greener production is an important step towards more resilient manufacturing sectors.

1. Introduction

The world is undergoing a period of rapid transformation marked by a convergence of emerging and persistent challenges. Over the past few years, crises such as the COVID-19 pandemic, ongoing armed conflicts, the intensifying impacts of climate change, and rising geopolitical tensions, including the China–US trade tensions and recent tariff increases, have unveiled deep vulnerabilities within socio-economic systems. Nowhere is this more evident than in Southeast Asia, a region known for its dynamic economic growth yet persistent exposure to a multitude of risks. In this policy brief, we draw on the Lloyd's Register Foundation World Risk Poll (WRP) to explore how robust industrial capabilities, particularly within the manufacturing sector, play a pivotal role in enhancing socio-economic resilience, focusing on the Southeast Asian region. We also offer concrete case studies that can inspire other countries to build resilience through industrial policies.

Southeast Asia's growing role in global manufacturing

As a region, ASEAN accounted for 8% of global trade and 5% of global manufacturing value added in 2023, while attracting 17% of global FDI. The bloc has emerged as a central node in global commerce, serving as China's primary trading partner, Japan's second largest, Korea's third largest, and the USA's fourth-largest trading partner.[1] Over the past decade, ASEAN economies have deepened their participation in global value chains, leveraging a mix of competitive labour costs, improving infrastructure, and steadily expanding industrial capabilities.

The region is experiencing rising specialisation within key industries such as electronics, automotive, food processing, and chemicals, underpinned by a young workforce and expanding skills base. ASEAN offers a compelling alternative to China as a manufacturing hub, benefiting from supply chain diversification trends and its strategic geographic location at the crossroads of major shipping routes. Its growing social, legal, economic, political, and technological influence enhances its appeal, positioning Southeast Asia as one of the next major global manufacturing powerhouses.

Context of change and emerging risks

The COVID-19 pandemic demonstrated how interconnected and interdependent our world has become. Beyond its immediate public health implications, the pandemic precipitated severe economic shocks that disrupted global supply chains and crippled industries overnight. In Southeast Asia, as in many parts of the world, enterprises, especially micro-, small-, and medium-sized firms, faced abrupt interruptions in operations, supply chain breakdowns, and extraordinary financial pressures. The pandemic's ripple effects underscored the urgent need to fortify economies against future shocks, emphasising that resilience is not just about rapid recovery – it is about proactive adaptation.

Simultaneously, armed conflicts have compounded these challenges. Armed conflicts, for instance, have significantly disrupted energy markets and agricultural supply chains, driving up global energy and food prices. This volatility has far-reaching implications for Southeast Asia, where many economies depend on imported energy and food products. These conflicts not only underscore the

[1] Ing, L. (2024). *ASEAN in the Global Economy: A Half-Century Journey*. Economic Research Institute for ASEAN and East Asia (ERIA).

pervasive impact of geopolitical strife on global markets but also highlight how wars can act as catalysts for widespread socio-economic disruption.

The mounting effects of climate change represent an equally daunting challenge. Southeast Asia, home to some of the world's most densely populated and economically vibrant areas, is among the regions that are most vulnerable to extreme weather events – from powerful typhoons and floods to prolonged droughts. These recurring natural disasters strain infrastructure, disrupt production, and derail economic growth. While climate adaptation measures have been implemented with varying degrees of success, the escalating frequency and severity of such events demand that resilience-building become a central pillar of sustainable development strategies.

Adding to these challenges are the rising geopolitical tensions that have fundamentally reconfigured global economic dynamics. The prolonged trade conflict between China and the USA, and the recent round of US tariff increases, for example, have raised uncertainty in international trade, compelling nations to reconsider their positions in global supply chains. Southeast Asian countries, many of which are both manufacturing hubs and critical links in global production networks, are being forced to navigate this new environment by diversifying their trade partnerships and investing in domestic capacities.

These complex challenges are deeply interconnected, often amplifying one another in what some analysts term a "polycrisis".[2] The **cascading nature of risks** means countries are now contending with multiple shocks simultaneously, rather than isolated crises. This new reality highlights a growing imperative for nations and regions to build resilience – the capacity to withstand, adapt to, and recover from shocks. In other words, **understanding and strengthening the drivers of socio-economic resilience has become critical**. Nowhere is this need more evident than in the developing world, including Southeast Asia, where recent crises have exposed both fragilities and the potential for adaptive responses. Policymakers across the region are increasingly focused on enhancing resilience as a core development objective – seeking ways to protect livelihoods, maintain stability, and sustain growth amid turbulence.

Role of industrial capabilities in enhancing resilience

Central to this resilience-building agenda is the development and reinforcement of industrial capabilities, notably in the manufacturing sector. A robust manufacturing base does more than just provide employment and support economic growth – it strengthens a nation's capacity to respond swiftly and effectively when crises strike. Empirical evidence from the COVID-19 era has shown that countries with strong industrial infrastructures were better positioned to pivot their production lines in response to emerging demands, such as the rapid manufacturing of PPE and critical medical supplies. This flexibility was not just a matter of convenience – it was a lifeline that bridged gaps in global supply chains at a time of acute need. Drawing lessons from the COVID-19 pandemic, Cambridge Industrial Innovation Policy proposes three main channels through which manufacturing contributes to socio-economic resilience (Table 1).

[2] World Economic Forum (2023). We're on the brink of a 'polycrisis' – how worried should we be?

TABLE 1. CONTRIBUTIONS OF MANUFACTURING TO SOCIO-ECONOMIC RESILIENCE

	• Manufacturing provides goods that are critical for sustaining life – including food, beverages, medicines, clothing, fuel, and other basic necessities. • Manufacturing provides inputs (such as machinery, components, systems and engineering services) to critical national infrastructure (such as transportation, electricity, and communication).
	• Manufacturing provides strategically important products and assets to address certain types of emergency. • A shortage of COVID-19-critical items hampered countries' ability to respond to the crisis. • Different types of goods are required during different emergencies.
	• Historically, manufacturing has been dubbed the "flywheel of growth" because of its contribution to productivity, trade, jobs, and innovation. • In a number of countries, manufacturing industries have offered "pockets of resilience" supporting recovery from COVID-19, as well as previous crises.

Source: CIIP (2021). Adding the resilience dimension to industrial policy: Lessons from COVID-19.

The manufacturing sector is an essential engine for rapid economic adaptation. By fostering domestic production capabilities, governments can ensure that essential goods – from pharmaceuticals to critical infrastructure components – remain within reach even when global supply networks falter. For Southeast Asia, where a significant portion of the economy is driven by manufacturing and where MSMEs play a critical role in local economies, fostering such capabilities is a strategic imperative. In this context, industrial resilience is not just about ensuring continuity of production – it is about enabling transformation under duress. Nations that invest in resilient manufacturing systems are better able to mitigate economic shocks and sustain growth, even during periods of substantial adversity.

Digitalisation, circular economy practices, and the inclusiveness of industrial systems remain important facets of modern manufacturing that contribute to socio-economic resilience. Digital technologies, for example, enabled firms to continue operations remotely and to adopt flexible production processes at the height of the COVID-19 restrictions.[3] Similarly, circular manufacturing models – characterised by resource efficiency, recycling, and reduced dependency on volatile global supply chains – offer pathways to build more sustainable and robust production systems.[4] When these innovations are coupled with policies that support inclusivity in manufacturing activities, the result is a dynamic and adaptive ecosystem, which is capable of weathering disruptions and emerging stronger after a crisis.

[3] Calza and Lavopa (2022). Digitalization and industrial resilience during the COVID-19 pandemic.
[4] Ferrari et al. (2023). The COVID-19 pandemic as a window of opportunity for more sustainable and circular supply chains.

The World Risk Poll: a valuable resource for understanding global risks

The Lloyd's Register Foundation World Risk Poll (WRP) is the first and only global, nationally representative study of worry about, and harm from, various risks to people's safety. Conducted every 2 years, delivered as a focused part of the Gallup World Poll, the WRP is based on 147,000 interviews in 142 countries. The first WRP was conducted in 2019, in response to pressing data gaps on risk and safety around the world. Since 2021, the findings of each WRP have been published in four themed reports, covering some of the greatest risks facing people and communities globally. In 2024 the issues covered included severe weather and climate change resilience, workplace safety, and waste management. Previous polls have included risks such as workplace violence and harassment, and AI and data misuse.[5] The data set also allows useful breakdowns by country, industry, gender, and income group levels.

In this policy brief, we use WRP data to analyse different regions and countries' exposure to risks, and the contribution of manufacturing to socio-economic resilience, focusing on the Southeast Asia region. The policy brief is structured as follows: the next section describes the differing resilience and risk exposure of regions and Southeast Asian countries; next, it delves into the contribution of manufacturing to socio-economic resilience; then, it provides concrete examples of industrial policies with direct impacts on socio-economic resilience; and a concluding section summarises the main messages of the policy brief.

[5] Lloyd's Register Foundation (n.d.). About the poll.

2. The role of industrial capabilities in socio-economic resilience

2.1 The differing resilience of regions and countries

Different countries and regions of the world offer their inhabitants different levels of socio-economic resilience. Resilience, defined here as the capacity to withstand, adapt to, and recover from shocks, is a multifaceted concept and therefore difficult to measure. This is where the WRP makes an important contribution, providing a Resilience Index with four dimensions: individual, household, community, and societal. Table 2 describes the variables used to calculate each dimension.[6]

TABLE 2. DIMENSIONS OF THE WORLD RISK POLL RESILIENCE INDEX

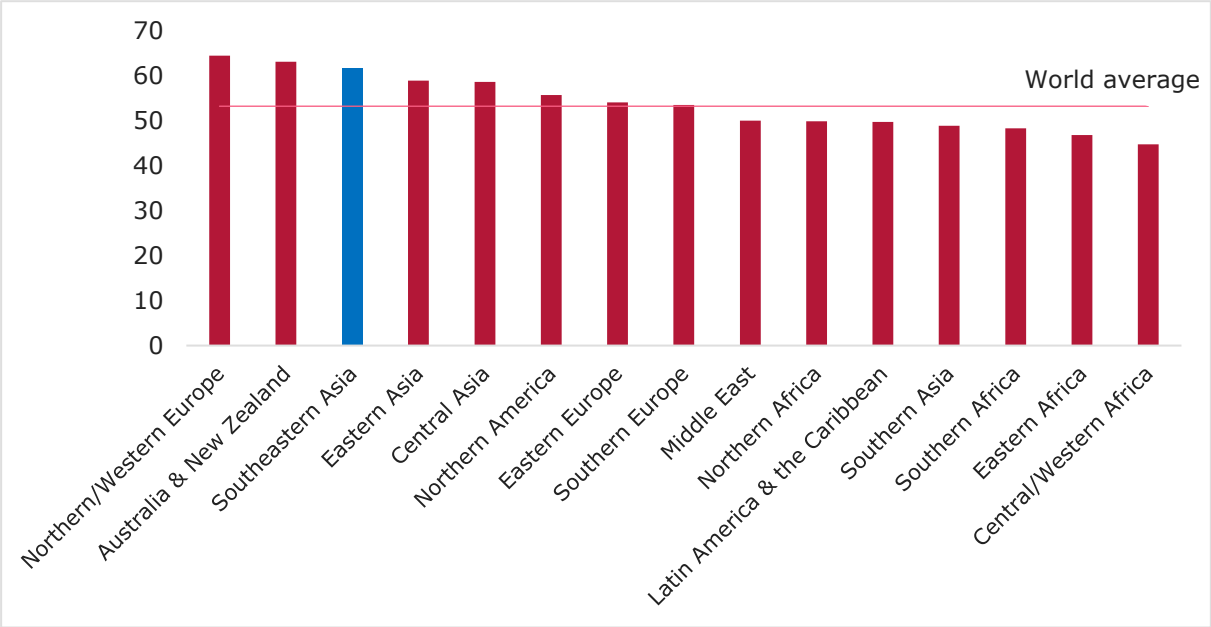
Resilience Index dimension	Variables used
Individual	**Agency/Self-efficacy:** If a disaster were to occur near you in the future, do you think there is anything you could do to protect yourself or your family from its impact? **Educational attainment:** What is your highest completed level of education?
Household	**Financial assets:** Suppose your household suddenly lost all income and had to survive on savings and things that could be sold. How long would your household be able to cover all the basic needs, such as food, housing, and transportation? **Planning:** If a disaster were to occur near you in the future, do you have a plan for what to do that all members of your household who are over 10 years old know about? **Access to communications:** Does your home have access to 1) the internet, 2) a cellular phone?
Community	**Social capital:** • How much do you think most of your neighbours care about you and your wellbeing? • Do you feel safe walking alone at night in the city or area where you live? • Have you done any of the following in the past month? Helped a stranger or someone you didn't know who needed help. **Local infrastructure:** In the city or area where you live, are you satisfied or dissatisfied with: • The roads and highways? • The educational system or the schools? • The availability of quality healthcare?
Societal	**Discrimination:** Have you, personally, ever experienced any discrimination because of any of the following? The colour of your skin? Your religion? Your ethnicity/nationality? Your gender? A disability, if you have one? **Safety net:** How much do you think the government of [country] cares about you and your wellbeing? **National institutions index:** In [country], do you have confidence in each of the following, or not? • The military? • The judicial system or courts? • The national government?

