Development Centre Studies

Towards Greener and More Inclusive Societies in Southeast Asia

OECD DEVELOPMENT CENTRE

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Foreword

Environmental protection and green growth have become increasingly important in the work of the OECD Development Centre. In 2015, its report *Securing Livelihoods for All: Foresight for Action* warned that environmental challenges were among the most pressing threats to the global progress achieved in improving livelihoods. Since then, the Development Centre has increased its effort to support strategies for greener and more inclusive growth with core advice in country-specific, regional and thematic work. Its reports, the *Latin American Economic Outlook*, *Africa's Development Dynamics*, the *Economic Outlook for Southeast Asia, China and India* and the *Multi-dimensional Reviews*, notably include more systematic reviews of environmental and climate change issues.

As more countries in Southeast Asia embark on the green transition and look for ways of making the necessary environmental reforms politically acceptable, understanding the redistributive effects of green growth and putting in place policies to protect and reallocate affected workers will be key. This report adds two important perspectives on the linkages between environmental, economic and social concerns in Southeast Asia. First, it assesses the share and types of jobs exposed to environmental degradation, depicting the characteristics of workers likely to win or lose from a transition towards renewable energy in Indonesia. Second, it underscores the effects on jobs and income of adopting more sustainable farming practices, illustrated by the expansion of organic rice cultivation.

This report was produced in the context of the Development Centre's Programme of Work's component on Inclusive Growth and Decent Jobs for Youth, with the financial contribution of the Government of Korea. The study supports the priority actions of the "New Deal for Development", agreed at the High-Level Meeting of the Governing Board of the Development Centre in October 2020. It also contributes to the OECD Southeast Asia Regional Programme's support to the ASEAN Comprehensive Recovery Framework (ACRF) adopted at the 37th ASEAN Summit in 2020 in response to the COVID-19 crisis. The ACRF lays out ASEAN's vision, strategy and action plan for the COVID-19 recovery, towards a more sustainable and resilient future.

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Editorial

Global greenhouse gas emissions continue to increase, with historical contributions from unsustainable energy use, land use and patterns of consumption and production. The related, adverse impacts of climate change on nature and people disproportionately affect the most vulnerable among us. Globally, this concerns no less than 3.6 billion people, mostly in developing countries. In Southeast Asia, 100 million workers with jobs linked to the environment could be affected. They are also the most vulnerable: people employed in agriculture, mining or water and waste management typically gain two-thirds of the national median labour earnings. Environmentally linked employment also goes hand in hand with informality, depriving workers of labour rights and social protection. In the region, about 90% of these jobs are in the informal economy.

Southeast Asia has achieved remarkable economic growth over the past few decades, but it has relied heavily on natural resources: climate-related risks thus threaten many jobs, which calls for urgent adaptation and mitigation measures to protect the livelihoods of the most exposed populations. However, although ASEAN countries have green growth objectives in their national development plans, too little attention has been paid so far to the social impacts of the green transition, especially on employment.

In that context, this report takes a close look at the energy sector: three-quarters of Southeast Asia's total energy supply currently relies on unabated fossil fuels, mainly coal. Yet, there are large potential economic, as well as social gains in transitioning to renewable sources. In Indonesia, for instance, the world's largest exporter of coal, a transition towards cleaner energy production could create more than 1 million new jobs. One challenge, however, is protecting the workers who will lose their jobs, particularly in the coal mining value chain. This concerns 250 000 people, heavily concentrated in a few geographic locations and who do not necessarily have the skills to be reallocated in clean energy sectors. Here, social protection and targeted territorial development can mitigate the adverse consequences of the transition.

The report also looks at agriculture, which employs about three in ten workers in Southeast Asia. Most of them are smallholder farmers and seasonal informal workers, who often lack decent livelihoods. We find that a transition to more environmentally sustainable practices, such as organic farming, could increase both employment in the agricultural sector and the income of farmers, while improving the environment. Sectors linked to chemicals and fertiliser inputs, by contrast, would experience losses in output and jobs. There, policy makers need to consider how benefits are distributed, and protect those at risk of being left behind.

Eventually, whether in energy or agriculture, the conclusion is an optimistic one: policy reforms *can* help Southeast Asia meet the triple objective of economic efficiency, social equity and environmental sustainability. For that, they must protect vulnerable people relying on the environment for their livelihoods from the adverse effects of climate change and green transitions and prepare workers to transition out of losing sectors. Social protection schemes for informal workers and the populations most exposed to climate-related disasters must be strengthened. And policy makers must carefully assess the potential effects of their green and low-emission development strategies on jobs, based on the location and profiles of workers, in order to adequately anticipate skill development and reallocation measures.

Ragnheiður Elín Árnadóttir

Director, OECD Development Centre

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Abbreviations and acronyms

ACRF	ASEAN Comprehensive Recovery Framework
ACSDSD	ASEAN Centre for Sustainable Development Studies and Dialogue
ADB	Asian Development Bank
AEC	ASEAN Economic Community
AGOC	ASEAN Guide for Organic Certification
AIFS	ASEAN Integrated Food Security
AMAF	ASEAN Ministers on Agriculture and Forestry
APAEC	ASEAN Plan of Action for Energy Cooperation
ASCC	ASEAN Socio-Cultural Community
ASEAN	Association of Southeast Asian Nations
ASEAN GAP	Good Agricultural Practices for Production of Fresh Fruit and Vegetables in the ASEAN Region
ASOA	ASEAN Standard for Organic Agriculture
BIMP-EAGA	Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area
BKCF	BIMP-EAGA–Republic of Korea Cooperation Fund
CAP	Common Agricultural Policy (European Union)
CCUS	Carbon Capture Utilisation and Storage
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FiBL	Research Institute of Organic Agriculture
FTE	Full-Time Equivalent
GAP	Good Agricultural Practices

GAqP	Good Aquaculture Practices
GGGI	Global Green Growth Institute
GHG	Greenhouse Gas
IEA	International Energy Agency
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
ISIC-4	International Standard Industrial Classification of All Economic Activities, Revision 4
IOT	Input-Output Table
ICT	Information and Communication Technology
Lao PDR	Lao People's Democratic Republic
LCCP	Low Carbon Scenario Compatible with the Paris Agreement
LFS	Labour Force Survey
MCED-5	Fifth Ministerial Conference on Environment and Development in Asia and the Pacific
OECD	Organisation for Economic Co-operation and Development
PGS	Participatory Guarantee System
PSA	Philippine Statistics Authority
SAFT	Standards in the Southeast Asian Food Trade
SDGs	Sustainable Development Goals
SMEs	Small and Medium-sized Enterprises
SPA-FS	Strategic Plan of Action on Food Security in the ASEAN Region
TVET	Technical and Vocational Education and Training
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
USDA	United States Department of Agriculture

Executive summary

Southeast Asia is committed to promote environmentally sustainable economic growth. This has been demonstrated by the adoption and endorsement of an array of regional declarations and blueprints by the Association of Southeast Asian Nations (ASEAN). Since the mid-2010s, ASEAN countries have been mapping out green growth strategies. All ten member states have green growth objectives in their national development plans as of 2023. Despite these commitments, the region is not on track to achieve the sustainable development goals and is showing slow progress, even regression on environment-related goals. Environmental degradation due to the increased frequency of extreme weather events, exacerbated by deforestation and overfishing, continues unabated, threatening the working conditions and livelihoods of millions of Southeast Asians.

The region's typical geographic features as insular and coastal countries make it prone to climate change-related disasters and extreme weather events. Over 100 million workers have jobs that are directly or closely linked to the environment, making them vulnerable to climate change impacts. "Environmentally linked" jobs represent about 37% of total employment in the region. While most of them are in agriculture, up to 5% are jobs in sectors with strong indirect links to natural resources, such as waste management or manufacturing of wood products. Workers in environmentally linked jobs are likely to earn 20% less than the national average and to be in informal employment. In Southeast Asia, the informal economy employs an important share (70%) of the labour force, but jobs with direct links to the environment have an even higher propensity (93%) to be in the informal economy. Informal status typically implies that workers have no social protection and must cope with the consequences of environmental shocks on their own.

Further analysis was carried out for Indonesia and Viet Nam to understand the vulnerabilities of workers in relation to natural disasters. Provinces prone to a high frequency of floods and droughts were overlapped with job characteristics found in these areas. In Indonesia, over half of its labour force (51%) is vulnerable to income loss due to natural disasters. In Viet Nam, this concerns 21% of the workforce. The two countries have similar levels of informality and shares of workers in environmentally-linked jobs. The reason for Indonesia's higher share of vulnerable workers is the concentration of its population in Java, where natural disasters are prevalent, while in Viet Nam, natural disasters concern mostly the sparsely populated North Central Coast region.

While Southeast Asia's remarkable economic growth has relied heavily on natural resources, the region must adopt new, more sustainable development pathways as it grapples with environmental challenges. The transition towards greener growth will necessarily create shifts in the labour market: some sectors will create jobs, others will lose jobs or simply disappear. The negative impact will likely be felt more strongly among those already at a disadvantage in the labour market. Understanding the effects of climate change and green growth on jobs and people is a crucial step for promoting inclusive green growth in Southeast Asia. The study does this by looking at the effects a global energy transition on Indonesia's labour market.

A scenario where the world adopts sustainable energy production and use to reduce global greenhouse gas (GHG) emissions in accordance with the Paris Agreement is used to analyse the possible effects on labour in Indonesia. The simulation shows that the energy transition would result in a total net employment gain of 1 089 000 in Indonesia, or 0.86% more than the business-as-usual scenario. Employment gains are expected to benefit a wide range of sectors, from electricity and gas and construction to metal mining sectors. New employment opportunities would be created for low to highly educated profiles. The electricity and gas (particularly photovoltaic), trade and construction sectors capture the largest employment gains. Mining and manufacturing of fossil fuel are the only sectors expected to lose about 31 000 jobs. Public sector-oriented activities, such as social work, health, education and public administration remain virtually unaffected.

Even though job gains far outweigh job losses, what remains a concern is the geographic concentration of job losses in Kalimantan, the Indonesian region specialised in fossil fuel extraction. The profiles of workers who would be negatively affected by an energy transition are mostly men, wage employed in the formal economy, with higher earnings than the national average and good education levels. Still, a non-negligible 44% of them are in the informal economy, without social protection. In the absence of adequate strategies for job reallocation and territorial economic diversification, the energy transition will have economic costs but also consequences on the social cohesion of the country.

Another sector that requires particular attention in Southeast Asia in terms of its contribution to GHG emissions and environmental degradation is agriculture. Agriculture contributed on average about 11% of GDP in ASEAN countries in 2020 and remains an important source of livelihoods for about 96 million workers. However, Southeast Asia's thriving agri-food industry is destroying the ecosystem and biodiversity on which it relies. The increased need for arable land for livestock and higher-value crops has led to the massive conversion of primary forests for agriculture. The sector is also the second biggest contributor to global GHG emission after energy. The need for a transition towards more sustainable agricultural practices is urgent from both a biodiversity conservation and climate change mitigation perspective. Considering the size of the agricultural labour force, the effects of a transition in agriculture on employment will be substantial.

The study analyses the potential effects on employment and income of a conversion from conventional to organic rice farming in Indonesia, the Philippines, Thailand, and the region as a whole. Using Input-Output modelling, the simulation shows that an expansion of organic rice farmland to 5% of total rice farmland results in an overall increase in employment and income. The scenario creates 5.4 times more direct jobs than an equivalent land size expansion of conventional rice farmland. When looking at both direct and induced effects on the rice sector, the scenario creates 21 times more jobs. This is explained by the fact that organic farming tends to be more labour intensive, but also by the induced effects from increased income and demand for rice. Notably, in that scenario, the income of rice farmers increases by about USD 8 more per month. This is assuming that price premiums from organic products also benefit farm gate value. The sector likely to experience the most negative impact is "Chemicals and chemical products", due to the decrease in demand of fertilisers and chemical inputs.

There are several policy implications for a greener and more inclusive society in Southeast Asia. First, countries in Southeast Asia must reduce the vulnerability of the current 100 million workers who depend on the environment for their livelihoods. Social protection schemes such as universal healthcare, unemployment insurance and cash transfer schemes are needed. Public social expenditure in the region as a share of GDP ranged from 3% to 8% in 2019, well below the OECD average of 20%. Second, when embarking on a transition towards greener pathways, whether in energy or agriculture, a careful assessment of the distributional effects on labour and a detailed understanding of the profiles of affected individuals will be necessary, and compensation measures anticipated. Equity is crucial in ensuring political acceptability of a reform. Third, the most vulnerable geographic areas need plans for local development and economic diversification. Finally, reskilling and upskilling must be anticipated in losing and winning sectors alike. The agriculture sector will notably need policy support as it currently absorbs the majority of vulnerable and informal workers. Both adaptation and mitigation measures in the form of skills training, technology transfers and new market opportunities will be necessary, as well as income support during the initial transition phase towards a more sustainable agricultural practice.

1 Overview

Southeast Asia's remarkable economic growth has relied heavily on natural resources. Today, the region faces significant environmental challenges. Environmental degradation, pollution and biodiversity loss from deforestation, natural resource depletion and overfishing are starting to have economic and social consequences. The region is particularly vulnerable to climate change-related disasters due to the high percentages of its population living in coastal areas and having jobs that are linked to the environment. These people are often already in precarious situations.

Environmental protection and green growth are therefore becoming policy priorities for Southeast Asia. Southeast Asian countries show commitments towards sustainable development through an array of international declarations, regional guidelines and national strategies. Despite these efforts, evidence indicates that the region is not on track to achieve the sustainable development goals and is showing slow progress and even regression on environment-related goals (UNESCAP, 2021[1]).

A transition towards a green growth approach will cause some sectors to disappear and others to emerge, with inevitable consequences on the number and nature of jobs. This will result in changes in employment prospects for millions of Southeast Asian workers. The negative impact will be felt more strongly among those who are already disadvantaged in the current labour market. Understanding the redistributive effects and implementing policies to protect and reallocate affected workers will be key to ensuring political acceptability of necessary environmental reforms.

This study assesses the share and type of jobs susceptible to environmental degradation in Southeast Asia and the possible effects on labour of a green transition in energy and agriculture based on simulations in a few countries. Chapter 2 discusses Southeast Asia's environmental challenges and reviews policy frameworks related to green growth. Chapter 3 identifies employment vulnerabilities linked to environmental shocks or degradations across seven Southeast Asian countries. Chapter 4 portrays the characteristics of workers in winning and losing sectors in the context of a transition towards renewable energy, focusing on Indonesia. Chapter 5 presents the results of a simulation exercise that looks at the effects on jobs and income of adopting organic farming practice for rice cultivation in Southeast Asia.

Southeast Asia's green growth needs labour protection schemes and job reallocation strategies

In Southeast Asia, the risks of climate change are adding to the already significant human and economic costs of frequent natural disasters. By 2060, Southeast Asia is projected to lose more than 5% of its regional GDP due to climate change (Dellink et al., 2014[2]). Green growth – achieving economic development while maintaining environmental sustainability – can provide a framework for sustainable growth strategies. Many countries in Southeast Asia are adopting economic development that considers environmental and social values. However, Southeast Asia's overall performance level according to the Green Growth Index is currently below the OECD average, especially on social inclusion and exposure to pollution levels. Nonetheless, defining and measuring progress on green growth has been a challenge, largely due to its context-specific nature.

Since the 1980s, Southeast Asia has been integrating environmental concerns into regional agendas. The Association of Southeast Asian Nations (ASEAN) has issued joint statements, established committees, set up financing schemes, and supported programmes, partnerships, policy dialogue and research to support green growth. After the COVID-19 crisis, ASEAN considered sustainable development to be an integral part of post-COVID-19 economic recovery and long-term socio-economic development strategies. The ASEAN Economic Community (AEC) and ASEAN Socio-Cultural Community (ASCC) Blueprints 2025 demonstrate the region's commitment to sustainable growth. At the national level, Southeast Asian countries acknowledged the role of mitigation and adaptation measures in economic growth and have been mapping out green growth strategies since the mid-2010s. All ten ASEAN countries have now included green growth objectives in their national development plans, and five countries (Cambodia, Malaysia, Lao PDR, Singapore and Viet Nam) have separate green growth strategies as of 2023.

Most studies simulating the impact of green growth on jobs show a net positive effect on employment, with winning sectors outweighing losing sectors. A more granular look shows that low-skilled workers in environmentally linked jobs such as utilities, waste management and mining will be disproportionately affected. Southeast Asia recognises the employment implications of green growth as stated in the ASEAN 2018 Declaration on Promoting Green Jobs for Equity and Inclusive Growth. However, policy frameworks are not adequately prepared for workers' protection during the green transition, and social protection and equity issues are usually mentioned separately from green growth.

Understanding the job implications of climate impacts and the green transition in Southeast Asia is a crucial step for promoting inclusive green growth. The region's labour markets are highly informal and vulnerable, with around 244 million workers lacking labour and social protection (ILO, 2019[3]). However, current policy frameworks for green growth provide little information on the short-term impacts on employment and worker protections. Social protection and skills training to protect vulnerable workers and facilitate job reallocation need more prominence in green growth development frameworks.