Source: Lloyd's Register Foundation (n.d.). World Risk Poll Resilience Index.

Figure 1 shows that Southeast Asia has one of the highest resilience indexes in the world, behind only Northern/Western Europe, and Australia and New Zealand. Southern, Eastern, and Central/Western Africa are the global regions with the lowest resilience indexes.

[6] For the full methodology, see Lloyd's Register Foundation (n.d.). World Risk Poll Resilience Index.

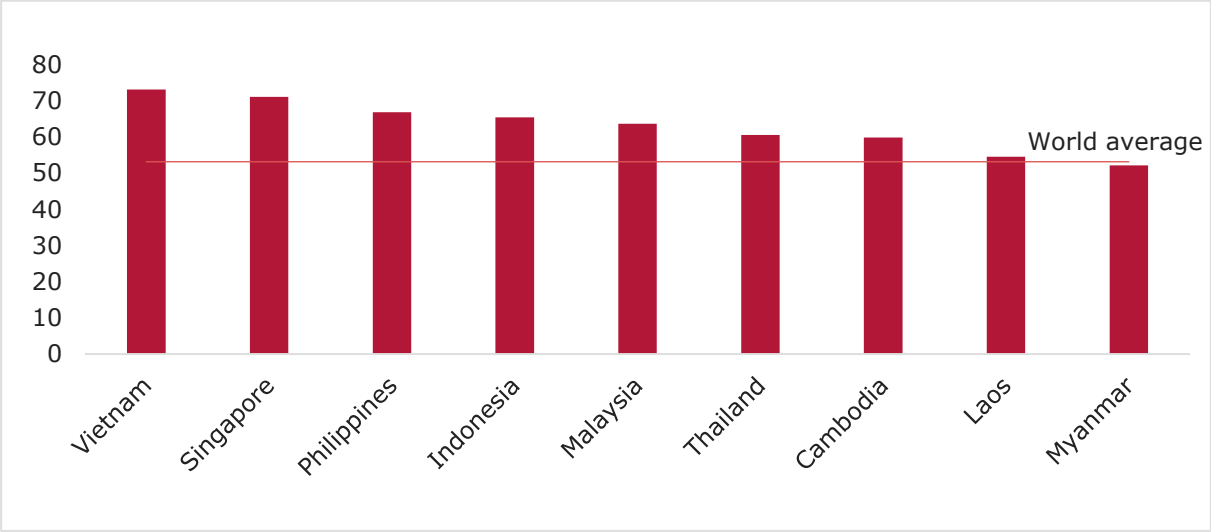
FIGURE 1. RESILIENCE INDEX ACROSS GLOBAL REGIONS, 2023



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

Within Southeast Asia, there are also significant cross-country differences (Figure 2). Vietnam and Singapore are the countries with the highest resilience indexes in the region, while Laos and Myanmar are the lowest performers. However, among Southeast Asian countries, only Myanmar has a Resilience Index below the world average.

FIGURE 2. RESILIENCE INDEX OF SOUTHEAST ASIAN COUNTRIES, 2023



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

Overall, despite being a region with a high incidence of extreme weather events, Southeast Asian countries perform very well globally in terms of resilience. Table 3 shows a breakdown of the Resilience Index dimensions, and Southeast Asian countries perform well across all dimensions. However, they are particularly strong in the **community** aspect of resilience – a dimension that takes into account the quality of interpersonal relationships and the perceived quality of the infrastructure and public services available.

TABLE 3. BREAKDOWN OF THE RESILIENCE INDEX DIMENSIONS OF GLOBAL REGIONS, 2023

Global region	Resilience Index	Household	Community	Society	Individual
Northern/Western Europe	64.4	67.0	67.4	65.1	58.4
Australia and New Zealand	63.1	71.0	60.7	58.2	63.1
Southeast Asia	61.6	61.4	70.2	69.2	45.8
Eastern Asia	58.9	63.9	61.0	58.1	52.7
Central Asia	58.6	54.0	64.4	70.6	46.8
Northern America	55.7	59.4	55.2	50.3	57.8
Eastern Europe	54.0	58.0	56.4	55.6	46.1
Southern Europe	53.5	58.4	56.0	55.2	44.5
Middle East	50.0	53.2	63.9	54.7	47.1
Northern Africa	49.8	45.7	53.2	66.8	33.7
Latin America and the Caribbean	49.7	52.9	52.3	49.8	44.2
Southern Asia	48.8	40.0	56.6	61.5	37.3
Southern Africa	48.3	49.0	52.0	57.0	35.2
Eastern Africa	46.8	43.4	51.9	60.7	31.2
Central/Western Africa	44.7	40.4	49.5	58.8	30.2
WORLD	**53.2**	**53.7**	**57.9**	**59.2**	**43.7**

Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

Progress has also been made in the region in terms of disaster preparedness, especially with the establishment in 2015 of a multi-layer system of disaster management consisting of regional, national and subnational levels. This system features the primary role of the national disaster management authorities and the regional leadership in ASEAN. Since its establishment, Southeast Asian countries have advanced in many of the set targets related to disaster resilience. Economic loss and affected infrastructure and services from disasters have reduced, and coping capacities have consistently improved. ASEAN has also diversified and deepened partnerships with extra-regional countries, international organisations, civil society, and the private sector, gaining global recognition for its important work in disaster management.[7]

Another important aspect is that the region has made significant progress in industrialisation. As discussed in the next section, this process has important effects on socio-economic resilience.

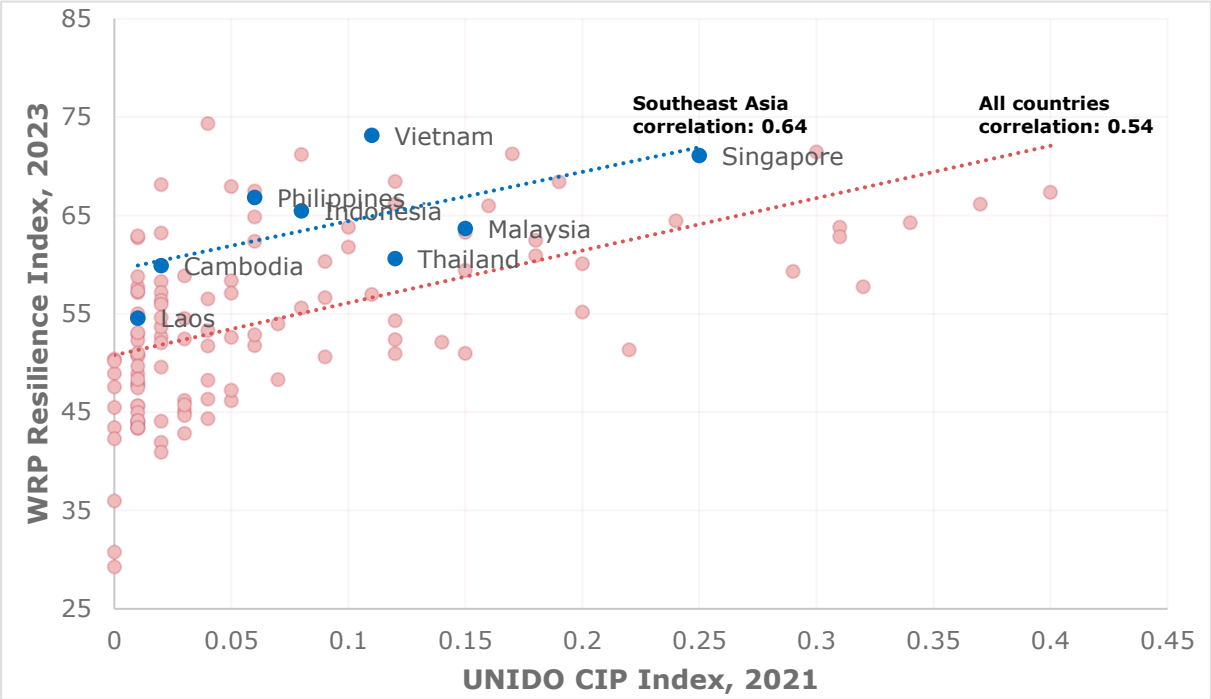
2.2 The link between industrial capabilities and resilience

The first point to note is that there is a strong correlation between countries' industrial capabilities and their resilience. Figure 3 shows the correlation between the countries' performance in UNIDO's Competitive Industrial Performance (CIP) index – used as a proxy for industrial capabilities – and their performance in the WRP Resilience Index. The correlation is high for all countries with available data (0.54), and even higher for the Southeast Asian countries with available data (0.64). Although correlation does not imply causation, this finding suggests a strong potential for industrialisation to boost countries' resilience. The figure also shows significant variation across

[7] ASEAN (2021). ASEAN disaster resilience outlook: preparing for a future beyond 2025.

countries with low CIP indexes, indicating that, for these countries, other factors may be more important in shaping socio-economic resilience.

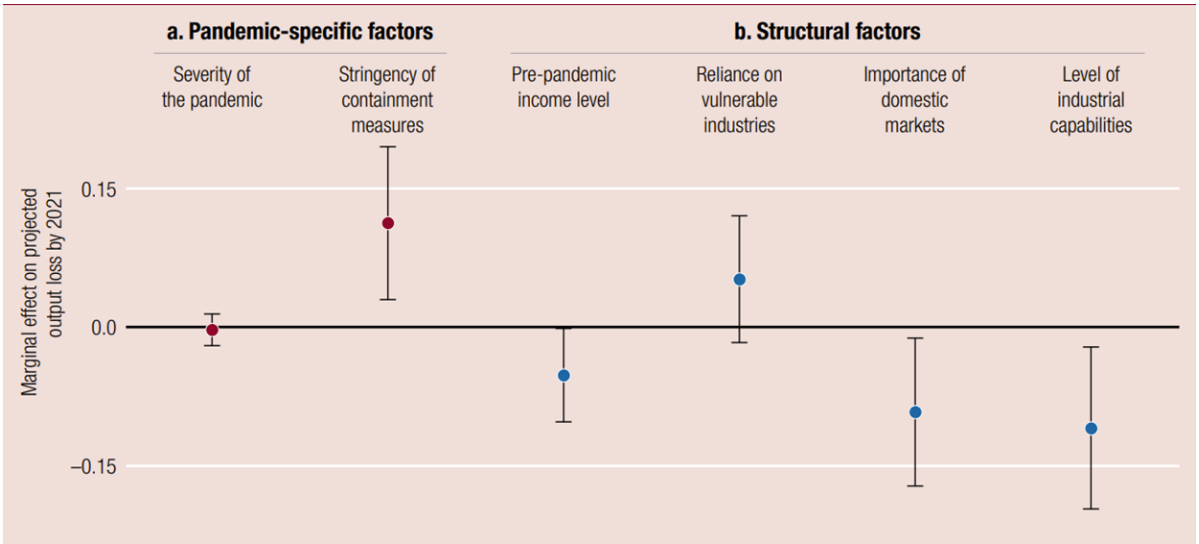
FIGURE 3. CORRELATION BETWEEN THE WRP RESILIENCE INDEX AND UNIDO'S CIP INDEX



Source: Own elaboration based on Lloyd's Register Foundation World Risk Poll 2023 – Resilience Index, and UNIDO, CIP Index, 2021.

Figure 4 also provides evidence of the role of industrial capabilities in socio-economic resilience. It shows the results of an econometric exercise analysing the main determinants of the projected output losses due to the COVID-19 pandemic. Factors positioned above the horizontal axis (indicating zero impact) are those that amplified the effects of the crisis. These include the strictness of containment measures and dependence on industries vulnerable to COVID-19. Conversely, factors situated below the horizontal axis are those that softened the impact of the crisis, such as income levels, the size of domestic markets, and industrial capabilities. Of these, only the latter two – domestic markets and industrial capabilities – were found to be statistically significant. Notably, industrial capabilities emerge as the most crucial factor mitigating the impact of the crisis among those considered. The findings reinforce the importance of strengthening industrial capabilities to enhance future preparedness.

FIGURE 4. DETERMINANTS OF COVID-19 IMPACT ON ECONOMIC ACTIVITY: THE ROLE OF INDUSTRIAL CAPABILITIES



Source: UNIDO (2022). Industrial Development Report 2022.

Note: Econometric estimates are for 128 countries with available data for all variables used in the model. The figure depicts coefficients (dots) and confidence intervals (at 95%) (lines) for the average marginal effects of the variables of interest on the projected output loss of each country for 2021. A linear model with cluster-robust standard errors was implemented. Regional dummies were included. See Lavopa et al. (2021) for more details on the methodology used.

Having demonstrated the importance of industrial capabilities for socio-economic resilience at the national level, the next sub-sections illustrate how manufacturing can contribute to this at the individual level.

2.3 Manufacturing is one of the safest industries in the world

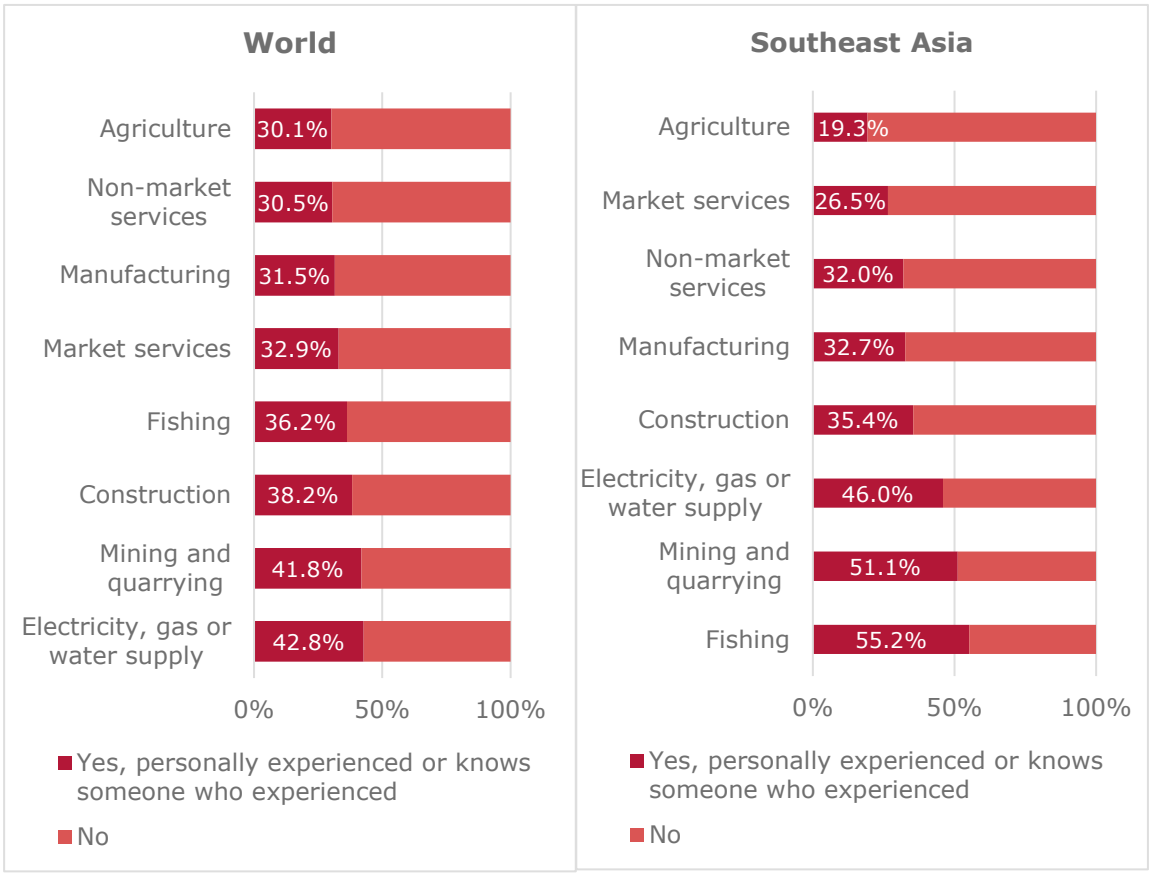
An aspect of manufacturing that is often overlooked or misunderstood is that it is one of the safest industries to work in. While it is undeniably an industry that exposes workers to heavy, repetitive, or sometimes dangerous tasks, it is also highly regulated in terms of occupational health and safety. Manufacturing companies are generally legally required to follow strict practices that limit workplace accidents and other health risks.

This point is confirmed by the WRP question about workplace safety. As Figure 5 shows, globally manufacturing was among the industries with the smallest shares of respondents saying they had either experienced or knew someone who had experienced harm at work in the previous 2 years. In Southeast Asia, specifically, manufacturing performs a bit worse than the global level, but it is still above average compared to other sectors in the region.

Globally, the sectors with the lowest perceptions of workplace safety are electricity, gas, or water supply, mining and quarrying, construction, and fishing. In Southeast Asia, fishing and mining and quarrying performed quite poorly, with over 50% of respondents claiming they had personally experienced or knew someone who had experienced harm from work in the previous 2 years.

FIGURE 5. EXPERIENCES OF HARM AT WORK ACROSS DIFFERENT INDUSTRIES

WRP question: "Have you or someone you personally know experienced serious harm from the work you do in the past 2 years?" World and Southeast Asia, by industry

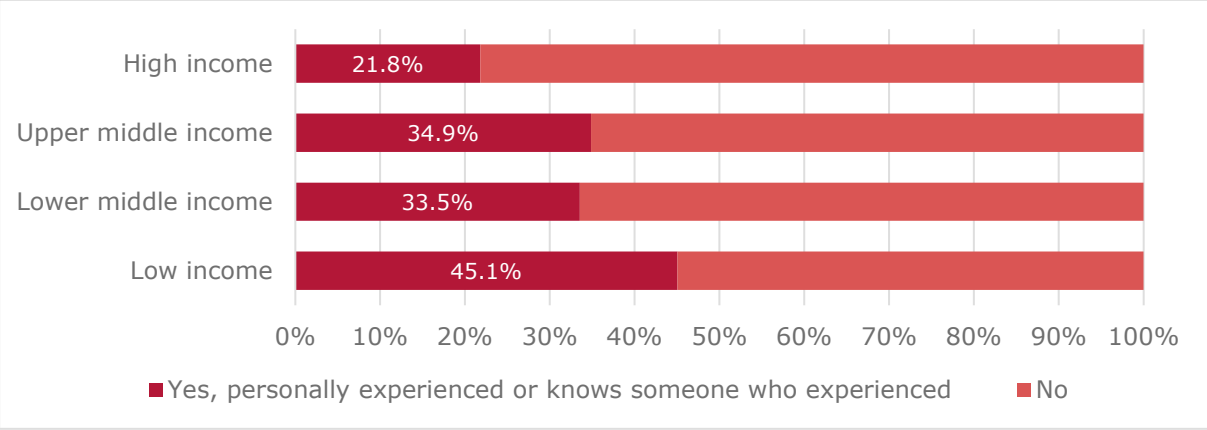


Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

Despite it generally being a relatively safe industry to work in, there are different levels of worker safety in manufacturing. As Figure 6 shows, in high-income countries manufacturing is seen as a very safe industry, whereas in middle-income countries this perception reduces, and it reduces further in low-income countries. This shows there are different manufacturing practices, and, done properly, it can be a very safe industry, highlighting the importance of policies promoting and enforcing workplace safety practices.

FIGURE 6. DIFFERENT LEVELS OF MANUFACTURING WORKER SAFETY ACROSS INCOME GROUPS

WRP question: "Have you or someone you personally know experienced serious harm from the work you do in the past 2 years?" World, by income group, manufacturing only

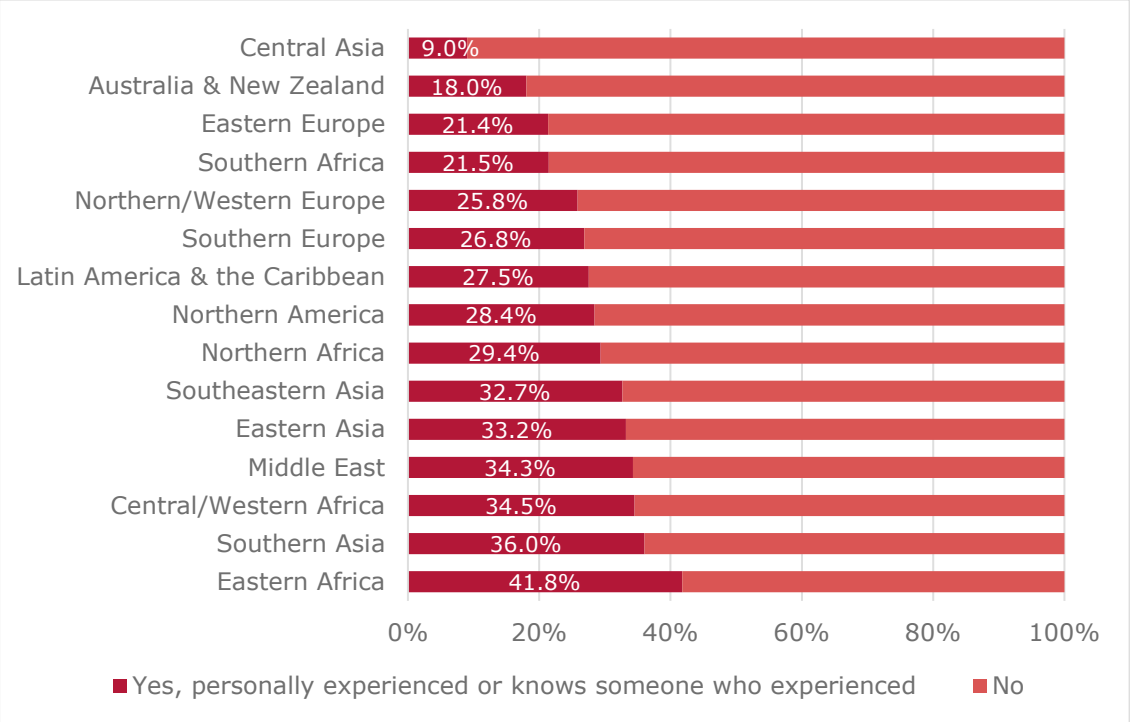


Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

Figure 7 globally compares the perception of workplace harm in manufacturing – Southeast Asia performs below average, suggesting room for improvement in how manufacturing is conducted in the region.

FIGURE 7. DIFFERENT LEVELS OF MANUFACTURING WORKER SAFETY ACROSS GLOBAL REGIONS

WRP question: "Have you or someone you personally know experienced serious harm from the work you do in the past 2 years?" World, by global region, manufacturing only



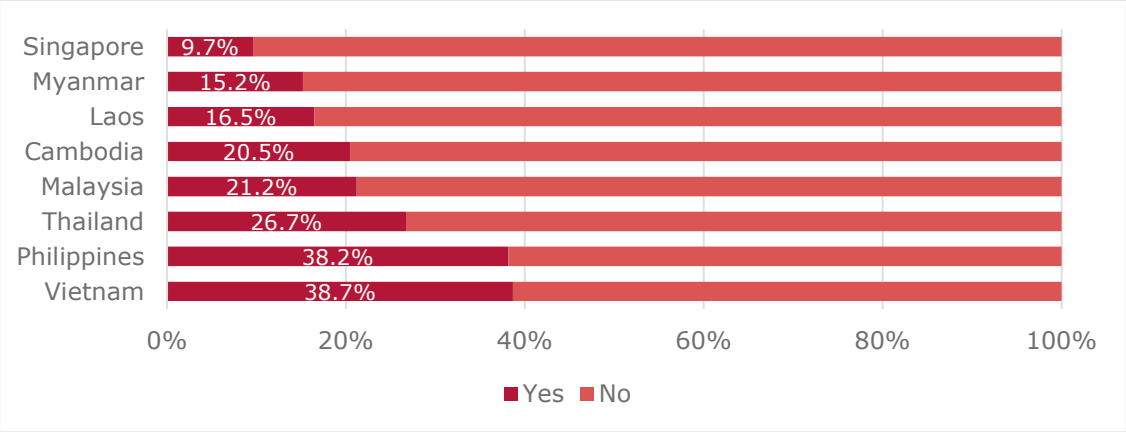
Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

Variation is also evident among Southeast Asian countries (Figure 8). Indonesia and Singapore are the top performers in the region, indicating that manufacturing is done safely in these countries.

At the other end of the spectrum, the Philippines and Vietnam are the countries with the most room for improvement in manufacturing workplace safety.

FIGURE 8. DIFFERENT LEVELS OF MANUFACTURING WORKER SAFETY ACROSS SOUTHEAST ASIAN COUNTRIES

WRP question: "Have you or someone you personally know experienced serious harm from the work you do in the past 2 years?" Southeast Asia, by country, manufacturing only



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.
Note: Indonesia not included because of insufficient responses.