Environmental degradation will affect workers already in difficult employment situations

The environment matters, not least for emerging Southeast Asian economies. Natural capital ranges from 25% of total national tangible capital in Indonesia to 61% in Lao PDR (World Bank, 2021[4]). Despite the importance of natural resources, deforestation – due primarily to land clearing for agriculture – is happening at a rapid pace, with 15% of the region's forest area lost since 1990. Indonesia and Malaysia, the world's top palm oil producers, accounted for 89% of the region's deforestation from 2005 to 2015 (Estoque et al., 2019[5]). This trend is not only endangering one of the most important global biodiversity hotspots, it also has economic and social costs.

One in three Southeast Asians rely on the environment and ecosystem services for their jobs. About 37% of jobs in the region are strongly linked to the environment, ranging from 27% in the Philippines and 38% in Indonesia to 52% in Myanmar. This concerns over 100 million Southeast Asian workers. Most of these jobs are in agriculture, but not only. Up to 5% are jobs in sectors that depend indirectly on natural resources, such as waste management or manufacturing of wood products. In addition, travel and tourism, which is increasingly around nature-based activities and ecotourism, provides jobs for 41.8 million people in Southeast Asia, representing 13.2% of employment and 11.7% of GDP in 2019 (OECD, 2023[6]).

What is alarming is that workers who will suffer most from environmental degradation tend to be already disadvantaged in the labour market. Workers in environmentally linked jobs earn 20% less than the national median labour earnings and typically work in the informal economy where there is no social protection. This lowers their capacity to cope with natural disasters or other environmental shocks. They also tend to have an employment status which is considered vulnerable, such as own account workers and contributing family workers, as opposed to wage jobs. This form of "nature penalty" is most severe in the sectors with direct links, such as agriculture, and declines progressively as the environmental link weakens. Workers in sectors related to the environment have a lower level of education than the national average, with a larger share of people having basic education or less. This is a source of vulnerability as low education implies low job mobility.

In Indonesia, more than half of the labour force is vulnerable to income loss due to natural disasters

Southeast Asia's typical geographic features as insular and coastal countries makes it one of the most vulnerable regions to climate change. The region faces increasingly unpredictable weather events such as heat waves, floods and droughts. In order to better understand the income vulnerabilities of workers in relation to natural disasters, a more in-depth analysis was conducted for Indonesia and Viet Nam. Provinces prone to a high frequency of floods and droughts are identified and overlapped with job characteristics in these geographic areas. A worker's income vulnerability to environmental shocks is defined by three concomitant factors: 1) sensitivity due to the economic activity's link to the environment; 2) exposure to environmental degradation; and 3) capacity to cope with and adapt to natural disasters through social protection for example (informality). In this analysis, sensitivity is measured by the share of the workforce engaged in environmentally linked activities. Exposure to natural disasters is measured by the frequency of floods and droughts. Capacity to cope with and adapt to natural disasters is measured by the worker's access to social protection through formal employment.

In Indonesia over half of the labour force (51%) is vulnerable to income loss due to natural disasters. In Viet Nam, this concerns 21% of the workforce. The two countries have similar levels of informality and share of workers in environmentally linked jobs. The reason for Indonesia's higher share of vulnerable workers is the concentration of its population in Java, a region where natural disasters are prevalent. In Viet Nam, natural disasters concern mostly the sparsely populated North Central Coast region.

Social protection is key to reducing workers' vulnerability to environmental degradation and natural disasters

In Southeast Asia, people working in environmentally linked jobs tend to be in the informal economy and low educated. Furthermore, natural disasters increase income vulnerabilities of workers as they have limited coping and adaptation mechanisms. It is urgent for the countries in the region to strengthen their social protection systems. As climate change-induced disasters continue to intensify, Southeast Asian workers will need more support to protect their livelihoods through universal healthcare, unemployment insurance and cash transfer schemes. Public social expenditure in the region as a share of GDP ranges from 3% to 8% in 2019, well below the OECD average of 20% (OECD, 2022[7]). Many ASEAN countries do not have unemployment benefits or pension schemes.

In the absence of unemployment insurance, workers affected by natural disasters or environmental degradation could receive cash transfers to sustain their livelihoods. The random occurrence of natural disasters calls for social protection systems to be agile, with immediate intervention right after the event. Cash transfers are flexible and scalable and therefore can provide fast temporary relief to workers and their families. However, improving the social protection system, especially for those workers and families likely to be impacted by climate change-induced disasters is a priority, as they are currently the more disadvantaged group of the population. Social protection options need to be provided to informal economy workers through contributory schemes. This should include developing broad-based social protection systems that are shock-responsive and accelerate the development of unemployment insurance programmes. Disaster responses can leverage existing social programmes and take the form of temporary measures. In the long term, countries should rely less on cash transfers and develop income-enhancing programmes as part of disaster resilience strategies. Adaptation measures through new skills, technologies and practices are needed, particularly in the agriculture sector.

A green transition in the energy sector promises jobs in Indonesia

Southeast Asian countries are committed to reducing reliance on fossil fuels to tackle climate change and air pollution. As the region's largest economy and also the world's largest exporter of coal, Indonesia's transition towards more sustainable sources of energy will have an impact on emissions and can be an example for countries that rely on fossil fuels to follow suit. The *Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050* sets ambitious goals, including reducing greenhouse gas emissions by 29% compared with a business-as-usual scenario by 2030. This represents opportunities but also challenges from a labour market perspective: it will likely create winners and losers across industries, skill types and geographies.

To analyse the effects on employment, a sustainable development scenario by 2030 (referred to as 2 degrees scenario or 2DS) is compared to a business-as-usual scenario (referred to as 6 degrees scenario or 6DS) The simulation shows that an energy transition under the 2DS would result in a total net employment gain of 1 089 000 in Indonesia, or 0.86% more than the 6DS. The analysis builds on a model by the International Labour Organization (Montt et al., 2018[8]) where the world adopts sustainable energy production and uses 2DS to reduce global emissions in accordance with the Paris Agreement.

Employment gains in Indonesia are expected to benefit a wide range of sectors, from electricity and gas and construction to mining (other than fossil fuel) sectors. New employment opportunities could also benefit workers with various educational backgrounds. The electricity and gas, trade and construction sectors capture the largest employment gains. Further disaggregation of the electricity and gas sector shows the largest increase in employment in solar photovoltaic. Public sector-oriented activities, such as those in social work, health, education and public administration remain virtually unaffected. The mining and manufacturing of fossil fuels are the only sectors expected to lose about 31 000 jobs.

Even though job gains far outweigh job losses, what remains a concern is the geographic concentration of job losses in Kalimantan, the Indonesian region specialised in fossil fuel extraction. The profiles of workers who would be negatively affected by an energy transition are mostly men, wage employed in the formal economy, with higher earnings than the national average and good education level. Still, a non-negligible 44% of them are in the informal economy, without social protection. In the absence of an adequate job reallocation strategy and territorial development to diversify economic activities in the affected region, the energy transition will have economic costs but also consequences on the social cohesion of the country.

Sectoral and territorial development plans are needed to avoid labour market disparities during the energy transition

Indonesia needs to consider both the sectoral and geographical impacts as it transitions away from fossil fuels as the main source of energy. Workers involved in fossil fuel mining and manufacturing need appropriate policy support for skill training, job seeking, relocating and protecting their basic needs. Working conditions in the winning sectors need to be improved, as the share of informal workers remain high. Policies aiming at reallocating workers from fossil fuel mining to metal or other mineral mining could be considered, provided overall working conditions in the latter are improved. Lack of local employment alternatives in the affected region or difficulties relocating workers in other areas must be addressed through local development plans and support programmes for displaced workers. Finally, while shifting from fossil fuel to metal mining might seem like a good reallocation option, a careful assessment of potential environmental consequences, such as water pollution from nickel extraction, needs to be carried out and adequate measures put in place.

Equity is crucial in ensuring political acceptability of the energy transition. To minimise the negative impacts on affected workers, the government should provide reskilling or upskilling opportunities, compensatory income support, and local development strategies. Social protection schemes for informal workers are urgently needed. As it rolls out its blueprint for decarbonisation and energy transition, the Comprehensive

Investment and Policy Plan 2023 for Indonesia's Just Energy Transition Partnership, the country must carefully consider the social consequences of climate action to ensure broad public support and unlock a "triple dividend" of environmental sustainability, economic efficiency and equity.

The green transition in agriculture and its effects on labour: The organic rice case study

Agriculture contributes on average to about 11% of GDP in ASEAN countries. The sector remains an important source of livelihoods for millions of Southeast Asians, accounting for about 96 million workers, or 27% of the total workforce in 2020. The region includes some of the top exporters of rice, maize, soybeans, cassava and sugar, as well as palm oil, coconut and rubber, which accounted for 8.3% of the world's agricultural products traded in 2021. Agriculture is closely linked to natural resources such as land, water and biodiversity and holds great potential for green growth in the region. Implementing sustainable agricultural practices could therefore reduce environmental impacts while fostering technological innovation and development.

Behind Southeast Asia's growing agri-food industry, however, is the degradation of its ecosystem. While agricultural production is heavily reliant on biodiversity, natural cycles and ecological processes, paradoxically, current agricultural practices accelerate freshwater depletion, soil degradation and air pollution in Southeast Asia. The increased need for arable land for livestock and higher-value crops has led to the massive conversion of primary forests for agriculture. Agriculture is also the second biggest contributor to global greenhouse gas (GHG) emission after energy. The need for a transition in agriculture towards sustainable practices is urgent from both biodiversity conservation and climate change mitigation perspectives.

Understanding the green transition in agriculture and its potential effects on employment is essential to ensure that policies and interventions are designed to mitigate any adverse effects on rural livelihoods and vulnerable workers while maximising the benefits of sustainable agriculture. Input-Output modelling was used to analyse the potential effects on employment and income of a conversion from conventional to organic rice farming in Indonesia, the Philippines, Thailand, and the region. Despite some data limitations on organic farming in developing countries, the simulation provides insights into the economic effects of a shift towards organic agriculture and the possible changes along the rice value chain.

An increase in organic rice farmland results in more jobs and income than an equivalent increase in conventional rice farmland

An expansion of organic rice farmland to reach a 5% share of total rice farmland (medium scenario) results in an increase in employment and income. The scenario creates 5.4 times more direct jobs than an equivalent land size expansion of conventional rice farmland. When looking at both direct and induced effects on the overall rice sector, the scenario creates 21 times more jobs. This is explained by the fact that organic farming tends to be more labour intensive, but also by the induced effects from increased income and demand for rice. Indeed, the same scenario increases income for rice farmers/workers by about USD 8 more per month than in the conventional farmland increase. In countries where farmers' monthly income ranges from USD 20 to USD 400, this increase can represent a significant contribution.

Analysing the changes at the sectoral level provides a dynamic picture of the rice value chain and its closely linked sectors. Changes in output value are most interesting to observe. Not surprisingly, the agricultural sector (including hunting and forestry) sees the largest return from the expansion of organic rice farmland. It is followed by several closely linked sectors such as food products, beverages and tobacco, and wholesale and retail trade. The medium scenario creates an additional USD 0.7 million in agricultural output, on average, for countries in the region compared to the equivalent area expansion of conventional rice farmland. The chemicals and chemical products sector, on the other hand, is estimated to lose USD 1.17 million in output. Employment and income effects at the sectoral level are not significant but still positive and higher for the organic expansion scenario than the conventional. The small effects likely relate to the small contribution that organic rice farming makes to overall employment and wages compared with other sectors in the economy, as well as the small percentage of land increase simulated.

An increase in demand for organic rice combined with an expansion of organic rice farmland area leads to a more robust and positive impact on output and employment. On average in the region, there is an additional USD 3.05 million increase in output under the medium scenario land increase combined with a USD 100 000 increase in final demand spending. At its highest, the output increases by a factor of nine in Indonesia and more than triples in the Philippines. When compared with the medium scenario, the boost in employment from an additional USD 100 000 in final demand spending increases the number of FTE jobs by 0.042 for the region as a whole, by 0.009 in the Philippines and by 0.223 in Indonesia.

The green transition in agriculture will require multiple layers of policies to support farmers and reallocate workers from losing sectors

Promoting sustainable agriculture is becoming an important agenda for Southeast Asia. The simulation using organic rice farming practice demonstrates that countries could experience increases in output, employment and income in the agricultural sector. By adopting sustainable farming practices, such as organic or other nature-friendly techniques on a larger scale, Southeast Asian countries could mitigate the negative impacts of agriculture on the environment, conserve natural resources and improve food security and livelihoods. To achieve a smooth transition to greener agriculture, the transition plans would also need to include policies that promote consumer awareness about the benefits of organic food and other sustainable production methods.

The distributional impact on labour of the green agricultural transition will need to be carefully assessed and policy measures put in place to protect workers at risk of losing their jobs. Workers in the losing sector, like chemicals and chemical products, tend to be younger, more educated, paid more compared with the national average, and are more likely to live in urban areas. Facilitating their labour mobility through a combination of reskilling/upskilling and social protection will likely be cost-effective. The simulation also indicates that an increase in organic rice agriculture combined with increased final demand spending could help to balance out the losses in negatively affected sectors.

As a green transition could create jobs and increase income in the agricultural sector, making this sector attractive in order to recruit new talent should be a priority. Countries could launch campaigns highlighting the employment benefits and opportunities in sustainable agriculture, such as organic farming, in order to attract new recruits among the youth population. At the same time, governments should collaborate with educational institutions, research centres and industry stakeholders to develop vocational training programmes focused on sustainable agricultural practices and technologies.

Supporting existing farmers to convert to sustainable agricultural practices is also important. Converting conventionally farmed land to organically farmed land can take up to three years, during which time farmers can expect both yield and income losses. Subsidies and access to low-cost financing schemes during this transition phase will be necessary in order to protect the livelihoods of farmers. Furthermore, farmers will need support for technology upgrades, inclusion of digital inventions, and irrigation system improvements. Providing technical assistance and training to rural financial institutions (e.g. farmers' co-operatives and community-based organisations) could enhance their ability to support smallholder farmers in the green transition.

Creating enabling conditions could also make the green transition in agriculture more inclusive. Boosting market demand for sustainable food products has the potential to promote greener agriculture. Enhancing quality control systems is one way to reassure consumers about the origin and production methods used for organic food products. Countries are therefore encouraged to establish reliable certification and labelling systems to inform customers of the sustainable agricultural practices used.

When developing sustainable or organic food value chains, Southeast Asian countries should prioritise investments in agricultural infrastructure in order to strengthen the inclusiveness of value chains. Improving irrigation systems, enhancing storage and processing facilities, and upgrading transportation networks in rural areas can increase the overall efficiency of agri-food value chains, benefiting all actors engaged in the agri-food system.

Finally, while the region has high-level guidelines for sustainable agriculture, country-level implementation lags behind. Governments are encouraged to establish mainstreaming mechanisms that involve integrating sustainable practices and principles into agricultural policies, programmes and practices. Regular expenditure review or strategic assessment of sustainability indicators could help to measure the effectiveness of relevant policies and programmes.

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2 Green growth in Southeast Asia: Trends and commitments

Southeast Asia has achieved remarkable economic development over the past few decades, but its growth has relied heavily on natural resources. As the region's natural resource endowments deplete and climate change intensifies, environment-related costs are rising. Countries in the region are beginning to integrate green growth objectives into their national development plans. Displacement and reallocation of labour will be inevitable during any transition, but Southeast Asia lacks preparedness for the near- and long-term employment disruption that will result from a green transition. This chapter introduces the concept of green growth and provides an overview of Southeast Asia's policy frameworks for green growth, particularly from a labour perspective.

Since the early 2000s, member countries[1] of the Association of Southeast Asian Nations (ASEAN) have reported rapid growth rates and demonstrated resilience amidst global crises and uncertainties. Despite the COVID-19 pandemic, the average economic growth rate for the region in 2021 was 3.2%, and the region is projected to keep growing to 4.6% in 2023 (OECD, 2023[1]). ASEAN countries had a combined gross domestic product (GDP) of USD 3.3 trillion (United States dollars) in 2021, amounting to 3.4% of the world's GDP (Biswas, 2022[2]). Despite this success, the region faces significant social and environmental challenges. As a global hotspot of biodiversity, Southeast Asia is home to almost 20% of all species known in the world and holds 60% of the world's tropical peatland, over 40% of the world's mangrove areas in addition to underground mineral resources (ASEAN Secretariat, 2022[3]). However, rapid agricultural expansion, unsustainable natural resource management, infrastructure development and pollution are causing extreme losses of biodiversity (Coleman et al., 2019[4]). It is estimated that 13-42% of species will be lost in Southeast Asia by 2100, with at least one-half of these facing global extinction (Sodhi et al., 2010[5]). This environmental degradation and biodiversity loss, accelerated by the effects of climate change, is starting to have real consequences for the region's economy. Environmental protection and green growth are therefore becoming policy priorities for Southeast Asia. ASEAN is actively promoting green sectors and green jobs, as well as green urban planning and management, and is developing policies to support sustainable production and consumption (ASEAN-ILO, 2021[6]). The post-COVID-19 pandemic recovery is also seen as an opportunity to rethink and rebuild the current growth models into models that can reconcile economic benefits with environmental and social objectives.

However, a transition to a greener economy requires a careful impact assessment, particularly regarding job reallocation. In Southeast Asia, agriculture absorbed 27% of the labour force in 2019 (World Bank, 2019[7]), albeit with wide variations by country. A green growth approach will inevitably affect the number and nature of jobs in both emerging and disappearing sectors. This will result in changes in employment prospects for millions of Southeast Asian workers. While most studies on the green transition find that, overall, more jobs will be created than destroyed, not all sectors will be equally affected by the green transition (Wei, Patadia and Kammen, 2010[8]; ILO, 2018[9]). Renewable energy, for example, is more labour-intensive than electricity generated by fossil fuel, and investment in green energy can generate 2.8 times more jobs than the same investment in the fossil fuel sector (Garrett-Peltier, 2017[10]).

The negative impact will also be felt more strongly among those who are already disadvantaged in the current labour market. One of the key issues will therefore be to identify the sectors and economies that will experience job losses and ensure that the green transition is inclusive and fair. This chapter introduces the concept of green growth and provides a rationale for the urgent need for such growth in Southeast Asia. It then describes what green commitments have been made in Southeast Asia at the regional and national levels. Finally, it looks at the possible effects of the green transition on employment and it discusses policy implications, particularly for vulnerable workers.

From sustainable development to green growth: Definition and measurement challenges

Green growth is about achieving economic development while ensuring environmental sustainability. The idea of introducing environmental and social factors into the economic growth model has been discussed since the early 1980s and gained momentum under the concept of "sustainable development" with the Brundtland report in 1987 and the United Nations Conference on Environment and Development in 1992 (Pezzey, 1989[11]; Colby, 1991[12]). The global financial crisis in 2008 pushed this line of thinking further by considering the sustainable development approach as an alternative paradigm to tackle both the worldwide economic crisis and the environmental damage caused by the conventional carbon-intensive "brown" development strategy (Merino-Saum et al., 2020[13]; Bina and La Camera, 2011[14]). The term "green growth" was first introduced at the Fifth Ministerial Conference on Environment and Development in Asia and the Pacific (MCED 2005) held in Seoul, South Korea in 2005.

There is no internationally agreed definition of green growth, but all definitions are based on decoupling economic growth from natural resource use and negative environmental impacts (Box 2.1). According to the Organisation for Economic Co-operation and Development (OECD), green growth is about "fostering economic growth and development while ensuring that the natural assets continue to provide the resources and environmental services on which our well-being relies" (OECD, 2011[15]). Green growth is not intended to be a replacement for sustainable development. Still, it should be considered as a subset of it, entailing an operational policy agenda that can help achieve concrete, measurable progress at the interface of the economy and the environment (OECD, 2011[15]).

Box 2.1. The green growth spectrum

Multiple terminologies have been used to describe the "green" narrative of economic development. Although these terminologies share the common value of promoting economic growth together with environmental sustainability, they differ in their core construct and main advocacy. One end of the spectrum sees ecological protection as compatible and negotiable with continuous economic growth ("relative decoupling"), and thus supports technological improvements and market-driven policies. In contrast, the other end of the spectrum posits that environmental conservation trumps any economic purposes ("absolute decoupling") (Merino-Saum et al., 2020[13]). Listed below are definitions for various terms related to the green transition:

- **Sustainable development** is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987[16]). Sustainable development is considered an overarching goal that green growth and the green economy should achieve (OECD, 2011[15]).
- **Green growth** is about "fostering economic growth and development while ensuring that the natural assets continue to provide the resources and environmental services on which our well-being relies" (OECD, 2011[15]). The World Bank describes it as "a growth pattern that is efficient in its use of natural resources, clean in that it minimises pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing disasters" (World Bank, 2018[17]).
- **Inclusive green growth** was introduced in 2012 at the United Nations Conference on Sustainable Development (Rio+20) following criticism that green growth definitions remained heavily focused on environmental concerns and that the social and structural contexts were being ignored (Unmüßig, Sachs and Fatheuer, 2012[18]). The concept of inclusive green growth has since evolved into a policy agenda with growth, environment and equity as equally imperative objectives.
- **Green economy** indicates "low carbon, efficient and clean in production, but also inclusive in consumption and outcomes" (UNEP, 2011[19]) or "a thriving economy that delivers the linked economic, social and environmental outcomes sought by the Sustainable Development Goals (SDGs) and the Paris Agreement" (Green Economy Coalition, 2020[20]). The term is increasingly used interchangeably with green growth as it has similar economic, environmental and social constructs (Merino-Saum et al., 2020[13]; Adamowicz, 2022[21]).
- **Green recovery** emerged in 2021 in the aftermath of the COVID-19 pandemic to call for a policy direction that promotes post-pandemic recovery in a greener way. A green recovery is an investment that promotes both economic growth and significant environmental and social benefits (UNEP, 2021[22]). Green stimulus programmes were also introduced in 2008 following the global economic crisis.
- **Just transition** emphasises social justice in the process of greening an economy. The International Labour Organization (ILO) defines it as "greening the economy in a way that is as

fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind" (ILO, n.d.[23]).

Measurement has been another challenge around green growth, partly due to its equivocal definition and context-specific construct. While the OECD, the World Bank, the United Nations Environment Programme (UNEP) and the Global Green Growth Institute (GGGI) have been working together towards a common methodology for green growth since 2013 (World Bank, 2013[24]), each organisation has developed its own measurement indicators (Box 2.2). While the OECD and UNEP emphasise the policy process and interventions to meet green growth targets, the GGGI focuses more on the targets themselves. However, how much progress has actually been made regarding these indicators is unclear due to the very limited evidence that has been made available since 2013.

Box 2.2. Green growth measurements

Green growth can be estimated by using either a set of multidimensional measures or a composite indicator. The multidimensional measures are suitable for precise information about each dimension of green growth, but they cannot summarise the overall progress. In contrast, a composite indicator may lack detailed information but is more intuitive and useful when comparing countries (Rosenbaum, 2017[25]). The following list outlines the green growth indicators used by each organisation:

- OECD's **Green Growth Indicators**: The OECD estimates progress in green growth in four main dimensions: 1) environmental and resource productivity; 2) natural asset base; 3) environmental dimension of quality of life; and 4) economic opportunities and policy responses. These dimensions are measured by 4 primary indicators and 17 secondary indicators (OECD, n.d.[26]).
- UNEP's **Green Economy Indicators**: UNEP uses dimension-oriented indicators to evaluate policies related to a green economy. The indicators are used to: 1) identify priority issues; 2) formulate and assess green economy policy options; and 3) evaluate the performance of policy implementation (UNEP, n.d.[27]).
- GGGI's **Green Growth Index**: GGGI developed a composite indicator for the assessment of green growth performance and transition in achieving sustainability targets. The Green Growth Index scores green growth performance based on four pillars of green growth: 1) efficient and sustainable resource use; 2) natural capital protection; 3) green economic opportunities; and 4) social inclusion (GGGI, 2019[28]).
- ESCAP's **Green Growth Indicators**: The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) proposes a set of five indicators to measure the quality of green growth in the context of Asia and the Pacific: 1) equitable distribution of and access to resources; 2) structural transformation; 3) eco-efficiency; 4) investment in natural capital; and 5) recognising planetary limits (UN ESCAP, 2013[29]).

Today, taking into account environmental and social values for economic development is becoming a policy priority in many ASEAN countries. The green growth paradigm can provide a basic framework which countries could use to tailor their national and regional sustainable growth strategies. However, defining and measuring green growth still has significant room for improvement and will require more policy and scientific evidence in order to move it forward. In particular, definitions and indicators for the social inclusiveness of green growth are relatively underdeveloped and need more evidence in order to garner political support. The delay in the development of green growth measures could slow down the pace of global efforts to achieve the SDG targets. Detailed sub-level measures considering a country's regional and income category might be desirable given that the determinants and performance of green growth may vary according to a country's level of development (Li et al., 2021[30]).

The empirical evidence of decoupling in developed countries has been mixed to date, while evidence for developing countries is very limited (Parrique et al., 2019[31]; Mann, 2015[32]; Wang et al., 2018[33]). Critiques of green growth argue that the concept reduces the scale of the ecological problem to resource misallocation, shifts problems and costs (e.g. from carbon energy to renewable energy), underestimates the environmental impacts of the service economy, and disregards the issues of political power (Parrique et al., 2019[31]; Unmüßig, Sachs and Fatheuer, 2012[18]). For developing countries, pursuing a green growth strategy can be costly due to limited access to policy ideas, infrastructure and technologies, and may conflict with other national priorities (OECD, 2012[34]).

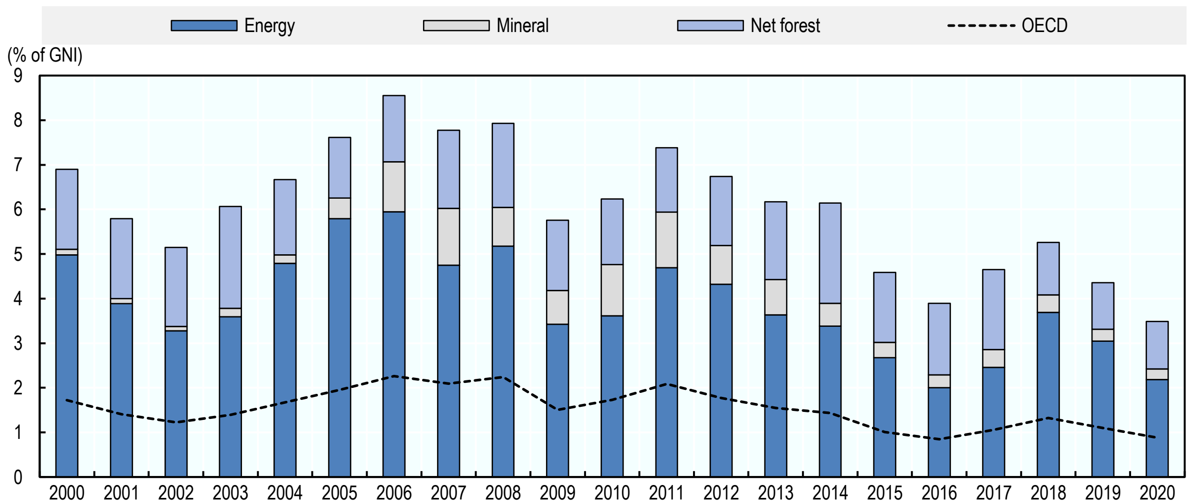
Southeast Asia's urgent need for greener growth paths

Southeast Asia's impressive economic growth has relied heavily on its natural resource endowments, resulting in natural resource depletion and increased vulnerability to environmental challenges. The region is not on track to achieve the SDGs and is particularly showing slow progress and even regression on environment-related goals (UNESCAP, 2021[35]). In ASEAN countries, natural resources were being depleted at an average of 3.5% of gross national income (GNI) in 2020. For comparison, the mean natural resource depletion rate of OECD countries was 0.9% in 2020 (Figure 2.1). Unsustainable extraction of non-renewable natural resources, overfishing, and intensive and extensive use of land have increased resource depletion, soil erosion, deforestation and greenhouse gas (GHG) emissions (Kirch, 2005[36]; Campbell et al., 2017[37]; IPBES, 2019[38]; IPCC, 2019[39]). In turn, environmental degradation makes the region highly vulnerable to climate change-induced disasters (OECD, 2014[40]). Among other issues, frequent catastrophic coastal floods and droughts are a considerable threat. Southeast Asia's economy relies heavily on its long coastlines, which provide livelihoods for approximately 72% of the region's population and contribute up to 60% of the GDP in some countries (PEMSEA, 2015[41]). Vulnerability to natural disasters has begun to inflict considerable human and economic costs on the region. It is estimated that between 2000 and 2021, 17 043 Southeast Asians lost their lives, and 157.4 million were affected by natural hazards related to environmental degradation,[2] with economic losses estimated at USD 88.5 million (CRED, 2022[42]).

Southeast Asia is facing emerging risks due to the acceleration of climate change and related natural disasters. By 2060, Southeast Asia is projected to lose more than 5% of its regional GDP due to climate change, the largest GDP loss in the world (world average: 0.7-2.5%) (Dellink et al., 2014[43]). Deteriorating environmental conditions could further aggravate the existing socio-economic gap between those who are better off and the most vulnerable populations (i.e. children, youth, women, people with a disability and older adults) (Islam and Winkel, 2017[44]; ADB, 2022[45]). Indeed, the COVID-19 crisis has put Southeast Asian economies' resilience to the test and revealed their vulnerability to poverty and inequality from external shocks. The pandemic caused a loss of 10.6 million jobs in Southeast Asia in 2020, with women, youth, and workers in small and medium-sized businesses being the most affected (ADB, 2022[45]).

Figure 2.1. Natural resource depletion in Southeast Asia remains significant

Adjusted savings: natural resource depletion (percentage of GNI), 2000-20



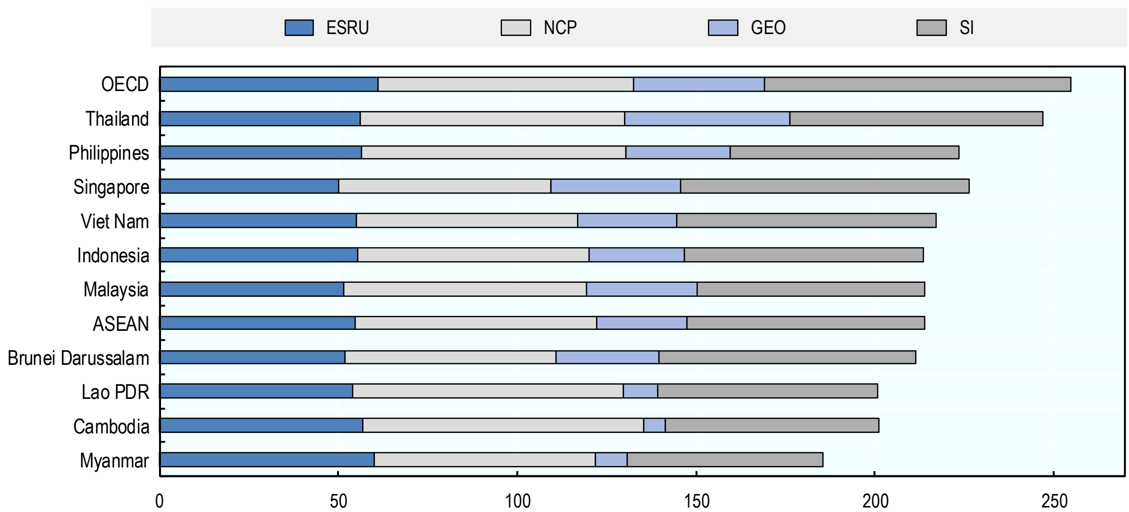
Note: Natural resource depletion is the sum of net forest depletion, energy depletion, and mineral depletion. Energy depletion is the ratio of the value of the stock of energy resources (coal, crude oil and natural gas) to the remaining reserve lifetime (capped at 25 years). Mineral depletion is the ratio of the value of the stock of mineral resources (tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite and phosphate) to the remaining reserve lifetime (capped at 25 years). Net forest depletion is unit resource rents times the excess of roundwood harvest over natural growth. The indicator values for ASEAN are the averages across the ASEAN countries with complete data across the years. For comparison, the mean natural resource depletion rates of OECD countries range between 0.8% and 2.3% for the same period.
Source: World Bank Database (n.d.[46]).

Green development strategies could promise Southeast Asia the benefits of sustained economic growth and a better grip on emerging poverty and inequality risks associated with climate change. In the short term, transitioning to a greener economy could offer Southeast Asia new economic opportunities, with some studies estimating that up to USD 1 trillion could be generated from job creation, business development, efficiency improvement and cost savings in potential sectors by 2030 (Hardcastle and Mattios, 2020[47]). In the longer term, developing an economy that is mindful of its environmental and social impacts could enable the region to sustain economic development and social cohesion, eventually leading to improved human well-being (OECD, 2014[40]). Making the green growth process inclusive is critical for maximising its long-term benefits, as widening inequality is a known barrier to accelerating the pace of poverty reduction and subsequent economic growth (UNU-WIDER, 2020[48]).

Southeast Asia's overall green growth performance level is currently below the OECD average, with the largest difference being in social inclusion (Figure 2.2). The GGGI Green Growth Index indicates that ASEAN countries are performing relatively well (average or above) within Asia. Nonetheless, they fall short of the OECD standard in all green growth dimensions. Thailand is the overall leader in green growth in Southeast Asia, whereas Myanmar needs to expend major effort to improve its performance. With regard to the social dimension, country performance is highest in Singapore and lowest in Cambodia and Myanmar, suggesting possible gaps in resources available for social development across countries (Li et al., 2021[30]). However, even Singapore's social inclusion falls behind other high-income countries in North America and East Asia. ASEAN population were exposed to pollution levels well above the World Health Organization's guidelines. In 2019, ASEAN countries recorded an annual mean concentration of fine particulate matters of 21.22 µg/m3, compared to 13.93 µg/m3 in OECD countries (OECD, 2023[49]).