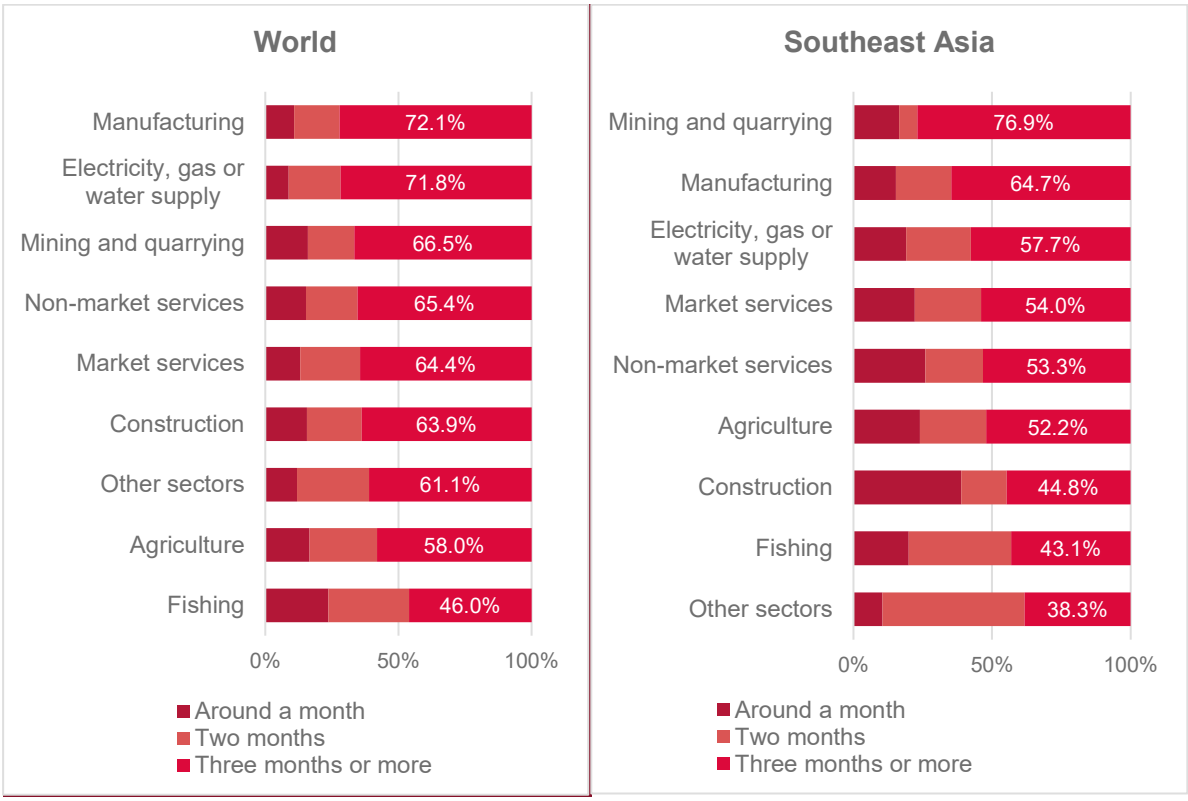
2.4 Manufacturing workers face less financial risk

Manufacturing is well known for offering formal jobs and paying higher-than-average salaries to workers. This reduces workers' and their families' financial risks, increasing their economic resilience. WRP data reflects this, and Figure 9 shows that, at the global level, manufacturing is the industry that offers the fewest financial risks to its workers, with 72.1% of respondents from this sector stating that if they lost their job, their household could still cover their basic needs for over 3 months. In Southeast Asia, manufacturing offers slightly less financial security, with 64.7% of respondents stating their household could cover basic needs for over 3 months. However, it still offers the second-highest financial security to workers, behind only mining and quarrying.

The same cannot be said for construction, fishing, or agriculture, in which self-employment and informal work abound, offering very little financial security to workers. In Southeast Asia, construction is a particularly worrying case, with 38.9% of workers claiming their household could only cover their basic needs for around a month if their income were lost.

FIGURE 9. THE FINANCIAL RISKS OF WORKERS IN DIFFERENT INDUSTRIES

WRP question: "Suppose your household suddenly lost all income and had to survive only on savings and things that could be sold. How long would your household be able to cover all the basic needs, such as food, housing, and transportation?" World and Southeast Asia, by industry



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

2.5 Manufacturing is one of the least discriminatory industries

The WRP asked respondents about any discrimination they had experienced. Figure 10 shows that, globally, a smaller share of manufacturing workers had experienced discrimination than in other sectors. This may be related to the strict regulations – including workforce regulations – that manufacturing companies must follow, or to the practical and impersonal nature of the manufacturing work, which may make recruiters, managers, and other workers less prone to engaging in discriminatory practices.

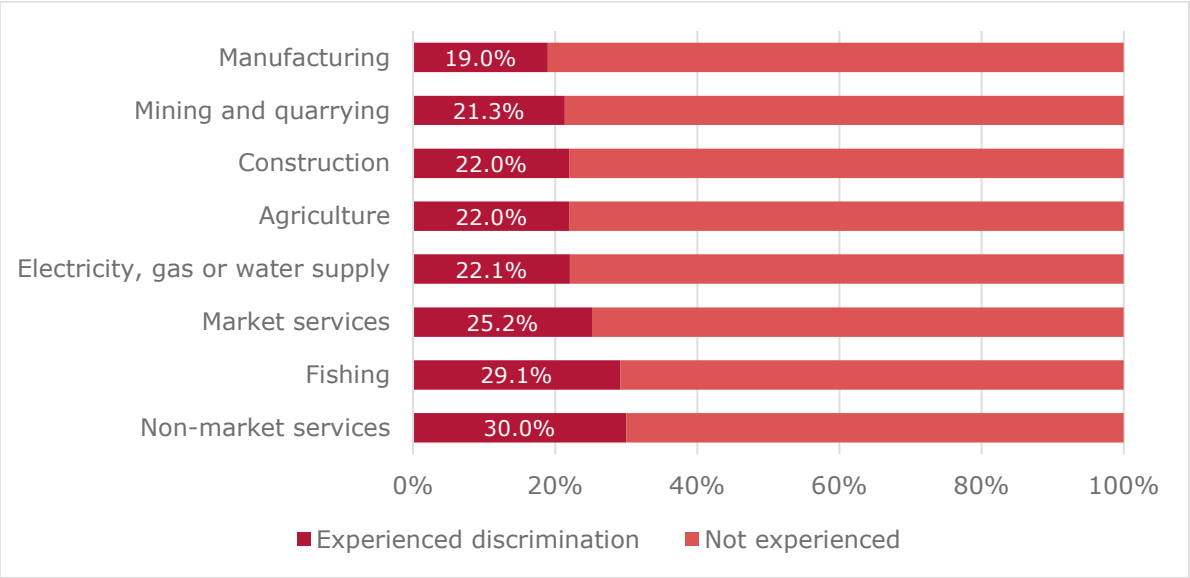
Non-discrimination is important for socio-economic resilience, as empirical evidence shows that more diverse and inclusive organisations tend to outperform non-inclusive ones. This occurs through several channels: increased innovation and learning; more inclusive and safe environments for people to speak their minds and improve operations; retaining top talent; accelerating complex problem-solving with more perspectives and ideas; and enhancing morale through a greater sense of belonging; among others.[8]

[8] Forbes (2024). One More Time: Why Diversity Leads To Better Team Performance.

This manufacturing performance contrasts, somewhat surprisingly, with that of non-market services, which includes education, healthcare, social services, public administration, government, and military. Globally, these services are the ones in which the highest share of workers experienced discrimination.

FIGURE 10. EXPERIENCES OF DISCRIMINATION ACROSS INDUSTRIES

WRP question: "Have you, personally, ever experienced any discrimination?" World, by industry



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

2.6 Fewer manufacturing workers experience mental health issues than in other sectors

Equally important to the physical health and safety of workers is their mental health. This is a crucial aspect of socio-economic resilience at the individual level, as poor mental health can hinder an individual's capacity to work, rest, and live a fulfilling life.[9] Also, evidence shows that poor mental health can affect an individual's physical health.[10]

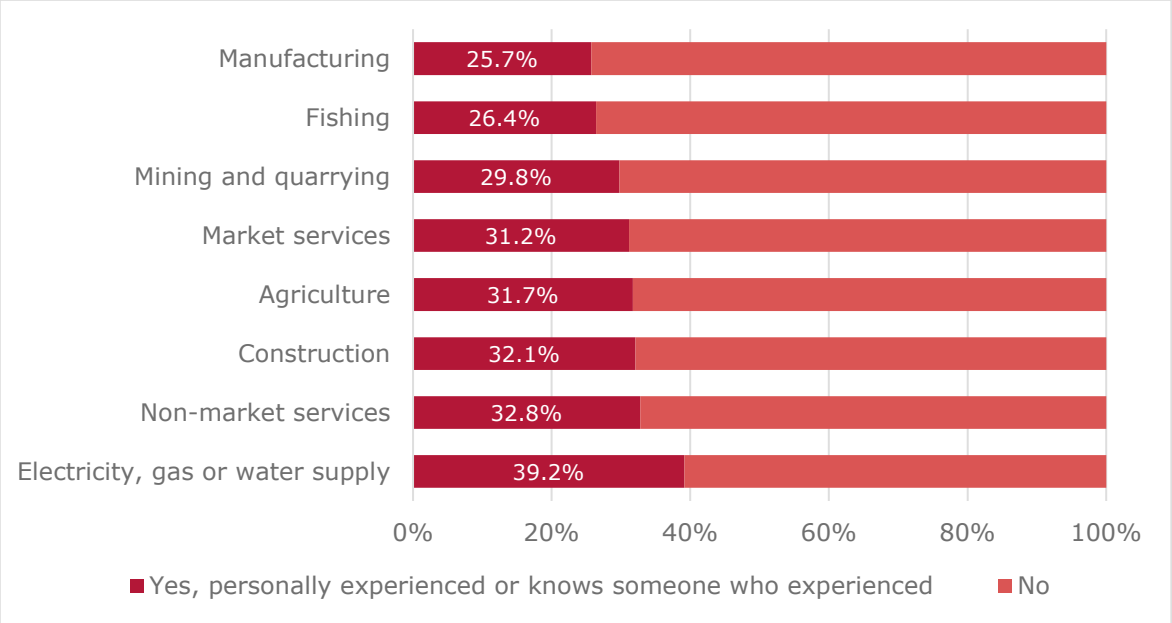
The WRP asks respondents about mental health issues they may have experienced. Figure 11 shows that manufacturing is the sector with the lowest share of workers who experience mental health issues globally. This could be related to the quality of manufacturing jobs, which are usually formalised, well-paid, stable jobs, and to the strict health and safety regulations that manufacturers must follow.

Here, the performance of manufacturing once again contrasts with that of non-market services and with the utilities sector (electricity, gas, and water supply). Globally, these sectors had the highest share of workers experiencing mental health issues.

[9] Oliveira et al. (2022). The Role of Mental Health on Workplace Productivity: A Critical Review of the Literature.
[10] Pizzol et al. (2023). Relationship between severe mental illness and physical multimorbidity: a meta-analysis and call for action.

FIGURE 11. EXPERIENCES OF MENTAL HEALTH ISSUES ACROSS INDUSTRIES

WRP question: "Have you or someone you personally know experienced serious harm from mental health issues in the past 2 years?" World, by industry



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

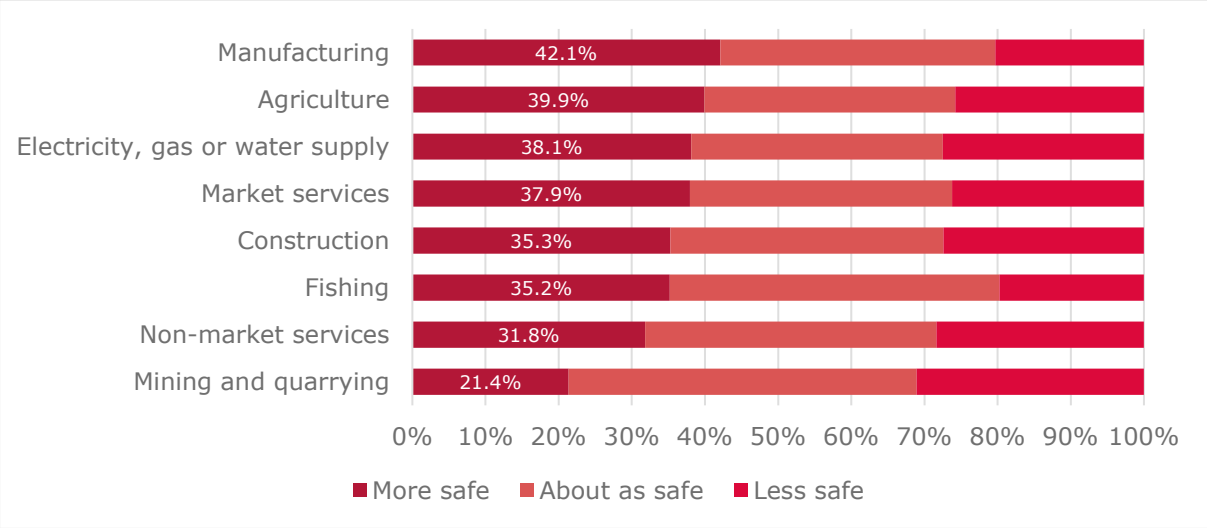
2.7 Manufacturing offers continuous safety improvements

Another important characteristic of the manufacturing sector is that it is constantly being changed by the introduction of new technologies, practices, and materials. It is therefore constantly seeking improvements to produce higher-quality products and establish more efficient, sustainable, and safer processes. This characteristic is reflected in the WRP question about whether the respondent felt more or less safe at the time of the survey than 5 years before. The results show that, among all sectors, manufacturing had the highest share of workers (42.1%) stating they felt safer than 5 years before (Figure 12).

The recent introduction of technologies such as autonomous vehicles, drones, and robots for straining or dangerous tasks in manufacturing may explain the improved safety perceptions of workers in the sector.