Figure 2.2. Southeast Asia needs to improve social inclusion in its green growth performance

Country performance by dimensions of GGGI's Green Growth Index, 2020



Note: ESRU: efficient and sustainable resource use; NCP: natural capital protection; GEO: green economic opportunities; SI: social inclusion. The indicator values for ASEAN are the averages across the ten ASEAN countries. Lao PDR is an acronym for Lao People's Democratic Republic.
Source: Acosta et al. (2021[50]).

Regional commitments towards green growth

Southeast Asia has been gradually increasing its co-operation efforts towards greening economies since ASEAN integrated environmental concerns into regional agendas in 1977 (ASEAN, 2020[51]). The region's support for sustainable growth gained momentum in 2005 when the Regional Implementation Plan for Sustainable Development in Asia and the Pacific, 2006-2010 was adopted. To date, ASEAN considers sustainable development to be an integral part of post-COVID-19 economic recovery and long-term socio-economic development strategies (ASEAN, 2020[52]). In support of green growth, ASEAN has issued joint statements through ministerial meetings; established relevant committees, working groups and networks; set up financing schemes; and supported programmes, partnerships, policy dialogue and research.

Adopting intra-ASEAN ministerial statements and declarations has been Southeast Asia's major policy instrument with which to demonstrate regional commitment to sustainable growth (Table 2.1). In 2015, ASEAN leadership agreed to establish a set of development blueprints for the region's long-term vision, political security, economic prosperity and socio-cultural development up to 2025 with implications for green growth with the *Kuala Lumpur Declaration on ASEAN 2025* (ASEAN, 2015[53]). In the ASEAN Economic Community (AEC) and ASEAN Socio-Cultural Community (ASCC) Blueprints 2025, ASEAN makes it clear that its member countries should co-operate in order to ensure that economic growth goes hand in hand with social development and environmental sustainability, and provide equal access and opportunity to environmental sustainability and sustainable development (ASEAN, 2016[54]). The ASCC Blueprint 2025 demonstrates the region's commitment to sustainable growth, focusing on four target areas: the conservation and sustainable management of biodiversity and natural resources; the promotion of environmentally sustainable cities; the enhancement of capacity in implementing climate adaptation and mitigation; and support for sustainable consumption and production.

Table 2.1. ASEAN demonstrates continued region-wide commitments to green growth

ASEAN's political commitments towards sustainable and green development, 2005-20

Policy statements and frameworks	Year	Main takeaways
Regional Implementation Plan for Sustainable Development in Asia and the Pacific, 2006-2010	2005	• Declared to promote environmentally sustainable economic growth, or equivalently green growth, as the central means to improve environmental sustainability, eradicate poverty and achieve the Millennium Development Goals (MDGs).
ASEAN Declaration on Environmental Sustainability	2007	• Agreed to intensify regional and international co-operation in promoting, sharing and implementing environmentally sustainable practices. • Agreed to increase individual and collective efforts to improve the quality of air and water within ASEAN countries through regional or national initiatives to reduce industrial and transportation pollution. • Agreed to promote sustainable management and use of soil, forest, and coastal and marine environments as part of regional and global efforts to improve biodiversity conservation.
ASEAN Leaders' Statement on Sustained Recovery and Development	2010	• Reaffirmed the collective commitment towards regional integration and the ASEAN Economic Community. • Promised to intensify co-ordinated efforts towards sustained global economic recovery from the global financial crisis and economic downturn.
Kuala Lumpur Declaration on ASEAN 2025	2015	• Adopted the *ASEAN Economic Community Blueprint 2025* and the *ASEAN Socio-Cultural Community Blueprint 2025*, together with the *ASEAN Community Vision 2025* and the *ASEAN Political-Security Community Blueprint.* • The AEC and ASCC Blueprints 2025 reiterate the ASEAN vision on sustainable economic growth with shared prosperity and social progress.
ASEAN Declaration on Promoting Green Jobs for Equity and Inclusive Growth of ASEAN Community	2018	• Acknowledged the need for a co-operative effort to build a green economy by positioning it in the human resources development agenda of ASEAN Member States. • Put forward a definition of green jobs as "decent jobs in economic sectors which reduce negative environmental impacts".
ASEAN Leaders' Vision Statement on Partnership for Sustainability	2019	• Agreed to promote co-operation and partnership between the ASEAN Member States and external partners through various ASEAN-led mechanisms to achieve sustainability in all dimensions. • Agreed to promote sustainable development and to co-ordinate and enhance co-operation in the region for green growth. • Established the ASEAN Centre for Sustainable Development Studies and Dialogue (ACSDSD) in Bangkok, Thailand.
ASEAN Comprehensive Recovery Framework (ACRF)	2020	• Set out the region's consolidated exit strategy from the COVID-19 pandemic. • Emphasised environmental sustainability and inclusive development as a key component of the region's post-pandemic economic recovery process.

Source: ASEAN (2012[55]; 2010[56]; 2018[57]; 2019[58]; 2020[52]); ASEAN Centre for Energy (n.d.[59]); IISD (2004[60]); United Nations (n.d.[61]).

Statements and frameworks issued in the last five years have increased the regional emphasis on green growth, recognising its employment implications. ASEAN countries acknowledged the need for mitigation and adaptation measures from the labour market perspective in Southeast Asia by adopting the *ASEAN Declaration on Promoting Green Jobs for Equity and Inclusive Growth of ASEAN Community* in 2018. The Declaration aims to foster green jobs and green skills, support relevant research on education and training, and promote diverse green products and services, with green jobs defined as "decent jobs in economic sectors which reduce negative environmental impacts" (ASEAN, 2018[57]). The ACRF that came about after the COVID-19 crisis anticipates that transitioning to low-carbon energy and creating green infrastructure would lead to job creation (ASEAN, 2020[52]). The ACRF also stresses that ASEAN countries should enhance collaboration and partnership in order to build capacity for green growth, including upskilling and reskilling the ASEAN workforce for green jobs.

However, in contrast to the enthusiasm to promote green growth and green jobs, the ASEAN-wide policy frameworks lack preparedness for workers' protection and job reallocation during the green transition. In most ASEAN statements and plans, social protection and equity issues are usually mentioned in a separate section from green growth. Social protection is a concern mainly in the context of human security and natural disaster relief (ASEAN, 2020[62]). Considerations for vulnerable workers who are likely to be affected by the structural changes and labour disruption that would result from a green transition need to be better integrated into green growth strategies.

National policy frameworks for green growth

At the national level, ASEAN countries began to map out green growth strategies in the mid-2010s, in addition to updating pre-existing climate change policies. In 2023, green growth has become a mainstream agenda in regional politics. All ten ASEAN countries currently include green growth objectives in their national development plans, and five of them have explicit green growth strategies, a progress compared to two in 2014 (Cambodia and Viet Nam) (OECD, 2014[40]). Likewise, the scope and implementation plans of green growth objectives have become increasingly comprehensive, although the relative focus largely varies by country.

National commitments to promote green growth are clearly laid out in the ASEAN countries' latest national development plans, but the aims of the green growth objectives and instruments with which to achieve these objectives vary across countries (Table 2.2). Natural resource endowments, development stage and the industrial structure of each country determine the focus areas of national green growth strategies. High-income ASEAN countries (i.e. Brunei Darussalam and Singapore) are more likely than the others to focus on supporting green innovation research and development (R&D) and enterprises with sustainable initiatives. Upper-middle-income ASEAN countries (i.e. Malaysia and Thailand) focus on sustainable and efficient resource management (e.g. energy, water) and the circular economy. Across the ten ASEAN countries, agriculture tourism services, urban environment, and energy- and environment-oriented services stand out as priorities for the green transition over other sectors (ASEAN-ILO, 2021[6]). Policy instruments and incentives that have been put in place in order to achieve green growth objectives consist of various financial and non-financial measures, including green subsidies, tax reductions, import duties exemptions, infrastructure investments and green public procurement.

Table 2.2. ASEAN countries show political willingness to pursue green growth

Latest national plans promoting green growth objectives across the ASEAN countries

Country	Policy framework	Main takeaways
Brunei Darussalam	*Towards a Dynamic and Sustainable Economy: Economic Blueprint for Brunei Darussalam*	• Provides the economic blueprint as part of the Brunei Vision 2035 (Wawasan Brunei 2035), with "sustainable environment" as one of six national aspirations for growth. • Five policy directions for sustainable environment include: 1) encouraging green practices and environment for business; 2) promoting green growth initiatives in energy and natural resources management; 3) supporting R&D and innovation; 4) investing in green industries; and 5) minimising further land use and environmental degradation.
Cambodia	*National Strategic Plan on Green Growth 2013-2030*	• Aims at long-term sustainable economic, social and environmental development. • Prioritises green investment and green job creation; the effective use of natural resources; human resources development and green education; green technology; green social safety system; green conservation of cultural heritage; and good governance on green growth.

Indonesia	*The National Medium-Term Development Plan 2020-2024*	• First-ever sustainable development plan for Indonesia, with the goal of achieving prosperous, fair and sustainable development by 2024 within the National Long-Term Development Plan (RPJPN), 2005-2024. • Promotes low-carbon development through a reduction in emissions and emission intensity in the energy, land, waste, green industry, and marine sectors, along with other climate mitigation and adaptation measures.
Malaysia	*Green Technology Master Plan Malaysia 2017-2030*	• Green growth is one of six core development strategies. • Creates a framework which facilitates the mainstreaming of green technology into the national development plan while encompassing the four pillars set in the National Green Technology Policy: the energy, environment, economic and social pillars. • Emphasises boosting energy efficiency, increasing the share of renewable energy sources in the power mix, and reducing carbon emissions.
	Twelfth Malaysia Plan 2021-2025	• Sets advancing green growth as one of nine focus areas, with a particular focus on the circular economy and integrated water resources management.
Myanmar	*Myanmar Climate Change Master Plan (2018-2030)*	• Aims to achieve climate resilience and pursue a low-carbon growth pathway across six major sectors by 2030.
	National Environmental Policy of Myanmar	• Provides long-term strategic guidance on the country's environmental and climate objectives within the Paris Agreement framework.
Lao PDR	*National Green Growth Strategy of the Lao PDR till 2030*	• Aims to develop the potential to integrate green growth into the sector- and local-level strategies and plans in each milestone (by 2020 and 2030) in order to ensure the achievement of long-term national socio-economic development goals.
Philippines	*Philippine Development Plan 2023-2028*	• Seeks inclusive and environmentally sustainable growth in order to create more jobs and reduce poverty. • Declares the aim to "Ensure just transition of workers affected by structural changes towards a greener, more sustainable, and low carbon economy."
Singapore	Singapore Green Plan 2030	• Seeks to advance Singapore's national agenda on sustainable development, including achieving net zero emissions, in a cross-cutting approach. • Its five focus areas are: 1) City in Nature, 2) Energy Reset, 3) Sustainable Living, 4) Green Economy, and 5) Resilient Future.
Thailand	*The Thirteenth National Economic and Social Development Plan (2023-2027)*	• Falls within the framework of the *Climate Change Master Plan 2015-2050* and the "bio-circular-green economy" model. • Focused on promoting: 1) an innovation-based production structure; 2) human resources development; 3) equal opportunities and justice; 4) sustainable production and consumption; and 5) the country's resilience to risks and changes.
Viet Nam	*National Green Growth Strategy for 2021-2030, vision towards 2050*	• Aims to contribute to the country's economic restructuring in order to achieve economic prosperity, environmental sustainability and social justice, with the goal of a green and carbon-neutral economy that positively contributes to limiting global warming.

Note: Countries in bold have stand-alone national plans dedicated to green growth.
Source: Brunei Ministry of Finance and Economy (2020[63]); Government of Brunei Darussalam (2018[64]); NESDC (2023[65]); GOVPH (2023[66]); Singapore Government (2023[67]); USDA/GAIN (2021[68]); LSE (2023[69]); Malaysia Ministry of Economy (2021[70]); Republic of Indonesia (2020[71]); World Resources Institute (2020[72]).

Along with their national commitments, some countries have established joint initiatives on green growth. In 2007, Brunei Darussalam, Indonesia and Malaysia launched a joint initiative that aimed to turn 22 million hectares of Borneo into a green economic zone in order to conserve the biodiversity of the area for the benefit of the people who rely upon it through a network of protected areas (Heart of Borneo) (WWF, n.d.[73]). In 2017, the Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA) adopted a common vision to narrow the development gaps, sustainably manage natural resources and promote stronger connectivity across those four ASEAN countries by 2025, which they laid out in *BIMP-EAGA Vision 2025* (BIMP-EAGA, n.d.[74]). The BIMP-EAGA–Republic of Korea Cooperation *Fund* (BKCF) has set clear green and climate-resilient targets to make the member countries and regions resilient, inclusive, sustainable and economically competitive.

Green growth and the impacts on labour

A growing body of literature, primarily from Europe and the United States, suggests that policies promoting green growth have a net positive impact on overall employment. Green growth policies would create new sectors and occupations using less carbon and fewer resources, and would modify existing sectors and occupations to be equipped with additional skills (Sharpe and Martinez-Fernandez, 2021[75]; ILO, 2018[9]). But, at the same time, the policies would likely decrease job opportunities in carbon-intensive brown sectors. Although the overall effect sizes are still debatable, climate and energy policies and pollution mitigation measures are estimated to create modest and manageable gains in employment as they shift demand towards less carbon-intensive sectors (OECD, 2017[76]; OECD, 2013[77]; Chateau, Bibas and Lanzi, 2018[78]). Public investments in green recovery after the COVID-19 crisis were also found to be more effective and immediate in creating jobs and boosting economic growth compared with non-green investments (O'Callaghan, Yau and Hepburn, 2022[79]).

How green growth policies will affect earnings, overall job quality and employment status is unclear. In the long term, with adjustment to short-term costs, decarbonisation policies are estimated to slightly increase after-tax real wages but moderately decrease total income (Chateau, Bibas and Lanzi, 2018[78]). The overall and distributive impacts of climate and energy policies on wages can differ significantly depending on the design of the policy instruments (e.g. a carbon tax with or without energy efficiency measures) and the regional context (Chateau, Bibas and Lanzi, 2018[78]). What is becoming increasingly evident, however, is that in the absence of a skills strategy and social protection, low-skilled workers in sectors such as utilities, waste management and mining will be disproportionately negatively affected by a green transition (Montt et al., 2018[80]).

In Southeast Asia, both the regional and national policy frameworks for green growth have made little headway in supporting social inclusion. Policies to support job reallocation and protect the livelihoods of vulnerable workers during a green transition are, in most cases, not mentioned in these frameworks (ASEAN-ILO, 2021[6]). Although most ASEAN countries have high-level green development strategies and objectives (e.g. in relation to urban planning and climate adaptation/mitigation), readiness to support skills development during the transition varies widely across countries. Singapore shows the highest level of policy readiness in terms of workers' protection, whereas Brunei Darussalam, Cambodia and Indonesia lag far behind. Policy readiness for inclusive green growth differs by country income in general because countries with a lower income might choose to prioritise alleviating poverty and meeting basic needs over workers' protection (Li et al., 2021[30]; Luukkanen et al., 2019[81]). Nevertheless, Cambodia and Viet Nam have clear social protection plans for at-risk populations integrated within their national green growth frameworks (Box 2.3).

Box 2.3. Social protection strategies towards inclusive green growth in Cambodia and Viet Nam

Cambodia and Viet Nam were the only two ASEAN countries that had established national strategies specifically focused on green growth around the mid-2010s. Over the years, other ASEAN countries have included green growth objectives in their national development plans or formulated stand-alone green growth strategies. However, Cambodia and Viet Nam are still the only two ASEAN countries that articulate the objectives and implementation plans to protect vulnerable populations from unintended exclusion during the green transition.

Cambodia promotes a "green social safety system", a socio-economic development plan with low carbon emissions, through enhancing social protection and "green culture social safety" in its long-term green growth plan, which was launched in 2013. "Green culture social safety" refers to an approach to social development within the green growth framework that leverages a social protection system, green growth means, and technology. The green social safety system is anticipated to improve quality of life, health, and the environment, and increase the welfare of vulnerable populations (e.g. women, children, youth, farmers, Indigenous people, older people, people in poverty, or people with a disability).

Viet Nam's latest strategy on green growth promotes social equality during the green transition by improving: 1) green transformation in social sectors (e.g. labour and employment, healthcare, and tourism), and 2) equal access to opportunities, information and basic social services during the green transformation. The Ministry of Labour, Invalids and Social Affairs is responsible for overseeing, developing and implementing various policy instruments for social inclusion, including developing technical human resources in green economic sectors, creating green jobs, and enhancing social security and social support for vulnerable groups (i.e. women, children, ethnic minorities, people in poverty, or people with a disability) and entities affected by the green transformation process.