FIGURE 12. EVOLUTION OF SAFETY ACROSS INDUSTRIES

WRP question: "Overall, do you feel more safe, less safe, or about as safe as you did 5 years ago?"
World, by industry



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

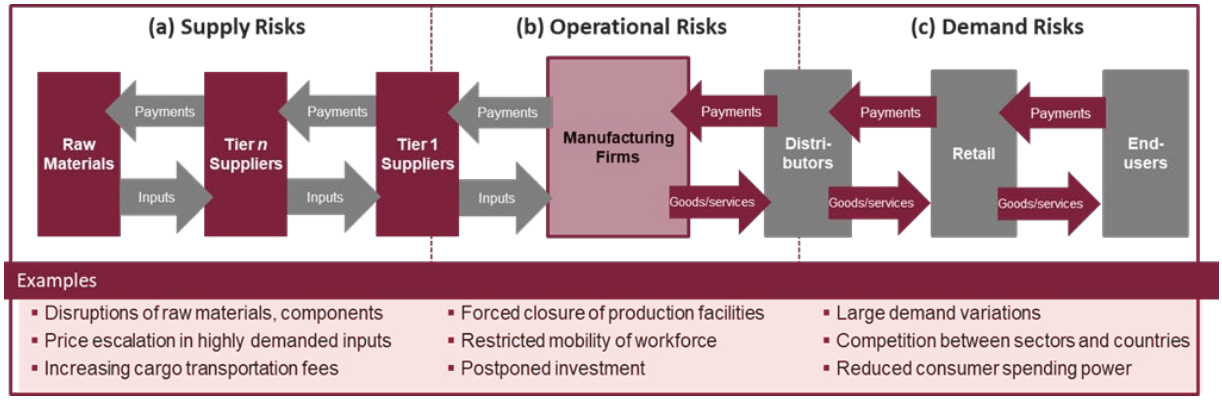
3. How the changing global risk landscape is affecting manufacturing

While the previous sections showed how manufacturing contributes to the resilience of countries and individuals, the sector is also heavily affected by the current context of multiple overlapping transformations. The manufacturing industry is characterised by complex value chains that are often international and vulnerable to shocks: if any part of the chain breaks down, entire production processes can come to a halt. New manufacturing technologies such as robotics and AI have the potential to greatly improve manufacturing productivity, but they also bring new risks. This section analyses how the changing global risk landscape is affecting the manufacturing sector.

3.1 Supply chain disruptions are becoming more frequent

Manufacturing supply chains are particularly complex, given that they usually rely on multiple tiers of suppliers and distributors working effectively together. As described in Figure 13, manufacturing risks can be classified into three main categories: supply, operational, and demand.

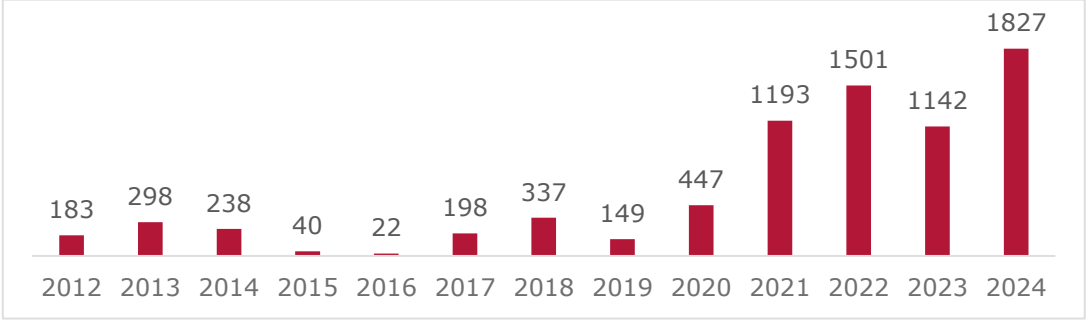
FIGURE 13. DIAGRAM OF MANUFACTURING RISKS



Source: Adapted from Manuj, I. and Mentzer, J.T. (2008). Global Supply Chain Risk Management. *Journal of Business Logistics*, Vol. 29, No. 1.

With the growing number of extreme weather events, supply chain disruptions are increasingly frequent. Figure 14 shows the increasing number of natural disasters in Southeast Asia since 2012 – and these numbers are expected to grow over time.

FIGURE 14. THE GROWING NUMBER OF NATURAL DISASTERS IN SOUTHEAST ASIA

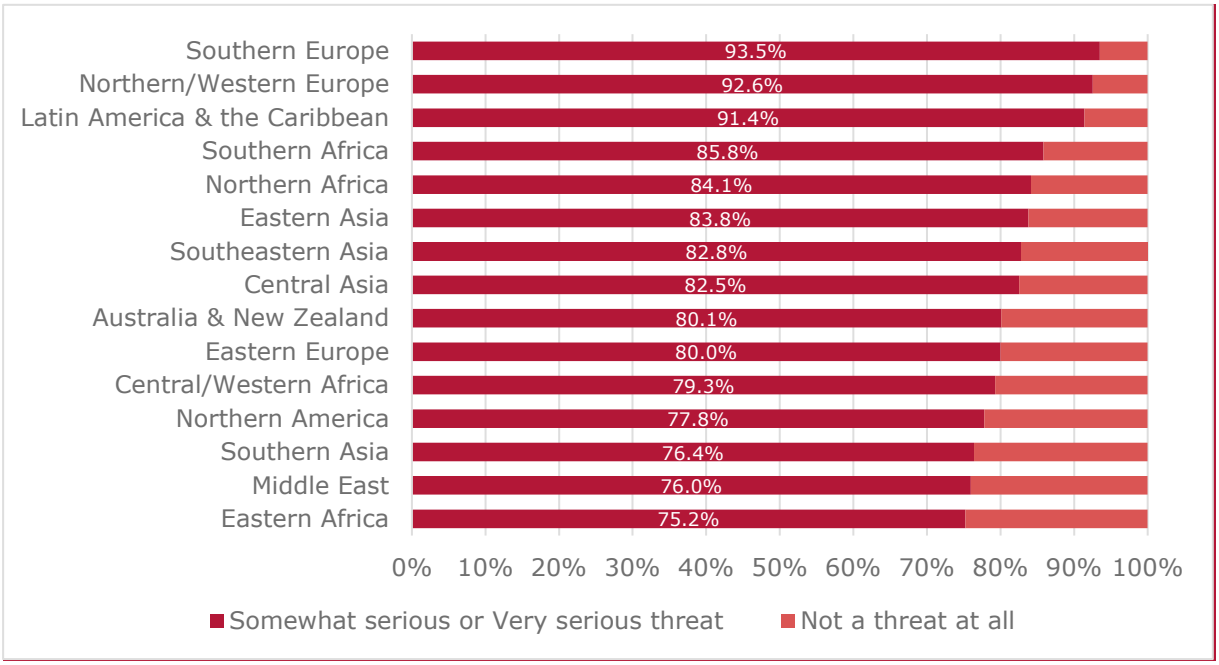


Source: ADINet Knowledge Hub (2025). Disasters by the numbers in the ASEAN region.

Figure 15, in turn, shows that people across all regions in the world consider climate change a serious threat. Southeast Asia is slightly above average in the global comparison, highlighting that this region is expected to be significantly affected by the changing climate.

FIGURE 15. PERCEPTION OF CLIMATE CHANGE RISKS ACROSS GLOBAL REGIONS

WRP question: "Do you think that climate change is a very serious threat, a somewhat serious threat, or not a threat at all to the people in this country in the next 20 years?" World, by global region

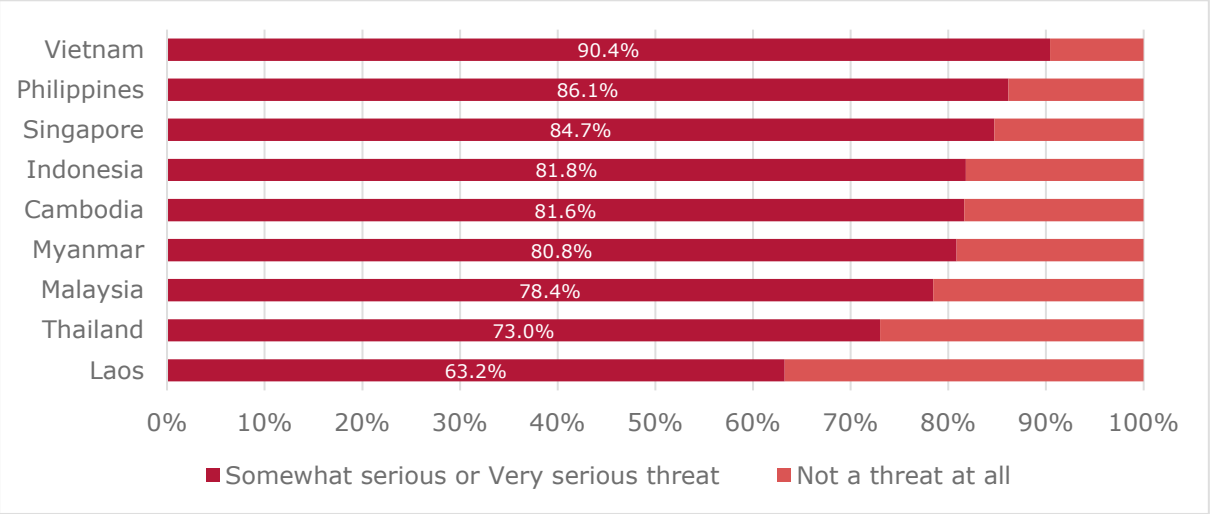


Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

Although there is some variation in the perception of climate change risk across Southeast Asian countries, in all countries people consider climate change a significant threat. Figure 16 shows that over 80% of people consider it a serious threat in Vietnam, the Philippines, Singapore, Indonesia, Cambodia, and Myanmar, and only slightly less than that in Malaysia, Thailand, and Laos.

FIGURE 16. PERCEPTION OF CLIMATE CHANGE RISK ACROSS SOUTHEAST ASIAN COUNTRIES

WRP question: "Do you think that climate change is a very serious threat, a somewhat serious threat, or not a threat at all to the people in this country in the next 20 years?" Southeast Asia, by country



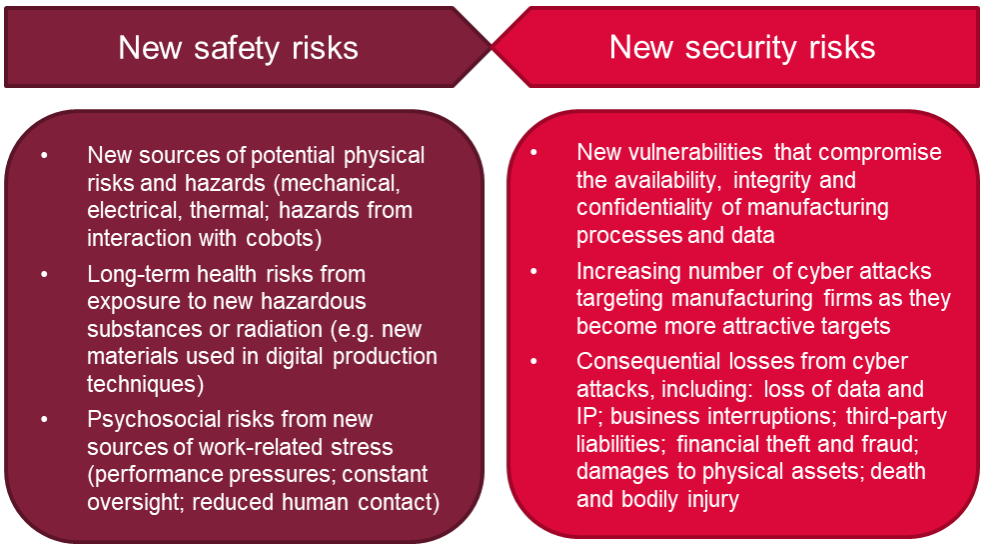
Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

3.2 New technologies bring new risks to firms and workers

The advent of new technologies such as AI, the IIoT, additive manufacturing, and smart robotics (sometimes packaged in the concept of Industry 4.0) is changing manufacturing processes and products. While this brings important gains in productivity, efficiency, speed, and production and quality control, it also brings new risks to both firms and workers.

Recent research has shown that new safety and security risks are associated with the integration of digital technologies in manufacturing – see Figure 17.

FIGURE 17. NEW TECHNOLOGY-RELATED RISKS IN MANUFACTURING



Source: Leal-Ayala et al. (2019). Ok Computer? The safety and security dimensions of Industry 4.0.

As the Global Manifesto for Industrial Safety illustrated, there are still many open questions about how best to ensure industrial safety in the new technological landscape:

> How do we make sure that an autonomous vehicle transporting parts across the factory knows when to stop to avoid a collision with a worker and always prioritises worker safety? How do we certify that algorithms underpinned by artificial intelligence and machine algorithms, complex and not always transparent and explainable, prioritise worker safety? How do we ensure that workers' gestures, voices or eye-tracking commands are not misinterpreted or sent to the wrong machine? How do we ensure that digital devices used to supervise workers' productivity do not lead to negative stress-related health impacts? How do we ensure that, as the computers controlling the production lines go online, cyber attacks do not jeopardise critical safety functions in factories?[11]

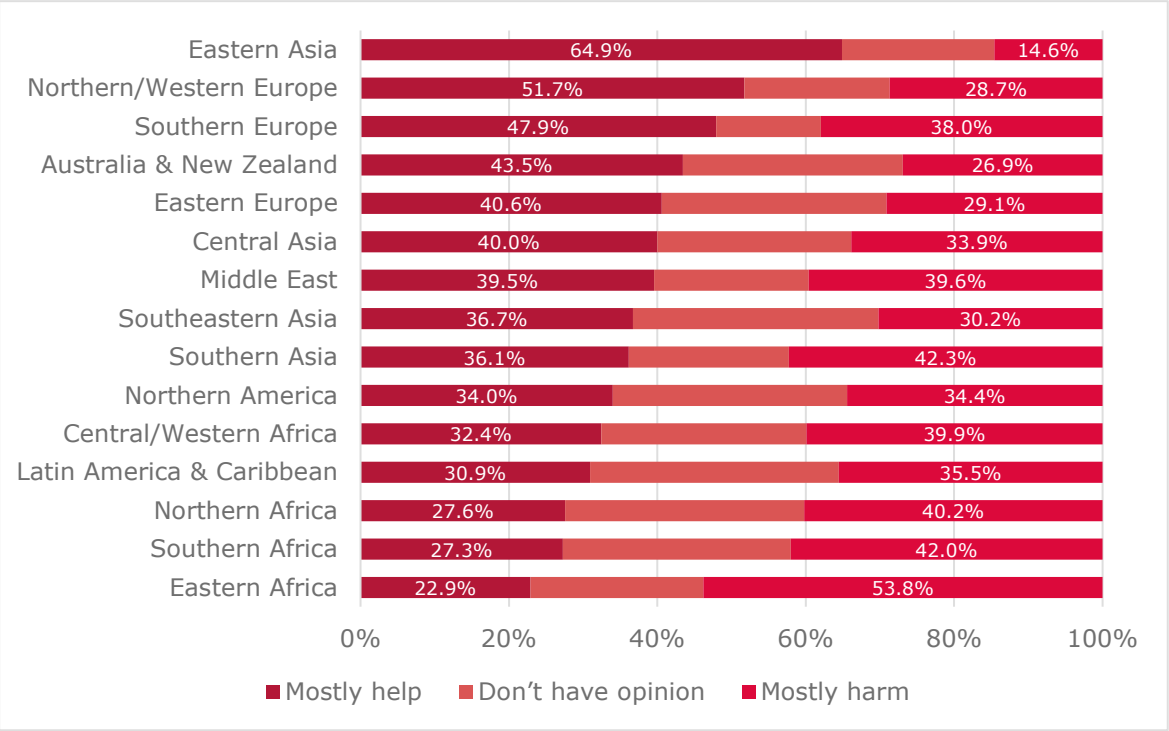
Focusing on AI, the WRP shows that people in different global regions have different perceptions about the potential effects of AI (see Figure 18). In Eastern Asia, AI is seen as mostly beneficial, while in Eastern, Southern and Northern Africa, it is seen as a technology that will mostly harm people in their regions. In Southeast Asia, views about AI are mixed, with 36.7% seeing it as a

[11] Global Initiative for Industrial Safety (2024). A Manifesto for Global Industrial Safety.

technology that will mostly help and 30.2% seeing it as mostly harmful. This shows that policies and regulations are required to ensure AI is used for the benefit of the people.

FIGURE 18. PERCEPTION OF RISKS FROM ARTIFICIAL INTELLIGENCE, BY GLOBAL REGION

WRP question: "Do you think artificial intelligence will mostly HELP or mostly HARM people in this country in the next 20 years?" World, by global region



Source: Own elaboration based on Lloyd's Register Foundation (2024). World Risk Poll 2023.

4. How industrial policy can help to build resilient economies and communities

Given that industrial capabilities, especially in manufacturing, have an important role to play in enhancing socio-economic resilience, it is also crucial to understand how governments can promote industrialisation. This section reviews the current state of the industrial policy debate around the world and presents several case studies of concrete industrial policy measures taken by governments in Southeast Asia that enhance socio-economic resilience. A detailed description of the policy cases can be found in the Appendix.

4.1 The current state of industrial policy around the world and in Southeast Asia

Industrial policy encompasses targeted state interventions to promote certain industries or firms over others, aiming to improve overall economic efficiency and productivity.[12] Industrial policies often tackle crucial structural and institutional interdependencies, policy alignment, and conflict management.

Having a long history that goes back to pre-Industrial Revolution times, industrial policy gained traction in the developing world in the early to mid-20th century. However, the emergence of laissez-faire economic thinking in the 1970s led to the demise of explicit industrial policies – although many developed and developing countries continued doing them implicitly. A renewed interest in more active industrial policies emerged after the 2008 global financial crisis and intensified in the mid-2010s following increased international competition, the emergence of disruptive industrial technologies, and climate concerns.[13,14,15] The COVID-19 pandemic, and recent geopolitical tensions, have pushed industrial policies back onto the agenda of governments around the world. Recent hallmark policies – such as the US Inflation Reduction Act (IRA), the European Green Deal Industrial Plan, and China's Made in China 2025 – demonstrate that industrial policy has once again become a cornerstone of economic strategy, often pursuing multiple, overlapping objectives.[16]

The return of industrial policy reflects the heightened volatility of today's world. Multiple crises have underlined the need for stronger manufacturing sectors that can mitigate shocks, safeguard supply chains, and advance climate goals. Nevertheless, industrial policy remains complex: it must reconcile conflicting interests, meet international trade rules, and create the right incentives.[17] If effectively executed, however, it offers a powerful framework for fostering long-term growth, managing present and future crises, and promoting equitable and sustainable development.

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[12] Chang, H-J. and Andreoni, A. (2019). The Political Economy of Industrial Policy.
[13] Wade, R. (2012). Return of industrial policy?
[14] Cherif, R. and Hasanov, F. (2019). The return of the policy that shall not be named.
[15] Labrunie, M. et al. (2020). The resurgence of industrial policies in the age of advanced manufacturing.
[16] EBRD (2024). An introduction to industrial policy.
[17] Chang, H-J. and Andreoni, A. (2019). The Political Economy of Industrial Policy.

In Southeast Asia, many governments have been putting forward important industrial policy initiatives, some of which are discussed in the next sections. The latest development in the region is ASEAN's publication, in May 2025, of the Framework of ASEAN Industrial Projects-Based Initiative (AIPBI) to drive regional industrial competitiveness (Box 1). The framework marks ASEAN's renewed commitment to revitalise industrial cooperation in the region by fostering joint development and catalysing high-impact industrial projects across the region.

Box 1: The Framework of ASEAN Industrial Projects-Based Initiative (AIPBI)

The AIPBI is a strategic framework designed to strengthen cross-border industrial cooperation across ASEAN. It supports sustainable, inclusive growth by enhancing regional competitiveness, deepening economic integration, and fostering collaboration among ASEAN Member States (AMS).

AIPBI's four strategic goals are to:

1. **Boost regional competitiveness:** leverage complementarities across AMS and the scale of the regional market to increase value-added participation in global value chains
2. **Promote sustainable and inclusive growth:** support equitable development, climate resilience, and opportunities for MSMEs and underserved communities
3. **Strengthen value chain resilience:** deepen intra-ASEAN industrial linkages to reduce vulnerabilities and capture shared opportunities
4. **Facilitate sectoral cooperation:** improve the movement of goods and talent, financing access, and industrial policy coordination.

Participation pathways for firms:

- **Project originators:** Firms can propose cross-border industrial projects via their national ministries, gaining facilitation benefits (e.g. enhanced IP protection, improved talent mobility).
- **Vendors/Suppliers:** Firms can join AIPBI projects as service providers or suppliers, accessing a broader ASEAN customer base.

Core facilitation benefits:

1. **Movement of goods:** streamlined tariffs and non-tariff incentives
2. **Movement of talent:** fast-tracked regional visa and talent mobility mechanisms
3. **Access to finance:** blended finance platforms to support project investment
4. **Policy coordination:** industrial policy alignment and collaborative frameworks.

Project eligibility criteria:

- project faces barriers to intra-ASEAN integration
- involves at least two AMS and contributes to regional growth
- delivers positive social and environmental impact.

By enabling voluntary industrial collaboration, the AIPBI seeks to build resilient value chains, promote sustainability, and create regional industrial champions.

Source: ASEAN (2025). ASEAN Industrial Projects-Based Initiative.

4.2 Southeast Asian policies seeking to localise industrial production

Seeking to promote supply chain resilience and in-country value addition, some Southeast Asian governments have been implementing relevant industrial policy initiatives. Examples include Indonesia's nickel export ban and Singapore's "30 by 30" food sovereignty initiative.

Indonesia's nickel export controls illustrate how resource-rich countries can escape the "resource curse" by moving up the value chain. Sitting on 1.3 billion tonnes of laterite nickel, Indonesia initially exported almost all its ore, operating only three smelters alongside fifty mines – a model that left it vulnerable to commodity price swings, low industrial value added, and limited job creation.

In response, Jakarta passed a 2009 law to localise processing, imposing in 2014 a full ban on raw ore exports, mandating domestic smelting. Early exemptions (2017–19) were later withdrawn when local capacity matured, and a reinstated 2020 ban drove explosive growth: smelting capacity leapt from two to at least twenty-nine plants by 2021. Substantial Chinese and other FDIs funded nickel pig iron, ferronickel, and stainless steel projects, generating thousands of jobs, boosting technology transfer, and enhancing worker skills. As downstream industries flourished, Indonesia's processed-nickel exports boosted foreign exchange earnings, improved the trade balance, and elevated the mining sector's GDP and fiscal contributions.

Critics warn of short-term revenue losses and environmental strain, but by embedding value added, reducing raw material outflows, and diversifying the economy, the policy has strengthened Indonesia's industrial base, supported sustainable development, and enhanced national economic resilience.

The aim of Singapore's "30 by 30" initiative, in turn, is to produce 30% of its national nutritional needs locally by 2030. Recognising that heavy import dependence leaves Singapore vulnerable to market, climate, and geopolitical shocks, the Singapore Food Agency (SFA) has championed cutting-edge urban agriculture: vertical farms, indoor hydroponics, and other high-tech systems that maximise yields per square metre. The SFA competitively allocates scarce cultivation spaces, underwrites innovative agri-tech through the "Singapore Food Story R&D Programme", and partners with universities to build a specialised workforce. To stimulate domestic demand, government-backed certifications such as "SG Fresh Produce" and "Farm-to-Table" are labelling local goods, while a S$144 million investment in alternative protein research – undertaken with the Agency for Science, Technology and Research – is diversifying the domestic food portfolio.

Early results include dozens of operational vertical farms and pilot protein startups; but high capital and operating costs, coupled with a consumer preference for affordable imports, are constraining scaleup. Although structural reliance on global supply chains endures, the "30 by 30" strategy exemplifies a forward-leaning, innovation-led approach to reinforce resilience, mitigate resource limitations, and align food policy with the UN's Sustainable Development Goals.

4.3 Southeast Asian policies seeking to make more efficient and sustainable use of industrial resources

Following a different approach, some Southeast Asian governments have created policies to make more efficient, sustainable use of industrial resources, applying circular economy principles. Examples include UNIDO-supported initiatives of electronic waste management in the Philippines and eco-industrial parks (EIPs) in Vietnam.

The Philippines has grappled with rapidly rising electronic waste, growing from 3.9 kg to 4.7 kg per person between 2019 and 2022. Much of this waste ended up in landfills or was handled by informal recyclers, contaminating ecosystems around Manila Bay with toxic heavy metals and wasting valuable recoverable materials. In response, the DENR and UNIDO piloted a suite of initiatives beginning in 2017. These included upgrading a non-incineration pollutant treatment facility in Batangas and establishing three community-based e-waste disassembly centres. These centres, equipped with proper tools and safety equipment, trained informal recyclers in internationally standardised dismantling and material separation techniques, simultaneously reducing environmental hazards and creating local green industry jobs.

Building on this momentum, UNIDO's 2024 "Sustainable Electronics Management" project expanded policy support, technological demonstrations, and capacity building to foster a circular economy industrial chain: informal workers transitioned into cooperatives or formal enterprises with decent conditions; ongoing technical training boosted safety and productivity; and public outreach campaigns embedded e-waste sorting into daily routines, cutting blind disposal. Collectively, these measures have diminished toxic pollutant entry into environments and eased pressure on primary resource extraction. This has strengthened the resilience of both the Philippines' ecosystem and its electronics industry supply chains by establishing a closed-loop model that lessens dependence on imported raw materials.

Vietnam's EIPs, in turn, exemplify how rapid industrialisation can be harmonised with environmental stewardship to enhance national resilience. Since the Doi Moi reforms of the 1980s, Vietnam has 425 industrial parks hosting an average of 90 companies each, but it has relied heavily on imported energy – 34% of its energy supply in 2022 – and discharged roughly 70% of industrial effluents untreated, polluting local ecosystems. In response, the Ministry of Planning and Investment and UNIDO launched nine pilot EIPs in six cities from 2015, backed by government decrees and international funding. These parks deploy shared utilities, waste-heat recovery, and water-reuse systems, saving over 22,000 MWh of electricity, 140 TJ of fossil fuels, and 600,000 m^3 of freshwater annually, while cutting nearly 3,600 tons of chemical waste and 32 kt of CO_2 emissions each year.

Yet, scaling the EIP model nationally demands greater investment in green technologies, enterprise capacity building, and regulatory refinement. Moreover, many EIPs house export-oriented textiles, electronics, and machinery firms now threatened by an increased US tariff, risking order losses, job cuts, and local economic downturns. Vietnam's EIPs offer a proven blueprint for sustainable industrialisation, but their broader adoption will hinge on aligning environmental gains with economic competitiveness and navigating shifting trade policies.