Source: Kingdom of Cambodia (2013[82]); OECD (2014[40]); Socialist Republic of Viet Nam Government News (2021[83]).

Understanding the job implications of climate impacts and of the green transition in the regional context is essential to help ASEAN policies make green growth inclusive. Labour markets in Southeast Asia are characterised by markedly high levels of informality and vulnerability, with some 244 million workers in informal employment with minimal or no labour and social protection (ILO, 2019[84]). The current Southeast Asian policy frameworks for green growth offer little insight into or response to near-term employment prospects and worker protections under the green transition scenario. Most studies available to date can provide a broad indication of what the green growth impacts on employment might look like. However, the specific distributive impacts could differ in Southeast Asia due to its distinctive market characteristics and industry structures (Bowen and Kuralbayeva, 2015[85]). So far, little research has been done to guide policies aimed at strengthening the social dimension of green growth (Li et al., 2021[30]).

Conclusion

In order to ensure that green growth is socially inclusive in Southeast Asia, ASEAN should improve regional policy frameworks to recognise nearer-term job disruption and suggest pathways for a smooth and fair transition. These frameworks need to include social protection measures for businesses, workers and families that are likely to be affected by the green transition. Vulnerable groups living in natural-disaster-prone areas will need specific social assistance in light of increasing droughts and floods linked to climate change. It will also be essential to develop agendas and implementation plans in order to enhance the employability of workers who have been displaced due to the low-carbon transition. Moreover, setting a regional standard for monitoring progress in social indicators could help reduce gaps between countries and create incentives for knowledge sharing on inclusive green growth measures.

For Southeast Asia, ensuring inclusive green growth is a key strategy for long-term prosperity and stability. Identifying the population that will be most affected by green growth is a good starting point to guide regional policy and strengthen social development during the transition period. Identifying the socio-demographic profile of at-risk workers can help to shape relevant public services and supports for displaced workers during the green transition. To this end, Chapter 2 identifies the sectors and workers most vulnerable to environmental degradation.

The energy sector is one of the most promising industries for an imminent green transition in Southeast Asia, with large potential economic gains (ADB, 2022[86]; OECD, 2014[40]). Three-quarters of Southeast Asia's total energy supply currently relies on unabated fossil fuels, mainly coal, despite a gradual increase in renewable power between 2000 and 2020 (IEA, 2022[87]). Deploying diverse renewables (i.e. hydropower, wind, solar photovoltaic, bioenergy, geothermal) could accelerate the clean energy transition and establish Southeast Asia as a solid sustainable energy supplier in the global market and attract energy investment. The region's large mineral resources also show great potential as the global demand for critical minerals (i.e. copper, lithium, nickel, cobalt, and rare earth elements) in clean energy technologies is set to increase quickly. Due to their versatile use in advanced technologies, critical mineral resources could attract investment in various projects in Southeast Asia. Finally, policy measures and new technologies promoting energy efficiency could result in additional savings by avoiding excessive energy use. Overall, the net gains from the green growth transition in energy and resources by 2030 are estimated to amount to USD 270 billion (Hardcastle and Mattios, 2020[47]). Chapter 3 of this report presents a case study of the employment effects of the clean energy transition in Indonesia.

Agriculture is another sector that presents a promising opportunity for the transition towards sustainability (ADB, 2022[86]; OECD, 2014[40]). The agricultural sector has the highest GHG emissions in Southeast Asia and is also highly vulnerable to the negative effects of climate change. Promoting a green transition in agriculture in the region could help mitigate environmental degradation, thereby preserving natural resources and biodiversity. The transition would promote climate resilience and enable farmers to adapt to the challenges posed by climate change. Given that nearly one in three Southeast Asian workers is engaged in the agriculture, forestry and fishing sector (ILO, 2018[9]), adopting sustainable farming could also bring new employment opportunities to the region. Such job opportunities would likely arise both upstream and downstream due to the strong industrial interconnection within the agri-food value chain. The positive green job prospects in agriculture could lead to improved food security and livelihoods for the Southeast Asian population. Chapter 4 examines the green (organic) transition in agriculture and its labour market impacts.

Notes

[1] Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic (hereafter: Lao PDR), Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.

[2] Including droughts, extreme temperatures, floods, landslides, mass movement (dry) and wildfires.

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3 Environmental degradation and employment vulnerabilities in Southeast Asia

Southeast Asian economies' heavy reliance on natural resources creates vulnerabilities for many workers and their households, with adverse effects on future growth prospects. Analysis of seven countries, representing 95% of the region's total population, shows that workers in sectors that rely on the environment account for 37% of total employment. Workers in these "environmentally linked" sectors tend to have lower incomes, lower education and in the informal economy. Further analysis on vulnerability for Indonesia and Viet Nam shows that a large share of the labour force is vulnerable to extreme weather conditions. In this context, specific social protection instruments to shield these workers and sectors against environmental shocks appear critical.

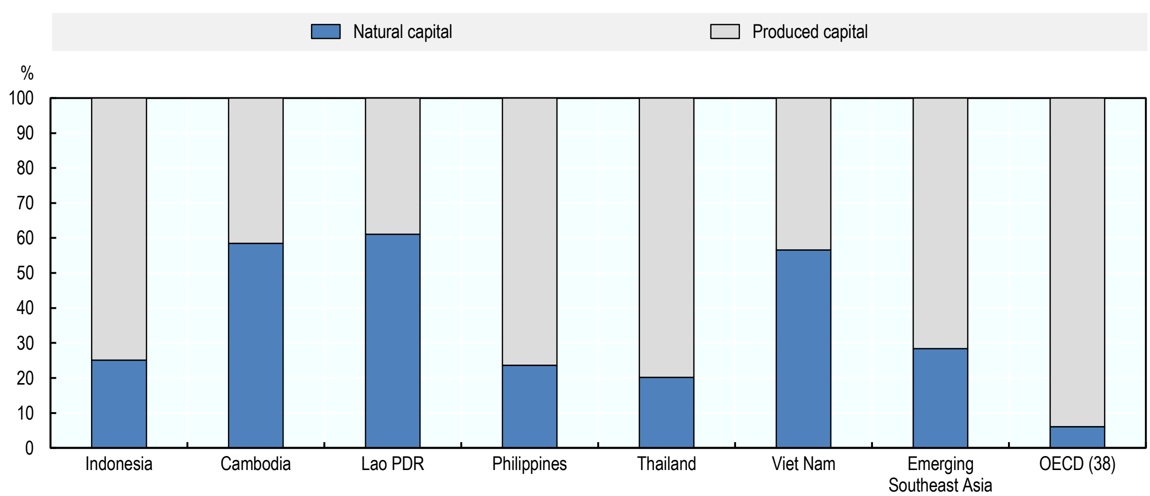
Since the 1990s, Southeast Asia has experienced strong and steady economic growth. The region's gross domestic product (GDP) has doubled since 2005 and most countries in the region are on the verge of eliminating extreme poverty (World Bank, 2020[1]). However, this economic success came at the cost of considerable environmental degradation, which disproportionately affects informal and lower-earning workers. This chapter presents the characteristics of workers in Southeast Asia who are highly dependent on natural resources, and who are thus most vulnerable to environmental degradation. The findings stress the need to develop adaptation policies, particularly in terms of social protection. This chapter also makes the case for policies aimed at mitigating further environmental degradation and its impact on human well-being, which are further discussed in Chapter 4.

Environmental degradation's threat to economic performance

The environment matters for emerging Southeast Asian economies. Natural capital in the region represents a much larger share of total national tangible capital compared with OECD countries (Figure 3.1).

Figure 3.1. Natural capital represents a large share of total national tangible capital in Southeast Asia

Distribution of total national tangible capital (%), 2018

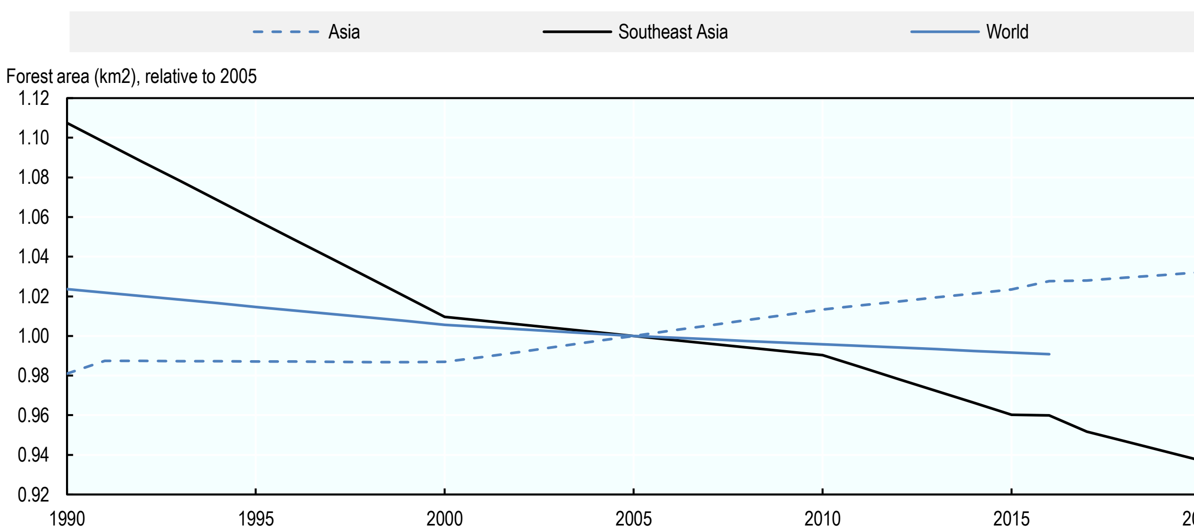


Notes: Total national tangible capital is defined as natural capital plus produced capital. Natural capital includes the valuation of agricultural land, forests, protected areas, mangroves, fisheries, fossil fuel energy reserves and minerals. Produced capital includes the value of machinery, buildings, equipment, and residential and non-residential urban land. Regional averages are weighted by total national tangible capital. "Emerging Southeast Asia" is defined as middle- and low-income countries in Southeast Asia. All countries covered by this definition are included in this graph, except for Myanmar. Lao People's Democratic Republic (Lao PDR)
Source: World Bank (2021[2]), *The Changing Wealth of Nations*, https://www.worldbank.org/en/publication/changing-wealth-of-nations/data.

While natural capital is of crucial economic importance, it is under threat. Southeast Asia has been undergoing rapid deforestation, unlike the rest of Asia. The region has lost 15% of its forest area since 1990 (Figure 3.2), a pattern primarily driven by land clearing for agriculture. In particular, palm plantations for oil production have expanded into previously forested land, especially in Indonesia and Malaysia, the world's largest palm oil producers (European Parliament Research Service, 2020[3]). Indeed, these two countries accounted for 89% of the region's total deforestation from 2005 to 2015 (Estoque et al., 2019[4]). This trend endangers one of the most important global biodiversity hotspots (ibid.). By contrast, Asia increased its forest area over the same period (5%), a figure largely driven by the People's Republic of China (hereafter: China) (38%) and India (12%).

Deforestation incurs a range of economic and social costs. First, it endangers economic activities located in forests, such as timber harvesting and tourism. Second, forests contribute to water filtration, an essential role given that 75% of global freshwater comes from forested watersheds. Third, forests also regulate temperature and precipitation at a regional level. Fourth, deforestation increases the likelihood of floods, as areas that have lost forest area have lower evapotranspiration and lower water infiltration (Ellison et al., 2017[5]). In other words, deforestation makes rain less likely to be either evaporated back into the air or retained in the soil, thus increasing surface water runoff. Floods are highly prevalent in Southeast Asia and increase the vulnerability of workers who are highly dependent on natural resources. Finally, deforestation contributes to climate change, as each hectare of forest stores 91 tonnes of carbon, which is released into the atmosphere when forest area is lost. This capability of forests to sequester carbon represents 65-90% of the total value of forests (BCG, 2020[6]).

Figure 3.2. Southeast Asia is deforesting faster than the world average

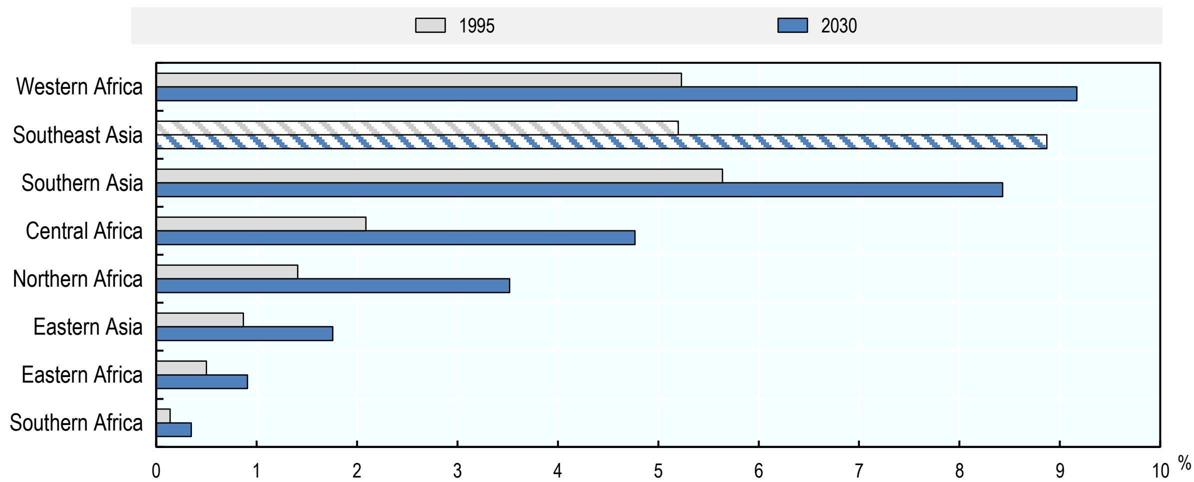


Note: Forest area is land under natural or planted stands of trees of at least 5 metres in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens. Here forest area relative to 2005 refers to the forest area in km^2 in each region, relative to the forest area in km^2 of this region in 2005. World level data is not available beyond 2016.
Source: FAO data retrieved from World Bank (2022[7]), *World Bank Open Data*, https://data.worldbank.org/.

Southeast Asia is also among the regions that are most vulnerable to climate change. In Viet Nam, for example, the number of days where the temperature was above 34°C – the threshold at which labour productivity decreases drastically – has increased by five days per year every decade between 1970 and 2011 (ILO, 2019[8]). By 2030, Southeast Asia will be among the regions facing the largest labour productivity losses due to climate change-induced heat stress (Figure 3.3). Climate change also induces increasingly higher economic costs related to flood, drought and landslides, which have increased by 63%, 23% and 147%, respectively, between 2001 and 2020 in Asia, with record breaking torrential rainfall observed in Southeast Asia (WMO, 2022[9]).

Figure 3.3. Southeast Asia could lose 3.7% of its labour productivity due to heat stress by 2030

Working hours lost due to heat stress by subregion,1995 and projections for 2030 (%)



Note: ILO estimates based on data from the ILOSTAT database and from the HadGEM2 (Hadley Centre Global Environmental Model, version 2) and GFDL-ESM2M (Geophysical Fluid Dynamics Laboratory) climate models (using as input the Representative Concentration Pathway 2.6 (RCP2.6) climate change pathway, which envisages a global average temperature rise of 1.5°C by the end of the 21st century).
Source: ILO (2019[8]).

Another key environmental challenge in the region relates to fish stock management. Overfishing is estimated to cause an annual economic loss of USD 54.8 billion (United States dollars) in Asia, or 65% of the world's total foregone economic benefits due to unsustainable fishing practices and mismanagement of marine fisheries (World Bank, 2017[10]). Southeast Asia is a large contributor to this phenomenon, as sustainable management instruments to control the level of fishing activity are often lacking (OECD, 2017[11]). This endangers working conditions in fisheries. Southeast Asian countries have among the highest share of employment in the sector, particularly in the Philippines, where fishers represent 4.6% of total employment, as well as in Indonesia (where they represent 2.1% of total employment) and Viet Nam (where they represent 1.7% of total employment); see Table 3.1 for an international comparison. Overall, it is estimated that about 20% of livelihoods in Southeast Asia depend on fisheries in a direct or indirect way (OECD, 2014[12]).

Table 3.1. Countries with the highest share of employment in fisheries, 2018

Country	Share of employment in fisheries (percentage of total employment)	Employment in fisheries (thousands)
Philippines	4.6	1 988
Indonesia	2.1	2 655
Chinese Taipei	2.0	235
Iceland	2.0	4
Viet Nam	1.7	934
Brazil	1.1	1 042
People's Republic of China (hereafter: China)	1.1	8 515
Malaysia	0.9	133
Greece	0.5	21
Thailand	0.5	194

Note: Only major economies in fisheries are covered. Southeast Asian economies are shaded in grey. The share of employment in fisheries is obtained by combining a numerator and denominator from different sources and should therefore be considered with caution.
Source: Authors' calculations using for employment in fisheries: OECD (2022[13]), *Employment in fisheries, aquaculture and processing*, https://stats.oecd.org/Index.aspx?DataSetCode=FISH_EMPL, and total employment: ILO (2021[14]), *ILOSTAT - Modelled estimates*, https://ilostat.ilo.org/.