4.4 Southeast Asian policies seeking to adapt the production base to the green transition

Another policy avenue adopted in the region has been to adapt the existing production base to the green transition. Examples include Malaysia's electric mobility transition and Thailand's "Thai Rice" initiative.

Malaysia's electric mobility transition illustrates how a resource-rich nation can leverage industrial strengths to advance sustainability and resilience. Although the transport sector is the country's second-largest energy consumer and conventional vehicles dominate thanks to stable, subsidised fuel, Kuala Lumpur has enacted a suite of strategic policies – the 2021 Low-Carbon Mobility Blueprint, the 2023 National Energy Transition Roadmap, and the New Industrial Master Plan 2030 – designed to accelerate electric vehicle (EV) adoption and build related manufacturing capacity.

By capitalising on its robust electrical and electronics sectors, Malaysia has attracted major investors: Chinese automaker BYD began local assembly in 2023, and domestic champion Proton launched its first battery electric e.MAS 7 in late 2024. Charging infrastructure is scaling rapidly, with over 2,000 public stations and a target of 10,000 by 2025, while Tenaga Nasional's (TNB – the country's largest utility company) 10-year roadmap aims for half a million EVs and 18,000 chargers by 2030. Major energy companies – including TNB, Petronas, and Gentari – are deploying fast charging networks, while private partnerships are rolling out integrated home, office, and public charging solutions. On the mobility side, pilot projects – electric buses in RapidKL's network and Grab's electrified ride-hailing fleet – are testbeds raising consumer awareness.

Despite these advances, the EV market share remains below 5% of new car sales, hindered by high upfront costs, limited local battery production, uneven charger coverage, lingering fuel subsidies, and a coal-reliant grid. To overcome these barriers, Malaysia is considering reallocating fuel subsidy savings into targeted EV incentives and ramping up renewables to ensure genuine emissions reductions. Beyond cutting emissions, EV adoption promises greater energy resilience by diversifying away from volatile fuels and strengthening the domestic supply chain in vehicle, battery, and charging technologies. The aim is to strengthen Malaysia's economy against external shocks while advancing its green transition.

Regarding Thailand, the Thai Rice Nationally Appropriate Mitigation Action (NAMA) project – launched with UN support and German IKI financing – seeks to transform the country's predominantly small-scale, family-run rice sector into a low-emission, climate-smart model. Although agriculture contributes just 8% to GDP, it employs over 30% of the population. Agriculture is the country's second-largest source of GHG emissions, and rice cultivation generates half of Thailand's agricultural GHG emissions, making the nation the world's fourth-largest emitter of rice-related GHGs. The NAMA project combines three pillars: empowering farmers with proven practices (laser land levelling, site-specific nutrient management); nurturing entrepreneurs to provide mitigation services; and driving national policy reform, including the "Good Agricultural Practices (GAP) ++" standard.

Early successes include pilot adopters demonstrating yield gains and emission reductions, yet widespread uptake remains constrained by farmers' risk aversion to new methods, inadequate extension support, misaligned market incentives, and gaps in policy integration within Thailand's climate action plans. Socio-demographic hurdles, such as an ageing rural workforce, youth migration to cities, high indebtedness, and limited access to finance, further impede adoption.

Furthermore, coordination among government agencies, financial institutions, service providers, and farmer groups is still evolving. Building on long-standing government aid for rice growers (credit schemes, quality-control programmes), fully embedding the NAMA project into national agricultural and climate policies will be a crucial step. Ultimately, the project could be an essential mechanism to scale climate-smart practices, enhance mitigation and adaptation capabilities, and secure long-term resilience in Thailand’s vital rice sector.

5. Conclusion and policy recommendations

In an era defined by overlapping crises – from pandemics and armed conflicts to climate extremes and geopolitical tensions – building socio-economic resilience has become a priority. This policy brief has demonstrated that strong industrial capabilities, especially in manufacturing, are central to that resilience. Manufacturing supplies life-sustaining goods and underpins infrastructure through domestic production of critical inputs, but it also enables rapid adaptation. Empirical evidence, including econometric analysis of COVID-19 output losses, confirms that industrial capabilities were among the most significant factors mitigating the pandemic's economic impact.

Quantitative insights from the Lloyd's Register Foundation World Risk Poll reveal there is a high correlation between industrial capabilities (measured by UNIDO's CIP Index) and the WRP Resilience Index. Although correlation does not imply causation, this indicates a potential role for manufacturing in improving resilience at the country level.

Beyond country-level benefits, manufacturing delivers a suite of social and financial benefits that reinforce resilience at the individual level. Workers in manufacturing globally report lower rates of serious physical harm and discrimination than in many other sectors, reflecting strict occupational health, safety, and non-discrimination regulations. Manufacturing jobs – typically formal, well paid, and stable – also offer greater financial security: a larger share of these workers can sustain household needs for months if their income is lost. Mental health outcomes similarly tend to be better, with fewer self-reported serious mental health issues than in sectors such as non-market services or utilities. Moreover, the sector is continually investing in new technologies and practices – autonomous vehicles, robotics for hazardous tasks, and enhanced safety protocols – so that over 40% of workers now feel safer than they did 5 years ago (the highest share across all sectors). These trends demonstrate manufacturing's capacity for continuous safety improvements, inclusive workplaces, and financial resilience, all critical for sustaining a productive and adaptive workforce.

At the same time, modern manufacturing faces evolving challenges. Complex global supply chains are increasingly threatened by more frequent extreme weather events, and digital technologies – from AI to IIoT – introduce novel safety and cybersecurity risks that require updated regulations and worker protections. Public perceptions of AI's benefits and harms vary widely across regions, signalling the need for policies that harness technological gains without compromising safety or wellbeing.

The Southeast Asian case studies underscore how industrial policy can translate these insights into practice:

- **Indonesia's nickel export controls** fostered downstream smelting and deep processing, generating FDI, jobs, and higher-value production.
- **Singapore's "30 by 30" initiative** promotes high-tech urban farming and alternative proteins to boost local food production and reduce import dependence.
- **The Philippines' sustainable e-waste management** has formalised recycling, trained informal workers, and built circular economy chains, reducing environmental hazards.
- **Vietnam's eco-industrial parks** integrate energy, water, and waste synergies to cut emissions and resource use even as manufacturing expands.
- **Malaysia's electric mobility transition** leverages its electronics base to incentivise EV assembly, charging infrastructure, and green supply chains.

- **Thailand's low-emission rice NAMA project** combines farmer training, service provider support, and policy reform to lower GHG emissions in its dominant agricultural sector.

These interventions share critical success factors: targeted incentives, public–private collaboration, technology transfer, capacity-building, and robust regulatory frameworks that align economic growth with sustainability, safety, and inclusivity. By learning from regional experiences and continuously adapting to emerging risks, policymakers can ensure that industrialisation remains a cornerstone of resilient, equitable development.

As Southeast Asia and the world navigate an increasingly volatile landscape, it will be essential to integrate resilient, inclusive, and digitally enabled manufacturing strategies into broader development agendas. Strengthening discrimination safeguards, promoting mental health, ensuring financial security for workers, and sustaining continuous safety improvements are integral to this effort. Ultimately, policies that foster dynamic, adaptive, and humane industrial ecosystems will best protect livelihoods, secure supply chains, and sustain growth amid future shocks. By learning from regional experiences and continuously adapting to emerging risks, policymakers can ensure that industrialisation remains a cornerstone of resilient, sustainable, and equitable development.

Policy recommendations

Effective industrial policy can help Southeast Asian governments to build dynamic, adaptive economies capable of withstanding future shocks. Building on from the findings presented in this policy brief, a few policy recommendations can be made:

1. *Owing to the role of the manufacturing sector in ensuring socio-economic resilience, policymakers should develop policies to grow and strengthen the sector*
   Manufacturing is often overlooked in national strategies and tends to have a public image that doesn't accurately reflect the benefits it offers to workers and the economy. As this policy brief has highlighted, the manufacturing sector generates high-paid, safe, non-discriminatory jobs and continuously seeks to improve itself. Promoting the growth of the manufacturing sector should be a priority for governments around the world, including in Southeast Asia.

2. *Promote localisation, redundancy, and industrial diversification to mitigate disruption risks*
   Owing to the increasing risk of supply chain disruptions, policymakers should consider a range of mitigation approaches. These could include incentivising localisation, redundancy, stockpiling, trusted partnerships, sourcing from nearby countries, and international collaboration. As the risks continue to evolve, reviews of supply chain risk should be carried out periodically, and risks in critical sectors and products should be monitored continuously.

   Governments should also pursue industrial diversification strategies. This includes diversifying supply chains, ensuring a diverse set of suppliers of key products, components, and raw materials, and diversifying the country's production structure, reducing the concentration of activities in a limited number of economic sectors.

3. *Promote industrial safety to ensure that manufacturing delivers high-quality, safe jobs, even in the face of technological changes*
   Manufacturing practices vary. The WRP shows that while in high-income countries manufacturing is mostly done safely, in low- and middle-income countries safety issues

remain a concern. Strong regulations, which are enforced, are thus crucial to ensuring the sector delivers high-paying, safe, and fulfilling jobs.

With the advent of new technologies, risks will continue to change. Policymakers should be mindful of these new risks and develop appropriate policies to ensure new technologies are introduced for the benefit of all. For example, there is a need for robust regulation and worker training in digital security protocols.

4. *Encourage manufacturers to adopt greener production*

   Greening practices, such as implementing circular economy models or investing in energy efficiency, not only bring financial benefits but also potentially increase resilience, as they reduce input needs and localise their provision. Encouraging manufacturers to adopt greener production is thus an important step towards more resilient manufacturing sectors.

Appendix – Detailed policy case studies

Box A1: Indonesia: natural resource-based industrial policy and economic resilience with nickel export controls

Whether resource endowment inevitably promotes a country's economic growth remains controversial. Although, theoretically, resource endowments may yield positive economic effects, numerous empirical studies have found that abundant resources often inhibit the economic growth of resource-rich countries, leading to environmental pollution and negatively affecting national resilience. To avoid the "resource curse", extending industrial chains and promoting industrial modernisation and high-end development are crucial strategies for urban transformation and upgrading.

Indonesia is one of the world's largest producers of nickel ore, with approximately 1.3 billion tons of nickel reserves. Prior to Indonesia's nickel ore export ban in 2014, the country mainly exported unprocessed laterite nickel ore. Approximately 50 nickel mines existed nationwide, yet only three nickel smelting plants were operational. This reliance on raw material exports made the Indonesian economy vulnerable to fluctuations in commodity prices, resulting in low industrial value added and limited employment opportunities. Faced with extensive low-priced resource outflows and environmental impacts from open-pit mining, the Indonesian government enacted law in 2009, laying the legal foundation for the localisation strategy of mineral processing. But in the early stages, conditional exports of unprocessed ores were still permitted. In 2014 the government first imposed a comprehensive export ban on raw minerals, mandating domestic smelting and processing to enhance industrial value added. Nonetheless, owing to the industry's immaturity, regulations were relaxed between 2017 and 2019, allowing companies that met certain criteria to export partially processed ores to alleviate economic pressure. With the significant improvement of domestic smelting capabilities, the Indonesian government reinstated a comprehensive nickel ore export ban in 2020, aiming to fully realise localisation of the industrial chain and promote the transformation of nickel resources towards higher-value deep-processing industries.

Following implementation of the ban, Indonesia's domestic nickel smelting industry experienced explosive growth. There were only two nickel smelters nationwide before the ban in 2014; but by 2021, at least 29 nickel smelters were operational. A large influx of FDI, particularly from Chinese enterprises, entered Indonesia to establish smelting projects for nickel pig iron, ferronickel, and nickel cast iron. The export ban effectively accelerated the development of the domestic nickel industry chain, encouraging the emergence of downstream industries such as smelting and stainless steel production, creating numerous employment opportunities, promoting technology transfer, and improving worker skills. Consequently, the nickel-related industry has become a new economic growth engine within Indonesia's manufacturing sector. Additionally, the increased export of nickel processed products significantly raised foreign exchange earnings and improved the trade surplus, boosting overall economic growth and enhancing the mining sector's contribution to GDP and local fiscal revenue. Although some critics argue that the nickel ore export ban might temporarily reduce government fiscal revenue, cause unemployment, and exacerbate environmental pollution, in the long term it facilitates local value added within the nickel industry chain and slows resource extraction, benefiting national industrial upgrading, sustainable development, and enhancing national resilience beyond short-term economic interests and employment goals.

Box A2: Singapore: the “30 by 30” vision, navigating the paradox of food security and resilience

Singapore, a city state with very limited land resources, has historically maintained a food self-sufficiency rate below 10%. Nevertheless, through open trade policies, diversified import sources, and robust governance, the country has consistently ranked near the top in the Global Food Security Index for many years. Scholars have referred to this phenomenon as the "Singapore paradox", describing a small nation that is inherently vulnerable yet achieving remarkable development and security outcomes. These achievements can be largely attributed to the government's approach of cultivating resilience based on high dependence on external food supplies. However, this model of high external dependence renders Singapore particularly susceptible to disruptions from global market fluctuations, climate change, and geopolitical risks within global supply chains. To enhance the resilience of the national food system and address potential future risks, the Singaporean government introduced the “30 by 30” vision.