Profiling workers in environmentally linked sectors

The continued environmental degradation in Southeast Asia highlights the need to look at vulnerability to environmental degradation from a labour market perspective. The analysis in this chapter relates to three main aspects of vulnerability: sensitivity, exposure, and adaptation capacity (adapted from ADB (2014[15])). According to the Intergovernmental Panel on Climate Change (IPCC), vulnerability is defined as the degree to which an individual is "susceptible to, or unable to cope with, adverse effects" of environmental degradation (IPCC, 2007[16]). An individual worker's vulnerability to environmental shocks therefore depends on three key factors: sensitivity (the harm caused by a given level of environmental degradation), exposure (the presence, occurrence and magnitude of environmental degradation) and adaptation capacity (the ability of individuals or systems to better cope with the impact of environmental degradation).

First, this study investigates a primary characteristic of sensitivity: the dependence of different economic activities on environmental resources in seven Southeast Asian economies (Cambodia, Indonesia, Lao PDR, Myanmar, the Philippines, Thailand and Viet Nam), representing 95% of the total population of the region. Second, it assesses vulnerability by combining information on sensitivity, exposure and adaptation capacity for Indonesia and Viet Nam. In order to estimate the number of jobs that rely on environmental resources and that are therefore sensitive to environmental degradation, this study builds on and adapts a categorisation at the sectoral level that was developed by Rademaekers et al. (2012[17]). Two levels of sectoral links to the environment are distinguished:

- Sectors with a "direct" environmental link are either using natural resources directly or supporting better environmental management.
- Sectors with a "strong indirect" link are those where most of the activity is related to the environment, without directly exploiting natural resources.

The sum of "direct" and "strong indirect" sectors is referred to as "environmentally linked" sectors. Table 3.2 describes the exact mapping between sectors and these categories. The share of jobs that are environmentally linked ranges from 27% in the Philippines to 52% in Myanmar (Table 3.3). Most of these jobs are in agriculture. It is worth noting that activities with a strong indirect link also represent a non-negligeable share, ranging from 2% to 5% of total employment in the countries observed (Table 3.4). In addition, travel and tourism, which is increasingly around nature-based activities and ecotourism, provides jobs for 41.8 million people in Southeast Asia, representing 13.2% of employment and 11.7% of GDP in 2019 (OECD, 2023[18]).

Table 3.2. Economic significance of environmentally linked activity, by sector

ISIC category	Economic sector name	Degree of environmental link	Aggregated economic activities
1	Crop and animal production, hunting and related service activities	**Direct link**: Direct use of natural resources or support better environmental management	Agriculture
2	Forestry and logging		
3	Fishing and aquaculture		
5	Mining of coal and lignite		Industry
6	Extraction of crude petroleum and natural gas		
7	Mining of metal ores		
8	Other mining and quarrying		
9	Mining support service activities		
35	Electricity, gas, steam and air conditioning supply		

36	Water collection, treatment and supply		
37	Sewerage		
38	Waste collection, treatment and disposal activities; materials recovery		
39	Remediation activities and other waste management services		
10	Manufacture of food products	**Strong indirect link**: Most of the activity in the sector is related to the environment.	
11	Manufacture of beverages		
12	Manufacture of tobacco products		
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials		
17	Manufacture of paper and paper products		
	All other sectors	**Rest of the economy**	Industry and services

Note: ISIC, Rev.4 refers the International Standard Industrial Classification of All Economic Activities, revision 4.
Source: Adapted from GHK (2007[19]), ECORYS-EU DG-Environment (2012[17]) and ILO (2018[20]).

Table 3.3. Number of workers employed in sectors that rely on the environment

Country	Total employment	Environmentally linked employment	Share of environmentally linked employment (%)
Indonesia	120 647 696	46 357 369	38.4
Philippines	42 428 368	11 496 187	27.1
Viet Nam	50 567 892	17 446 246	34.5
Thailand	38 301 024	15 025 097	39.2
Myanmar	22 079 116	11 454 796	51.9
Cambodia	7 883 106	2 792 398	35.4
Lao PDR	1 538 924	613 742	39.9
Total	283 446 126	105 185 835	37.1

Source: Cambodia Labour Force Survey 2019; Indonesia National Labour Force Survey 2016; Lao PDR Labour Force Survey 2017; Myanmar Labour force survey 2019; Philippines Labour Force Survey 2019; Thailand Informal Employment Survey 2018; Viet Nam Labour force survey 2019.

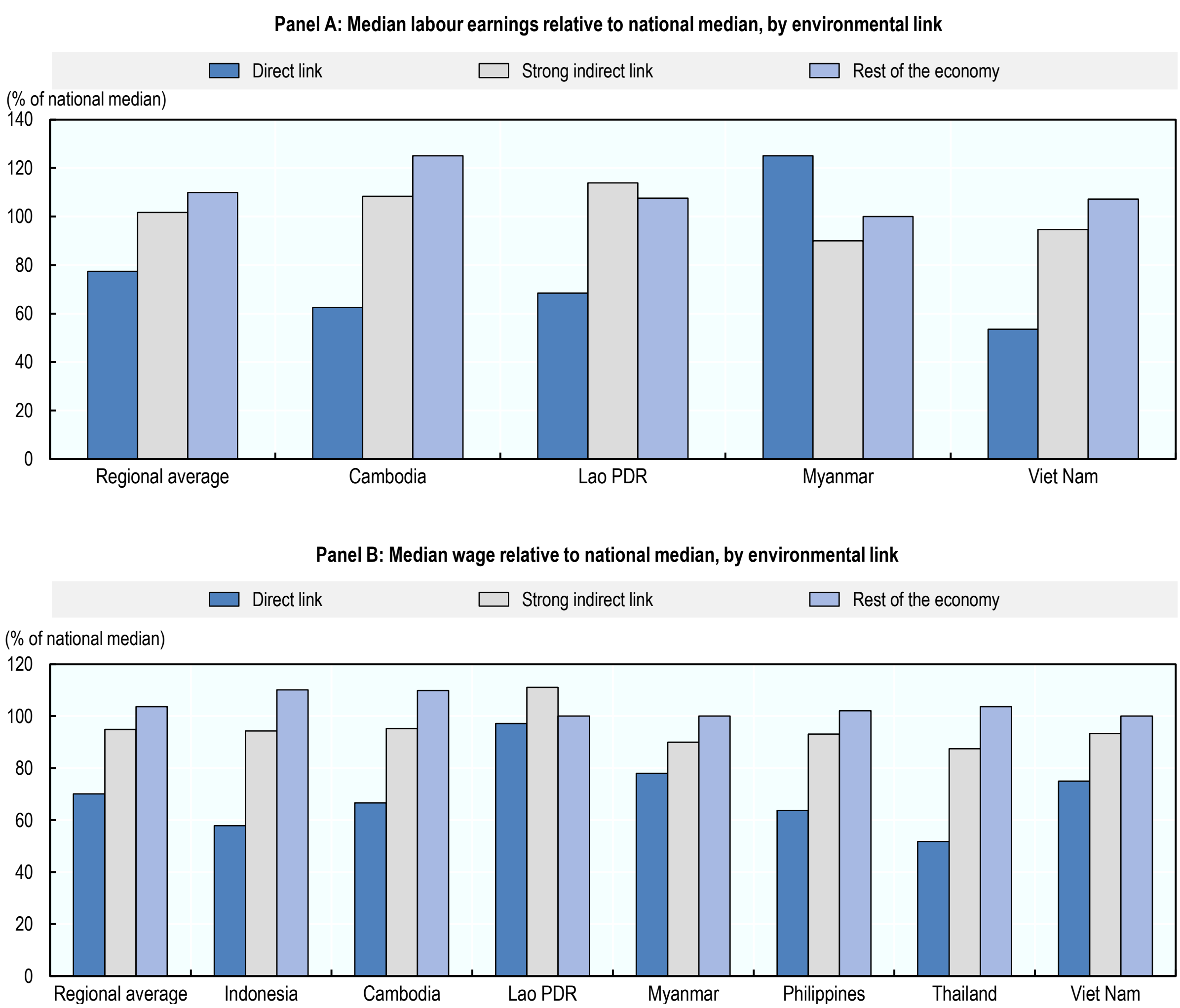
Table 3.4. Employment by category as a share of total employment, categorised by degree of environmental link (%)

Country	Direct link			Strong indirect link
	Agriculture	Primary sector, other than agriculture	Support environmental management	
Indonesia	31.7	1.4	0.2	5.1
Philippines	22.9	0.8	0.1	3.4
Viet Nam	29.4	0.9	0.2	4.0
Thailand	33.4	0.6	0.1	5.1
Myanmar	48.9	0.8	0.0	2.2
Cambodia	33.1	0.3	0.1	1.9
Lao PDR	35.8	1.3	0.3	2.5

Source: Cambodia Labour Force Survey 2019; Indonesia National Labour Force Survey 2016; Lao PDR Labour Force Survey 2017; Myanmar Labour force survey 2019; Philippines Labour Force Survey 2019; Thailand Informal Employment Survey 2018; Viet Nam Labour force survey 2019.

Environmentally linked jobs represent a large share of total employment, and many workers in these jobs appear to be particularly vulnerable. Across almost all countries for which data are available, labour earnings tend to be considerably lower in environmentally linked sectors. This form of "nature penalty" is strongest in sectors with direct environmental links and tends to decline progressively as the sectoral environmental link becomes weaker. As shown in Figure 3.4, the median labour earnings in sectors with a direct link to the environment are typically two-thirds of the national median labour earnings. A notable exception is Myanmar, where agricultural workers have a higher median income than the national median. This may be partly explained by the low competitiveness of the industrial sector in Myanmar (OECD, 2013[21]). To a lesser extent, a lucrative small-scale mining sector also pushes up incomes in Myanmar's primary sector (Osawa and Hatsukawa, 2015[22]). Overall, the results are similar when considering wages (a subset of labour earnings), for which data are available for a larger number of countries. These lower earnings and wages of workers in environmentally linked sectors indicate a lower capability to cope with shocks caused by environmental degradation. Environmentally linked employment also goes hand in hand with informality. As shown in Figure 3.5, the workers in sectors with a direct link, followed by those with a strong indirect link, tend to be considerably more informal than the rest of the economy.

Figure 3.4. The higher the dependence on the environment, the lower the earnings are

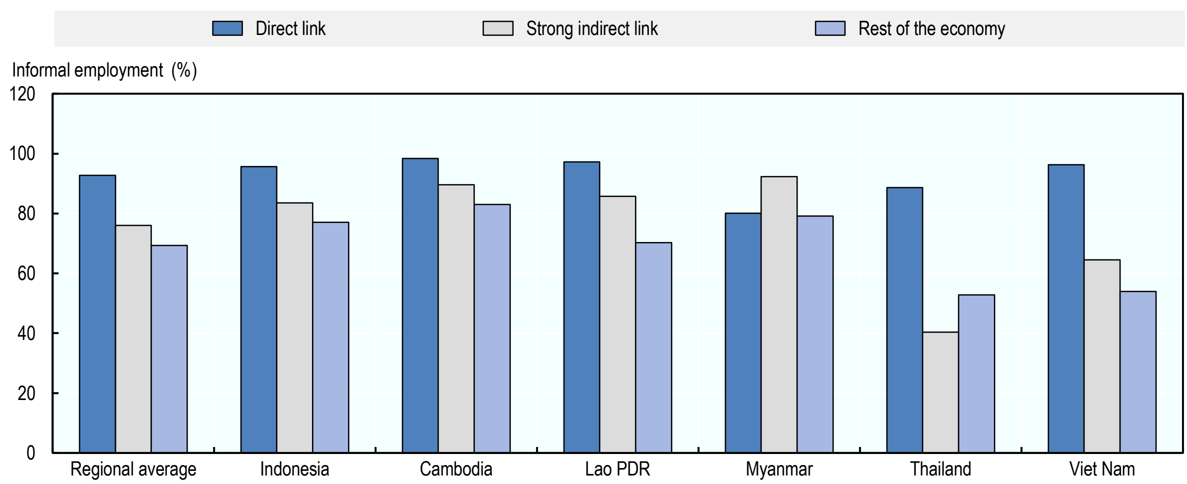


Note: Regional average is the unweighted average of the seven countries: Indonesia, Cambodia, Lao People's Democratic Republic (Lao PDR), the Philippines, Thailand, Myanmar and Viet Nam.
Source: Indonesia National Labour Force Survey 2016; Philippines Labour Force Survey 2019; Viet Nam Labour force survey 2019; Thailand Informal Employment Survey 2018; Myanmar Labour force survey 2019; Cambodia Labour Force Survey 2019; Lao PDR Labour Force Survey 2017.

The relationship between the strength of the environmental link and informality varies across countries, however. In Indonesia, Cambodia, Lao PDR and Viet Nam, informality is high in the “direct link” category, weaker in the “strong indirect link” category, and lowest in the rest of the economy. In Myanmar and in Thailand, the relationship is less clear (Figure 3.5).

Altogether, these results point to specific vulnerabilities: most informal workers in Southeast Asia lack social protection and rights at work. When facing environmental shocks, formal employment ensures that environmentally related health and income risks are (at least partially) mitigated through employment-based social protection schemes. Instead, informal status typically implies that workers must cope with the consequences of environmental shocks on their own.

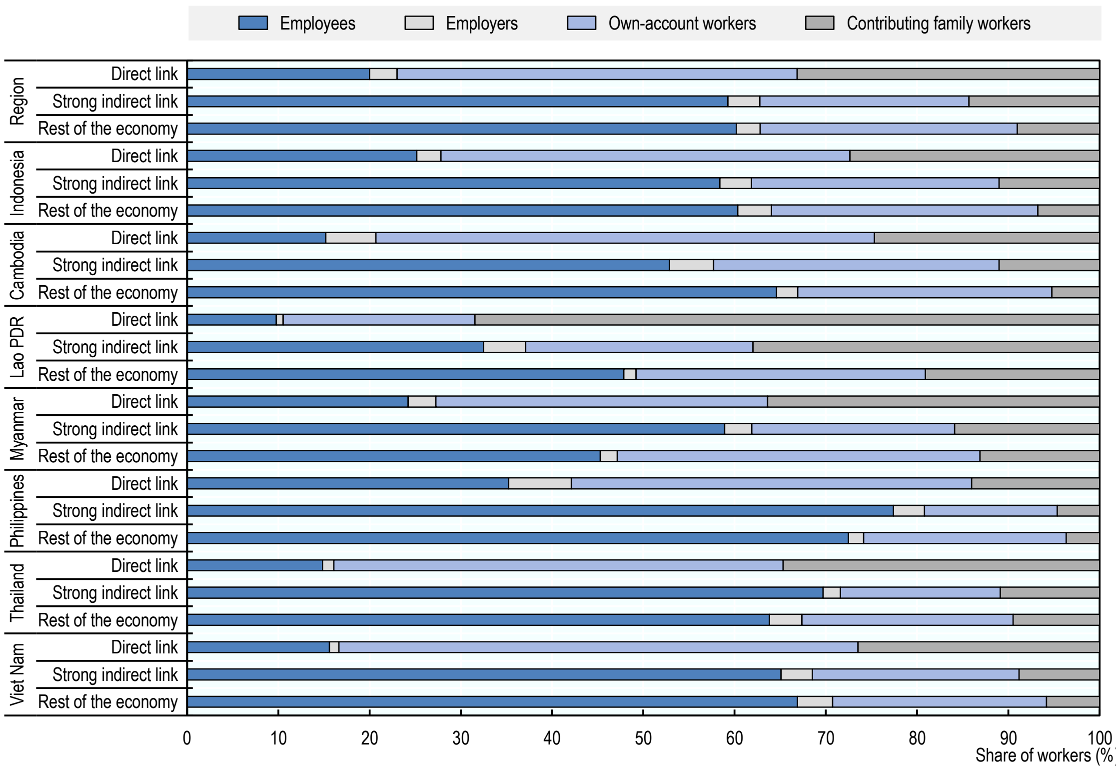
Figure 3.5. The stronger the environmental link, the higher the probability of jobs being informal



Note: Regional average is the unweighted average of the six countries: Indonesia, Cambodia, Lao People’s Democratic Republic (Lao PDR), Thailand, Myanmar and Viet Nam. Informality data for the Philippines are not available.
Source: Indonesia National Labour Force Survey 2016; Viet Nam Labour force survey 2019; Thailand Informal Employment Survey 2018; Myanmar Labour force survey 2019; Cambodia Labour Force Survey 2019; Lao PDR Labour Force Survey 2017.

The degree of reliance workers has on environmental resources is also reflected in their employment status. Sectors with direct and strong indirect links to the environment tend to employ more own-account workers and contributing family workers, while having fewer salaried employees (Figure 3.6).

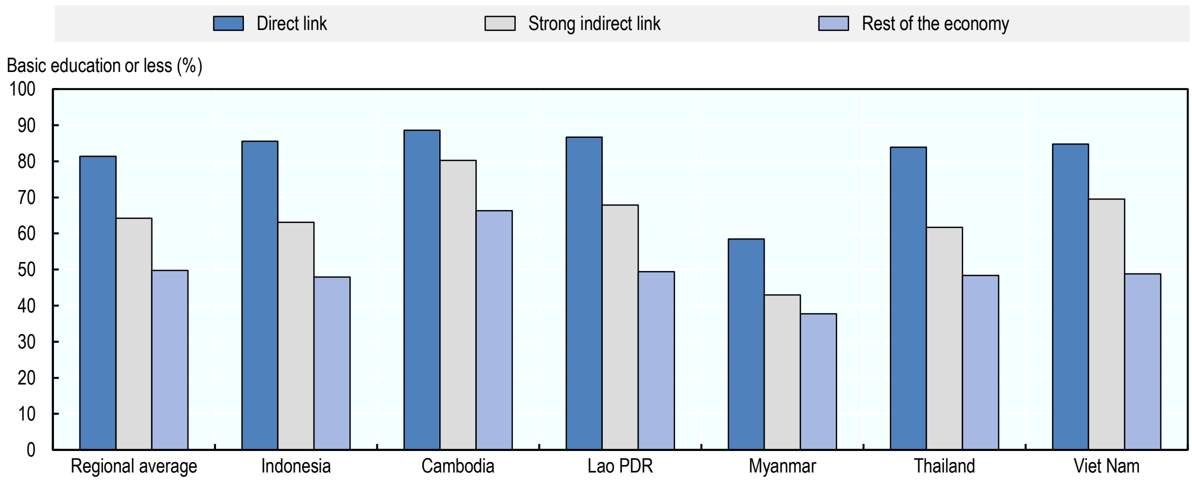
Figure 3.6. Workers who depend on the environment for employment are generally own-account and contributing family workers



Note: Region indicates the unweighted average of the seven countries: Indonesia, Cambodia, Lao People's Democratic Republic (Lao PDR), the Philippines, Thailand, Myanmar and Viet Nam.
Source: Indonesia National Labour Force Survey 2016; Philippines Labour Force Survey 2019; Viet Nam Labour force survey 2019; Thailand Informal Employment Survey 2018; Myanmar Labour force survey 2019; Cambodia Labour Force Survey 2019; Lao PDR Labour Force Survey 2017.

Similarly, the share of workers with basic and less than basic education (those who have completed primary education or lower secondary education) tends to gradually decrease as the link to the environment weakens (Figure 3.7). This is a source of vulnerability not only because lower education implies lower current and future incomes but also because it makes it more difficult for workers to change sectors and to move geographically (Machin, Salvanes and Pelkonen, 2012[23]) – a potential coping mechanism in the face of environmental shocks.

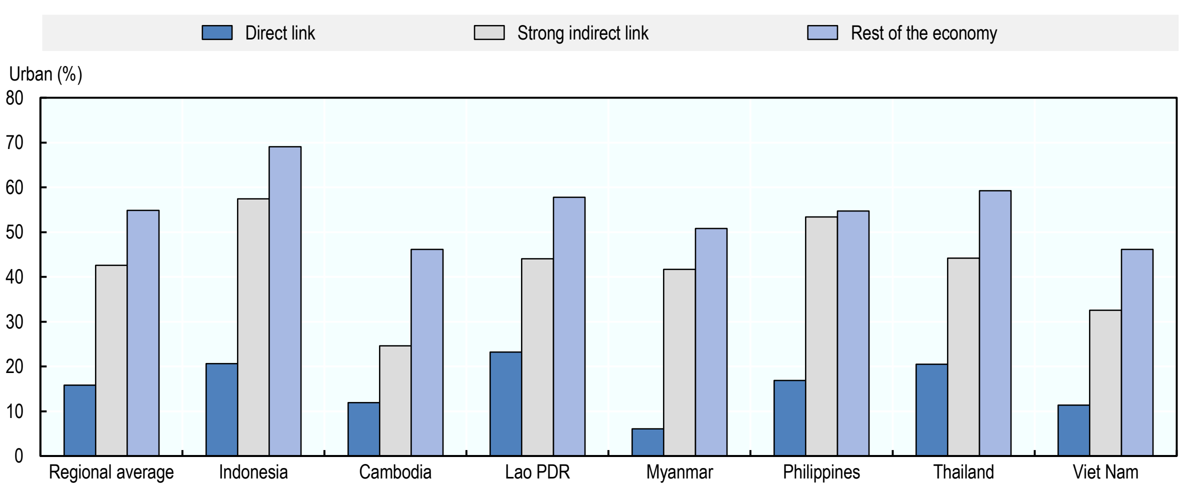
Figure 3.7. Workers with lower education hold the vast majority of environmentally linked jobs



Note: Regional average is the unweighted average of the six countries. Workers with basic education are those who have completed primary education or lower secondary education. Workers with less than basic education are those who have not completed primary education. Education data for the Philippines are not available.
Source: Indonesia National Labour Force Survey 2016; Viet Nam Labour Force Survey 2019; Thailand Informal Employment Survey 2018; Myanmar Labour Force Survey 2019; Cambodia Labour Force Survey 2019; Lao PDR Labour Force Survey 2017.

A higher environmental link is also related to living in rural areas (Figure 3.8). This may represent another source of vulnerability, as rural areas may lack the infrastructure to cope with environmental degradation. No clear relationships between an environmental link and either gender or age could be found.

Figure 3.8. Environmentally linked workers tend to live in rural areas



Note: Regional average is the unweighted average of the seven countries.
Source: Indonesia National Labour Force Survey 2016; Philippines Labour Force Survey 2019; Viet Nam Labour Force Survey 2019; Thailand Informal Employment Survey 2018; Myanmar Labour Force Survey 2019; Cambodia Labour Force Survey 2019; Lao PDR Labour Force Survey 2017.

In focus: Assessing the level of vulnerability of the workforce in relation to natural disasters in Indonesia and Viet Nam

In order to better understand the income vulnerabilities of workers in relation to natural disasters, a more in-depth analysis was conducted for two countries where data were available: Indonesia and Viet Nam. These two countries represent 60% of the Southeast Asian region's employment, are lower-middle-income countries, and represent two typical geographic features of the region as insular and coastal countries.

As discussed in the previous section, workers' income vulnerability to environmental shocks ultimately depends on the concomitance of: 1) sensitivity due to the economic activity's link to the environment; 2) the exposure to environmental degradation; and 3) the capacity to cope with and adapt to natural disasters through social protection, for example. To assess the level of vulnerability in the workforce, the analysis in this section maps the prevalence of natural disasters at the provincial level and compares this against local employment characteristics for Indonesia and Viet Nam. The analysis focuses on two specific types of shocks: floods and droughts. Indeed, floods are the most prevalent form of natural disaster, both worldwide and in Asia specifically (WMO, 2021[24]). Droughts, while less prevalent in Southeast Asia than floods, are increasing in prevalence under the effect of climate change: Extreme droughts could affect 64% of Southeast Asia by the second half of the 21st century (ESCAP-ASEAN, 2021[25]). The focus on Indonesia and Viet Nam is due to data limitations in other countries. While natural disasters data are available for all countries, the national labour surveys do not allow to compute labour market indicators at a geographically sufficiently disaggregated scale (except for the surveys for Indonesia and Viet Nam).

Flood and drought events from 1990 to 2018 are computed at the level of provinces (administrative level 1) for both countries. Indonesia and Viet Nam both present a much larger number of floods per province than droughts (up to 26 floods compared with 2 droughts per province for Indonesia, and up to 27 floods compared with 3 droughts per province for Viet Nam). Floods particularly affect the region of Java in Indonesia, and the North Central Coast in Viet Nam. The Java region has a relatively higher share of total national population and employment in Indonesia than the North Central Coast region in Viet Nam. For this reason, overall vulnerability to natural disasters is higher in Indonesia than in Viet Nam.

Three categories of natural disaster risk exposure at the provincial level are defined, as follows:

- "Low-exposure" provinces are those having experienced fewer than the average number of natural disasters (droughts plus floods, computed across all provinces).
- "Medium-exposure" provinces are those where the number of natural disasters is more than the average but fewer than two standard deviations above the national average.
- "High-exposure" provinces are those where the number of natural disasters is greater than two standard deviations above the national average.

To provide a working definition of vulnerability, this study also introduces a classification depending on the link to the environment, formal/informal employment status and disaster exposure (Table 3.5).

Table 3.5. Definition of levels of vulnerability to natural disasters

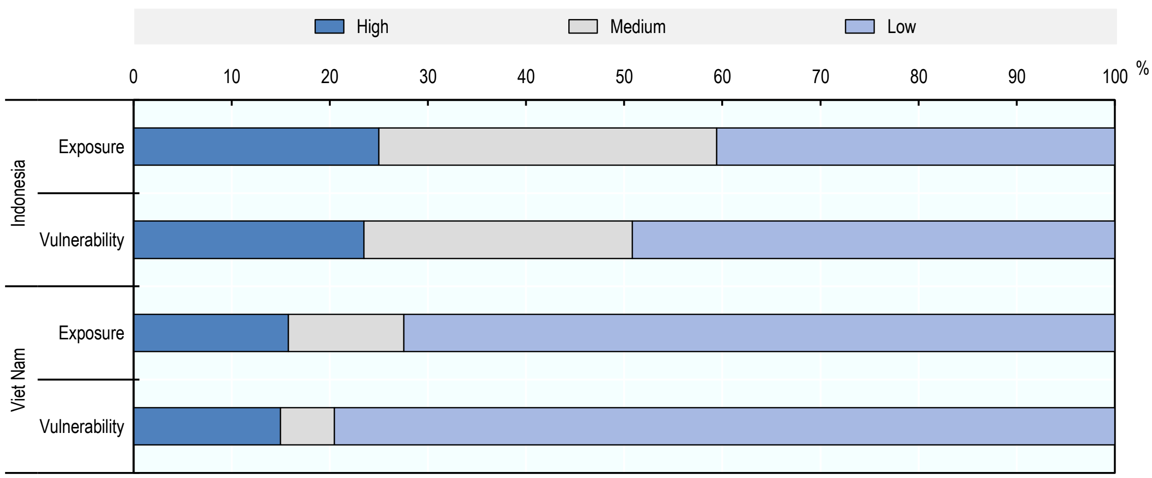
Frequency of natural disaster events	Informal jobs			Formal jobs
	… with a **direct** link to the environment	… with a **strong indirect link** to the environment	… in the **rest of the economy**	
Low	Low vulnerability	Low vulnerability	Low vulnerability	Low vulnerability
Medium	**High** vulnerability	**Medium** vulnerability	Low vulnerability	Low vulnerability
High	**High** vulnerability	**High** vulnerability	**Medium** vulnerability	Low vulnerability

Figure 3.9 shows that 25% of workers in Indonesia are exposed to natural disasters at a high level and 35% at a medium level. The figures are lower in Viet Nam, although not negligible, at 16% of workers

having a high level of exposure and 12% having a medium level of exposure. As a consequence, the share of workers who are highly vulnerable to income loss due to natural disasters is more than one-half (51%) in Indonesia and 21% in Viet Nam. Workers are considered highly vulnerable when they have a medium or high level of exposure to natural disasters and hold informal jobs in environmentally linked sectors (with a direct or strong indirect link to environmental sectors).

Figure 3.9. Natural disaster-linked vulnerabilities are significant for over one-half of Indonesian workers

Share of workers exposed and vulnerable to floods or droughts, by level of exposure and vulnerability (%)



Source: Indonesia National Labour Force Survey 2016; Viet Nam Labour force survey 2019; Centre for research on the Epidemiology of Disasters (2022[26]), *EM-DAT | The international disasters database* (database), https://www.emdat.be.

While there are differences between the two largest Southeast Asian economies, vulnerability to natural disasters seems widespread in both. Compared with Viet Nam, Indonesia has more than double the share of workers in a situation of high or medium vulnerability. While informality is slightly higher in Indonesia (84% compared with 71% in Viet Nam), this does not seem to explain the high difference in vulnerability. In addition, the share of workers with environmentally linked jobs is similar between Indonesia and Viet Nam (39% in Indonesia and 38% in Viet Nam).

The higher vulnerability estimates in Indonesia are due to the population being concentrated in areas where natural disasters are prevalent (particularly Java). In Viet Nam, natural disasters are concentrated in the North Central Coast region, where only a small share of the overall population lives.

Policy implications: Protecting livelihoods from climate-related impacts through social protection

Social protection is a critical enabler of ensuring a greener and more inclusive society. A comprehensive social protection system can absorb and mitigate environment-related impacts on the livelihoods and well-being of all, particularly workers with high vulnerability. Universal healthcare, unemployment insurance, family care support, and various income supports provided by the social protection system can compensate for workers' lost earnings and reduced family well-being and can help them rebound from the physical impacts of environmental degradation and climate-related natural disasters. An old-age pension would be particularly helpful in facilitating older workers in carbon-intensive sectors to retire (ASEAN-ILO, 2021[27]).

Social protection systems across Association of Southeast Asian Nations (ASEAN) member countries have notably improved as the countries have become aware of the importance of social protection in managing climate change-induced impacts. However, their public social expenditure as a share of GDP ranges from 3 to 8% in 2018-19, well below the OECD average of 20% (OECD, 2022[28]). Many ASEAN countries still do not have unemployment benefits in place (Table 3.6). Singapore, Thailand and Viet Nam have relatively sound, all-around social protection systems, while other ASEAN countries offer only some or limited access and coverage to various social programmes.

Table 3.6. Many ASEAN countries need to improve national social protection systems

Availability of social assistance programmes across ASEAN countries

	Medical care benefits	Sickness benefits	Unemployment benefits	Work injury benefits	Old age benefits	Invalidity and survivors' allowances	Maternity benefits
Brunei Darussalam	Some	Some	No	Some	Some	Some	Yes
Cambodia	Yes	Yes	In progress*	Yes	Yes	Yes	Yes
Indonesia	Yes	Limited	Limited	Yes	Yes	Yes	Yes
Lao PDR	Some	Some	In progress	Some	Some	Some	Some
Malaysia	Limited	Limited	Limited	Yes	Yes	Yes	Limited
Myanmar	Yes	Yes	In progress	Yes	In progress	In progress	Yes
Philippines	Yes	Yes	In progress*	Yes	Yes	Yes	Yes
Singapore	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Thailand	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Viet Nam	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *Cambodia = The law on unemployment benefits was passed in 2019 for future implementation. *Philippines = An unemployment insurance system for workers affected by the green or just transition is under development, and short-term financial payments are available for workers displaced by climate-related natural disasters.
Source: Adapted from ASEAN/ILO (2021[27]), *Regional Study on Green Jobs Policy Readiness in ASEAN: Final Report.*

In the absence of national unemployment insurance, climate/disaster recovery support or green transition relief for the affected workers could serve as a temporary solution in the nearer term. Income support through cash transfers is a known supporting tool that helps workers and their families affected by climate change-induced disasters to sustain their livelihoods and adapt to environmental degradation (Bowen et al., 2020[29]; Premand and Stoeffler, 2020[30]). Cash transfers' flexibility and scalability are advantageous in rapidly expanding coverage to groups affected by climate change-related impacts in developing countries, even without access to an online distribution system (ASEAN-ILO, 2021[27]). Previous experience of running an emergency cash transfer programme, particularly during the COVID-19 crisis, could guide policy makers in Southeast Asia to design and implement a special relief fund for the most vulnerable workers and their families.

That said, improving the existing social protection systems for all should be a priority for Southeast Asia over creating ad hoc support schemes. Given the environmental degradation and natural disasters that are likely to hit disadvantaged workers the hardest, providing support based on broad income eligibility set by the social protection system could be more efficient than setting up multiple special support programmes for different environmental reasons. For instance, Malaysia provides social security protection for all workers who contribute to the Social Security Organisation (SOCSO), although it has no specific policy addressing the negative impacts of green growth (ASEAN-ILO, 2021[27]). As part of strengthening social protection, countries currently developing unemployment insurance programmes (i.e. Cambodia, Lao PDR, Myanmar and the Philippines) are encouraged to accelerate the process in order to increase worker protection as soon as possible. Countries also need to continue efforts to include informal workers in their social protection systems and facilitate their contributions. In the long term, countries will need to rely less on cash transfers, and develop further income-enhancing programmes as part of disaster resilience strategies. Establishing a broad-based social protection system is also beneficial for the sustainable financing of national services and programmes, as economies struggle with rising inflation, brought on in part by large financial stimulus packages (Arthur and Hondo, 2022[31]).