Singapore's "30 by 30" vision aims to locally produce 30% of the nation’s nutritional needs by 2030, reducing dependence on food imports and enhancing food security. Central to this vision is the promotion of advanced agricultural models such as high-tech agriculture, vertical farming, and indoor hydroponics, significantly increasing food production per unit area. Technological innovation and resource optimisation are also prioritised to enable high-end, sustainable growth in the food sector. To realise these goals, the Singapore Food Agency (SFA) actively collaborates with agri-food businesses and stakeholders by competitively bidding for agricultural spaces, promoting efficient and innovative agricultural technologies, and providing financial support to enhance production capacities. Furthermore, the SFA has implemented the "Singapore Food Story R&D Programme", supporting research innovation in urban food production, future foods, and food safety. Meanwhile, in collaboration with educational institutions, the SFA has established training systems for agricultural talent, providing technical and human resource support for the industry’s transformation. To strengthen market demand for local agricultural products, the government has introduced certification schemes such as "SG Fresh Produce" and "Farm-to-Table", encouraging consumers and enterprises to actively select local products, jointly promoting the sustainable development of Singapore’s agricultural ecosystem. Moreover, the SFA, together with the Agency for Science, Technology and Research, has invested S$144 million into alternative protein research and development, creating innovative food solutions.

Since the implementation of the "30 by 30" strategy, Singapore has notably strengthened its food security resilience. But it continues to face significant challenges, such as the high operational costs associated with high-tech agriculture and limited consumer demand for local produce due to the long-standing preference for diverse and affordable imports. These factors constrain the competitiveness and scalability of local agri-food enterprises. Furthermore, while the strategy enhances short-term resilience, addressing the structural dependence on the global food system remains a longer-term challenge. Nevertheless, the "30 by 30 Agri-Food Initiative" is commendable as a forward-looking national strategy, boldly exploring new avenues to safeguard food security despite intrinsic resource limitations. Through agricultural technological revolution and policy innovation, it has partially mitigated the constraints imposed by resource disadvantages on national resilience, aligning conceptually with sustainable development principles and enhancing overall national resilience.

Box A3: The Philippines: sustainable electronics and waste management for resilient manufacturing

The Philippines faces serious challenges related to electronic waste. According to UN data, the country's per capita e-waste generation rose from 3.9 kg in 2019 to 4.7 kg in 2022. Owing to insufficient formal recycling systems, much of this waste is discarded as ordinary garbage or processed by informal recyclers. In Manila, improper disposal has had severe environmental impacts, with e-waste accumulating at landfills and illegal dumpsites near Manila Bay, resulting in toxic heavy metals entering local ecosystems. Meanwhile, valuable recyclable metals remain largely unrecovered, leading to pollution and resource loss.

In 2017 the Philippines Department of Environment and Natural Resources (DENR) and UNIDO carried out a series of pilot projects on e-waste recycling and treatment, covering the control of persistent organic pollutants in discarded electronic equipment. With the support of this project, the Environmental Management Bureau upgraded the non-incineration persistent pollutant treatment facility in Batangas Province and established three centralised electronic waste disassembly centres in local communities. These centres are equipped with basic disassembly tools and safety protective equipment, and they invite workers involved in informal recycling to participate in operations. Through hands-on training, the workers have mastered the skills needed to disassemble electronic devices and separate recyclable materials following international safety standards. These pilot centres have reduced the environmental hazards caused by arbitrary electronic waste disposal while creating employment and income sources for local communities, and they are regarded as an effective way to promote green industry.

In 2024 UNIDO launched the "Sustainable Electronics Management" project in the Philippines, which aims to enhance the country's capacity for e-waste management. In addition to reducing the generation of e-waste and improving resource recovery efficiency, the project aims to promote the development of related green industrial chains through policy support, technological demonstration, and capacity building, advancing the circular economy and environmental improvement.

An increasing number of recyclers who once worked in the informal sector have joined project-supported cooperatives or enterprises, growing the country's circular economy industry while securing decent working conditions. The project provides ongoing training for technical workers involved in the operation of recycling centres, enhancing frontline workers' skill levels and safety awareness, significantly reducing the risks of pollution or poisoning caused by improper handling. Implementing the project has also created positive social changes. With the support of project resources, the Philippines has launched extensive public outreach and education initiatives. This increase in public engagement has made electronic waste management a part of daily concerns, reducing the incidence of blind disposal and arbitrary treatment and alleviating environmental pressures at source.

The project significantly reduced the improper disposal of e-waste, lowering the risk of toxic pollutants entering the environment, enhancing the resilience and recovery capacity of the Philippine ecosystem. At the same time, the project has reduced excessive exploitation of primary resources by promoting recycling, which helps to maintain the integrity of the Earth's life support system. Through these measures, the project has strengthened the environmental resilience of the Philippines and enhanced the robustness of the Philippines' electronic industry supply chain by establishing a circular economy model. This allows a portion of strategic materials to be supplied domestically in a closed loop, to some extent reducing the dependence on foreign raw materials and improving supply chain resilience.

Box A4: Vietnam: eco-industrial parks (EIPs)

With the Doi Moi policy opening the economy since the 1980s, Vietnam is becoming an industrialised country, and its rapid industrialisation has significantly contributed to its economic growth. By 2024, Vietnam had established 425 industrial parks and manufacturing areas, each housing an average of 90 companies. However, as a country lacking fossil resources, Vietnam has a significant demand for energy imports. Being a net importer of coal and electricity, in 2022 34% of total energy supplies relied on imports, with over 50% of final energy consumption in industry. While the industrial zones boosted economic growth, they also discharged approximately 70% of industrial effluents without prior treatment, causing severe environmental pollution. To address these issues, Vietnam is transitioning its traditional industrial zone to EIPs.

Since 2015, the Ministry of Planning and Investment Vietnam and UNIDO have piloted nine EIPs in six different cities with funding from international organisations and governments. With the support of the Vietnam government through multiple supportive policies and regulations, the EIP model has been institutionalised in legal documents with the highest level of government decrees.

Implementing EIPs in Vietnam has produced notable environmental and economic benefits:

- energy savings: over 22,000 MWh of electricity and 140 terajoules (TJ) of fossil fuels saved annually
- water conservation: a reduction of more than 600,000 cubic metres of freshwater usage each year
- waste reduction: a decrease of nearly 3,600 tons of chemicals and waste annually
- emission reduction: an annual reduction of 32 kilotons of CO2 emissions.

Despite the positive outcomes, challenges remain in scaling up the EIP model nationwide. These include the need for substantial investment in green technologies, capacity building for enterprises, and refinement of the regulatory framework to encourage widespread adoption. Additionally, based on international political and business considerations, Vietnam's EIPs house numerous export-oriented industries, notably in textiles, electronics, and machinery. The imposition of a 46% tariff by the USA threatens to diminish the competitiveness of these products in the US market, potentially leading to a decline in orders and revenue for companies operating within EIPs. This could adversely affect employment and economic stability in regions dependent on these industrial zones.

Vietnam's experience with EIPs demonstrates a viable pathway towards sustainable industrialisation. By integrating environmental considerations into industrial development, EIPs contribute to economic growth while mitigating ecological impacts, increasing Vietnam's overall resilience. The continued expansion and refinement of this model hold promise for achieving a balance between industrial progress and environmental stewardship in Vietnam.

Box A5: Malaysia: electric mobility transition

Malaysia's transport sector is the country's second-largest energy consumer, just behind industry. As a net oil exporter, Malaysia enjoys stable fuel prices, allowing conventional internal combustion vehicles to dominate – even subsidised EVs struggle to compete on price. To support global sustainability commitments and national low-carbon goals, the government has introduced a suite of policies: the Low-Carbon Mobility Blueprint (2021), the National Energy Transition Roadmap (2023), and the New Industrial Master Plan 2030. Together, these frameworks set targets and incentives designed to accelerate EV adoption and guide related infrastructure and manufacturing development.

Beyond these overarching policies, Malaysia is nurturing a homegrown EV ecosystem. Leveraging its strong electrical and electronics sector, the country seeks to become a regional manufacturing hub for EVs and key components. In 2023 Chinese automaker BYD began local assembly operations, and in December 2024 national carmaker Proton unveiled its first battery electric model, the e.MAS 7. These investments signal growing domestic capacity and increased foreign participation.

Charging station deployment is also scaling up. As of early 2024, over 2,000 public charging stations were operational, and the government has set an ambitious target of 10,000 by 2025. Tenaga Nasional Berhad (TNB), Malaysia's largest utility, released a 10-Year EV Roadmap aiming for 500,000 EVs on the road and 18,000 charging points by 2030. Major energy companies, including TNB, Petronas, and Gentari, are deploying fast-charging networks, while private partnerships are rolling out integrated home, office, and public charging solutions.

On the mobility side, pilot programmes are testing EVs in public transport. RapidKL has introduced electric buses on selected routes in Kuala Lumpur and Putrajaya to assess operational costs and performance. Local ride-hailing company Grab has begun to electrify its fleet, leveraging government incentives and newly expanded charging networks. These initiatives offer learning grounds and raise public awareness of electric mobility.

Despite this progress, EV uptake remains modest: in 2023 battery electric and hybrid vehicles accounted for less than 5% of new four-wheeled sales, lagging behind regional peers. Barriers include high purchase prices, limited local production of batteries and other key parts, and uneven charging coverage. Large fossil-fuel subsidies and a power grid still reliant on coal (nearly half of generation) are further dampening the economic and environmental appeal of EVs.

To overcome these hurdles, policymakers are exploring reallocating fuel subsidy funds towards EV buyers, with proposals for income-based incentive schemes. There is also an increased focus on renewable energy investment to decarbonise the electricity supply and ensure that EVs deliver real GHG reductions. Beyond cutting emissions, EV adoption promises greater energy resilience by diversifying away from volatile fuels and strengthening the domestic supply chain in vehicle, battery, and charging technologies, fortifying Malaysia's economy against external shocks while advancing its green transition.

Box A6: Thailand: Thai rice

The agricultural sector in Thailand has long played an important role in serving the global demand for both basic and processed agricultural products. But Thai farming is characteristically small scale, since most farms are owned and operated by family members and passed from one generation to the next. Underscoring this, the agricultural GDP of Thailand was only 8%, whereas more than 30% of the population were part of the sector. Agriculture became the second largest source of GHG emissions in Thailand, while rice planting accounts for half of all agricultural land and 55% of emissions from agriculture, making Thailand the world's fourth-largest emitter of rice-related GHG. To enable Thailand to transform its rice sector to low-emission rice production, Thailand partnered with UN entities, with funds from the German International Climate Initiative (IKI), initiating the Thai Rice Nationally Appropriate Mitigation Action (NAMA) project.

The NAMA project enabled a shift towards low-emission rice production in Thailand through three core components: 1) enabling farmers to implement low-emission rice farming; 2) supporting entrepreneurs in providing mitigation services (i.e. land laser levelling); and 3) supporting policy formulation and measures promoting low-emission rice production at the national political level (i.e. developing the "Good Agricultural Practices (GAP) ++" standard).

Although the project has seen some achievements, it faces complex challenges that hinder the widescale adoption of climate-friendly practices. Proven technologies like laser land levelling and site-specific nutrient management are not being widely adopted because of farmers' hesitance to change long-established methods, coupled with inadequate extension support. Moreover, gaps in market incentives and policy integration – where agricultural mitigation targets are not clearly incorporated into national climate action plans – further discourage investment from both farmers and service providers. Compounding these issues are socio-demographic challenges: an ageing farmer population and labour shortages driven by the migration of young people to urban areas, which limits both innovation and productivity. Also, many smallholder farmers struggle with high levels of debt and limited access to finance, making them reluctant or unable to invest in new technologies, even when financial mechanisms such as 0% interest loans or revolving funds are available. Finally, effective coordination and adaptive management among government bodies, financial institutions, private service providers, and farmer groups remain critical to overcoming these financial and technical barriers.

Given the dominance of the agricultural sector, rice farmers have long received government aid. This includes assistance with production costs, harvesting and crop improvement schemes, the provision of credit related to inventory building and the creation of added value, and projects that aim to improve management and quality control procedures. Therefore, incorporating and promoting this project in government policies will boost project implementation. Overall, the transition to a climate-smart rice farming model addresses both mitigation and adaptation needs, building long-term resilience in Thailand's rice sector.

Policymaking for a more resilient world

The project *Policymaking for a more resilient world: leveraging the World Risk Poll for more effective digital, labour, and industrial policies* is led by Cambridge Industrial Innovation Policy, in partnership with UNIDO, and funded by Lloyd's Register Foundation. It draws on the Lloyd's Register Foundation World Risk Poll and interconnected data sets to examine perspectives on AI, digital, labour, and industrial policy, focusing on the Southeast Asia region. The project aims to inform policies that ensure a safer and more sustainable future for all.

Cambridge Industrial Innovation Policy

Cambridge Industrial Innovation Policy (CIIP) is a global, not-for-profit policy group based at the Institute for Manufacturing (IfM), University of Cambridge. CIIP works with governments and global organisations to promote industrial competitiveness and technological innovation. We offer new evidence, insights and tools based on the latest academic thinking and international best practices.

This report was delivered through IfM Engage, the knowledge-transfer arm of the Institute for Manufacturing (IfM), University of Cambridge.

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