Moreover, it is important for Southeast Asian countries to increase the resilience of their social protection systems to future climate change-related impacts. Building shock-responsive social protection, “flexing social protection responses to the evolving needs of the most vulnerable” (European Civil Protection and Humanitarian Aid Operations (ECHO), 2020[32]), emerged during the COVID-19 crisis but still remains relevant to addressing environment-related impacts. While the prevalence of climate change-induced disasters is rapidly increasing and intensifying, the timing of those climate events is not entirely predictable. The random occurrence of natural disasters calls for social protection systems to be agile, with immediate intervention right after the event. The disaster responses can leverage existing social programmes vertically (increasing the degree of support) and horizontally (expanding coverage to the affected population) or take the form of temporary measures. Again, Southeast Asian countries should ensure that informal workers and the most vulnerable workers are covered by their respective social protection systems.

Conclusion

This chapter sought to assess Southeast Asia’s vulnerability to environmental degradation from a labour market perspective. Based on seven countries representing 95% of the region’s total population, the results show that a large share of workers in the region rely on the environment: 37.1% work in environmentally linked sectors, ranging from 27.1% in the Philippines to 51.9% in Myanmar. These workers tend to have lower earnings and be more informal and less educated than the rest of the workforce. Focusing specifically on Indonesia and Viet Nam it was found that 23% of workers in Indonesia and 16% in Viet Nam are highly vulnerable to environmental shocks, based on their sensitivity to, exposure to, and capacity to cope with natural disasters. The higher level of vulnerability in Indonesia is primarily due to the concentration of populations in natural-disaster-prone areas.

In light of progressive environmental degradation and a pronounced increase in natural disasters, these findings highlight the urgency of adequate policy responses. Social protection, and cash transfers in particular, can support individuals before and after environmental shocks. In the long term, countries will need to rely less on cash transfers, and develop further income-enhancing programmes as part of disaster resilience strategies. In building resilience before shocks, novel technological solutions enable the further targeting of at-risk individuals. In post-shock settings, policy makers should prioritise the expansion of existing programmes over ad hoc schemes. Before large-scale implementation, new programmes should be assessed in a rigorous, evidence-based manner, namely through randomised controlled trials.

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Annex 3.A. Descriptive statistics on workers' income vulnerability in Indonesia and Viet Nam

Annex Table 3.A.1. Share of workers with basic and less than basic education

Country	Frequency of natural disaster events	Jobs with a **direct** link to the environment	Jobs with a **strong indirect link** to the environment	Rest of the economy
Indonesia	Low	84%	66%	43%
	Medium	81%	55%	39%
	High	88%	64%	54%
Viet Nam	Low	86%	75%	52%
	Medium	87%	75%	57%
	High	84%	60%	52%

Source: Authors' calculations.

Annex Table 3.A.2. Share of informal workers

Country	Frequency of natural disaster events	Jobs with a **direct** link to the environment	Jobs with a **strong indirect link** to the environment	Rest of the economy
Indonesia	Low	96%	90%	75%
	Medium	94%	76%	73%
	High	96%	83%	80%
Viet Nam	Low	97%	70%	57%
	Medium	97%	68%	57%
	High	91%	38%	44%

Source: Authors' calculations.

Annex Table 3.A.3. Share of female workers

Country	Frequency of natural disaster events	Jobs with a **direct** link to the environment	Jobs with a **strong indirect link** to the environment	Rest of the economy
Indonesia	Low	36%	49%	41%
	Medium	32%	44%	41%
	High	37%	49%	39%
Viet Nam	Low	49%	54%	47%
	Medium	48%	51%	47%
	High	42%	43%	47%

Source: Authors' calculations.

Annex Table 3.A.4. Share of young workers

Country	Frequency of natural disaster events	Jobs with a **direct** link to the environment	Jobs with a **strong indirect link** to the environment	Rest of the economy
Indonesia	Low	14%	17%	16%
	Medium	13%	16%	16%
	High	9%	17%	15%
Viet Nam	Low	11%	12%	12%
	Medium	12%	14%	13%
	High	13%	13%	12%

Source: Authors' calculations.

Annex Table 3.A.5. Share of urban workers

Country	Frequency of natural disaster events	Jobs with a **direct** link to the environment	Jobs with a **strong indirect link** to the environment	Rest of the economy
Indonesia	Low	12%	44%	61%
	Medium	19%	64%	74%
	High	28%	60%	70%
Viet Nam	Low	11%	23%	39%
	Medium	12%	37%	39%
	High	19%	69%	78%

Source: Authors' calculations.

4 Labour market implications of the energy transition: Indonesia case study

The global implementation of emissions reduction policies is expected to affect the demand for labour and skills in different ways. The transition towards low-carbon energy will undoubtedly create winners and losers in the labour market. A simulation exercise conducted for Indonesia shows that a global energy transition would concentrate employment losses along the fossil fuel value chain, while employment gains would occur across multiple sectors such as electricity and gas, construction, and mining of metals. To mitigate the adverse social consequences of the energy transition, policy makers should provide early support before layoffs, implement social protection measures, and invest in local development for negatively affected areas.

Southeast Asian countries are committed to reducing their reliance on fossil fuels as they battle with the twin environmental challenges of climate change and air pollution. Indonesia will play a key role in the region's energy transition, as it is the largest economy in Southeast Asia and the world's largest exporter of coal. The *Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050* (Republic of Indonesia, 2021[1]) sets ambitious goals to transition from fossil fuels to renewable energy. This represents opportunities but also challenges from a labour market perspective: it will likely create winners and losers across industries, skill types and geographies. To maximise the benefits from the energy transition, it is essential to understand such redistributive effects and to implement accompanying measures, such as early support before layoffs, social protection interventions, and investments in local development of negatively affected areas.

This chapter presents the results of a simulation exercise which involved assessing the labour market consequences in Indonesia of a hypothetical energy transition at the global level. While Indonesia was the only Southeast Asian country for which the analysis was possible due to data limitations, it offers relevant insights for other countries in the region. As a country that is heavily reliant on coal, Indonesia's experience also sheds light on other countries in this situation, such as the Philippines and Viet Nam (BP, 2022[2]). Indonesia is also well positioned to provide the critical minerals needed for the energy transition (IEA, 2021[3]). As such, comparisons can be drawn with Myanmar and the Philippines, which also produce large amounts of these resources (IEA, 2021[3]).

This exercise compares a "business-as-usual" emission scenario (referred to as a 6 degrees scenario (6DS)) with a "sustainable development" scenario (referred to as a 2 degrees scenario (2DS)) in 2030. It identifies sectors that will lose or gain employment and it provides a profile of the workers in the affected sectors. Policy implications to prepare the labour market for these changes are discussed for Indonesia as well as for the region as a whole.

Indonesia's commitment to a just energy transition

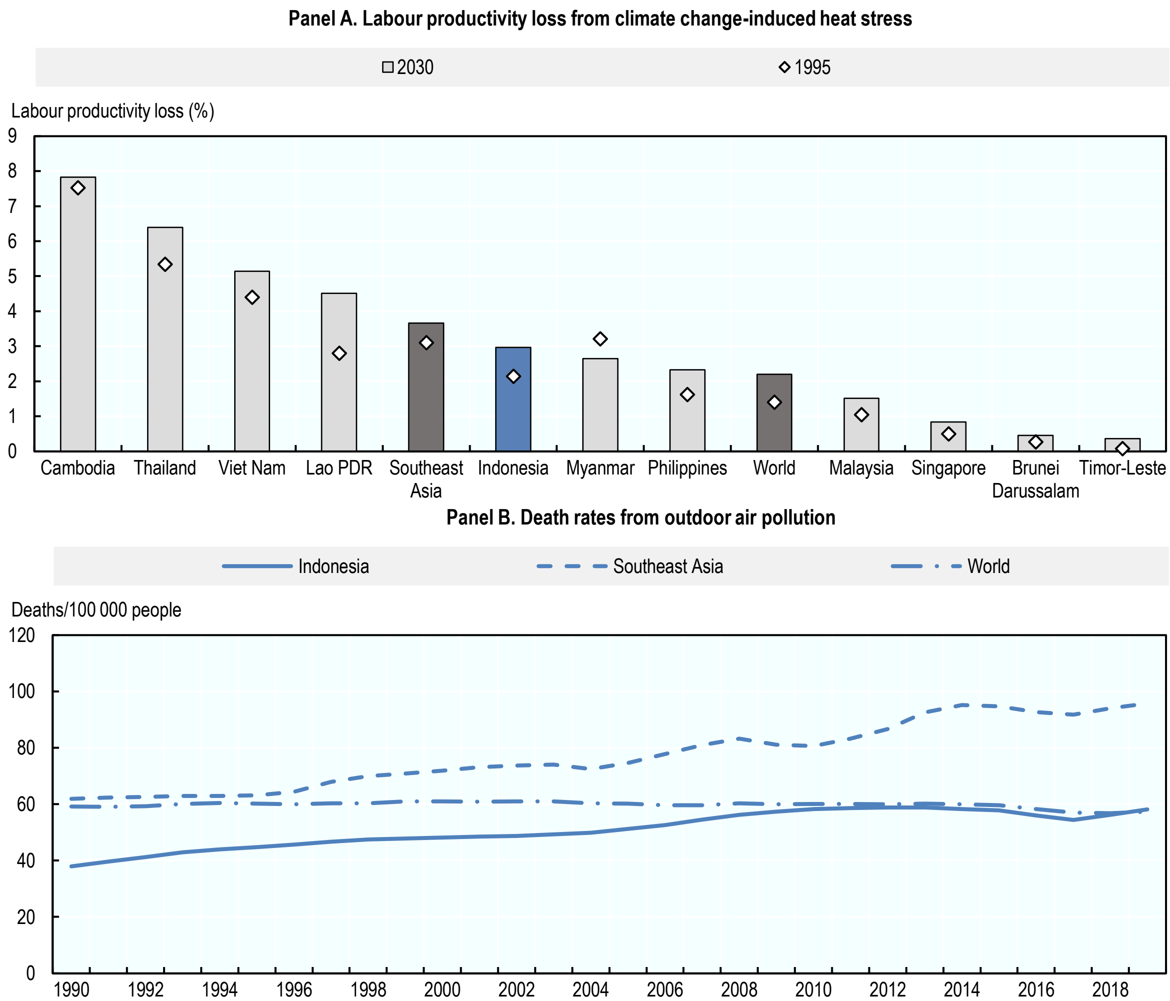
The preservation of the environment is key to Southeast Asia's inclusive growth, and Indonesia is no exception. The region is highly vulnerable to climate change. By 2030, heat stress (individuals' reduced physiological capacity to work due to high temperatures) is set to increase. It is expected to cost the country 3.0% of its labour productivity, up from 2.1% in 1990 (Figure 4.1, Panel A). Moreover, fossil fuels produce immediate costs related to air pollution. The burning of coal, diesel and petrol is a major source of fine particulate matter (PM 2.5), ground-level ozone and other pollutants. Fine particle air pollution is the cause of one in three deaths from stroke, lung cancer and heart disease worldwide (WHO, 2021[4]). The trend is worsening in Indonesia: death rates from outdoor air pollution increased from 38 per 100 000 inhabitants in 1990 to 58 per 100 000 inhabitants in 2019 (Figure 4.1, Panel B). While many countries across Southeast Asia have also experienced an increase in outdoor air pollution deaths since 1990, the situation in Indonesia is particularly worrying.

As a country exposed to climate change and air pollution, Indonesia has set ambitious targets to phase out fossil fuels and transition towards renewable energy, a policy set out in *Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050* (Republic of Indonesia, 2021[1]).

According to the *Long-Term Strategy*, Indonesia plans to:

- increase its renewable energy to at least 23% of primary energy demand by 2025, and at least 31% by 2050
- reduce its greenhouse gas (GHG) emissions by 29% (unconditional target) compared with a business-as-usual scenario and by 41% (conditional on international support) by 2030
- as part of the implementation of these objectives, a carbon tax was to be implemented in 2022, focusing on coal power plants (Republic of Indonesia, 2022[5]), but likely to be in place for 2025.

Figure 4.1. Indonesia suffers from climate change-induced heat stress and air pollution



Note: In Panel A, estimates based on data from the ILOSTAT database and from the Hadley Centre Global Environmental Model, version 2 (HadGEM2) and the GFDL-ESM2M (Geophysical Fluid Dynamics Laboratory) climate models (using as input the Representative Concentration Pathway 2.6 (RCP2.6) climate change pathway, which envisages a global average temperature rise of 1.5°C by the end of the 21st century). Lao PDR: Lao People's Democratic Republic. In Panel B, rates are age standardised, meaning that they assume a constant age structure of the population; this allows for comparison between countries and over time.

Source: Panel A: ILO (2019[6]). Panel B: Institute for Health Metrics and Evaluation (2019[7]), *Global Burden of Disease*, www.healthdata.org/gbd/2019.

Indonesia is currently heavily reliant on fossil fuel consumption and exports. In 2020, 82% of power generation in the country came from fossil fuel: 62% from coal, 18% from natural gas and 2% from oil (US EIA, 2021[8]). Mineral fuels, mineral oils and products of their distillation represented 15.4% of national exports in 2020 (OEC, 2022[9]). In particular, Indonesia is the world's largest exporter of coal by weight (US EIA, 2021[8]). The country specialises in lignite extraction (also known as "brown coal") (OEC, 2022[9]). These industries would be particularly affected by the energy transition.

At the same time, metal mining offers Indonesia opportunities to thrive. Indeed, technologies that are essential for the energy transition, ranging from electric cars to wind turbines, require large amounts of certain minerals. Nickel is one of these important resources and Indonesia is its largest producer, accounting for 33% of global extraction. Other resources important for the energy transition are currently produced in Indonesia (e.g. copper), or represent potential future opportunities (rare earth elements).

Understanding and anticipating the reallocation of labour across industries will be key to ensuring a just transition, which is a necessary condition for the political acceptability of these reforms. The next section therefore attempts to analyse the sectors likely to gain employment and those likely to lose employment from the energy transition, and the profiles of affected workers.

Opportunities and challenges in the labour market from the energy transition

The Paris Agreement, ratified by Indonesia in 2016, lays out the objective of "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" (UN, 2015[10]). The goal can be achieved in particular by: 1) increasing both the share of low-carbon sources in the energy mix and energy efficiency, and 2) by modifying agricultural practices and favouring natural carbon sequestration.

The current study focuses on the former approach: increasing the share of low-carbon sources in the energy mix and improving energy efficiency. By applying two future carbon dioxide (CO_2) emissions scenarios, it assesses the consequences of the energy transition on the labour market. The analysis is based on two scenarios, developed by the International Energy Agency (IEA) (2015[11]), which describe the possible evolution of energy generation over the coming decades in terms of energy supply and final energy demand throughout the economy at the global level.

The first scenario is the "business-as-usual" or 6DS. It should be interpreted as a particularly pessimistic pathway, where CO_2 emissions reach 44 gigatonnes globally in 2030. In this scenario, global average temperature is on a path to increase by approximately 5.5°C by 2050 and then stabilise at approximately 4°C by 2100. The second scenario is the "sustainable development" or 2DS. It consists of a hypothetical pathway where there is at least a 50% probability of the average global temperature not increasing by more than 2°C compared to pre-industrial levels. This means reducing the 34 gigatonnes of CO_2 emissions recorded globally in 2019 to 27 gigatonnes in 2030, which is 39% lower than the emissions in the 6DS.

The current analysis builds on a model by Montt et al. (2018[12]) and the International Labour Organization (ILO) (ILO, 2018[13]), where specific emissions trajectories are then developed for 44 countries, including Indonesia. The 2DS presented here for Indonesia has both similarities and differences compared with a specific official scenario developed by the Government of Indonesia, known as the Low Carbon Scenario Compatible with the Paris Agreement (LCCP). While net emissions targets in the LCCP are comparable with the 2DS, the LCCP includes in addition actions on agriculture, forestry and other land use targets. The methodology used for carrying out this analysis can be found in Annex 4.AAnnex 4.A.

In some countries, including in Indonesia, the energy transition could generate a net employment gain. In the event of a global reduction in emissions compatible with the Paris Agreement, it is estimated that Indonesia would be among the largest beneficiaries of the energy transition in terms of net employment creation (Montt et al., 2018[12]) – see Annex 4.A. for details on methodology. If the world adopts sustainable energy production and use (the 2DS), employment in Indonesia would be 0.86% higher in 2030 compared with the employment level in the 6DS in 2030. It is estimated that more than 1 million new jobs would be created, and about 31 000 jobs would be destroyed (Table 4.1). Compared with other countries and regions studied, Indonesia exhibits a large net employment gain (Figure 4.2). Only Chinese Taipei and Bulgaria are expected to record higher net employment creation rates by 2030 from this scenario. Note that all countries and regions are expected to experience a net gain in employment, with the exception of the Middle East.

Net job creation does not give the full picture of the impact of an energy transition on the labour market. The transition may increase overall employment, but at the same time it would require the reallocation of labour from one sector to another. In particular, fossil fuel-related sectors would lose employment, whereas sectors involved in renewable energy production would gain employment. This implies retraining and reskilling a large number of workers. The following analysis therefore looks in more detail at the particular sectors that would be affected in terms of employment by a potential energy transition.

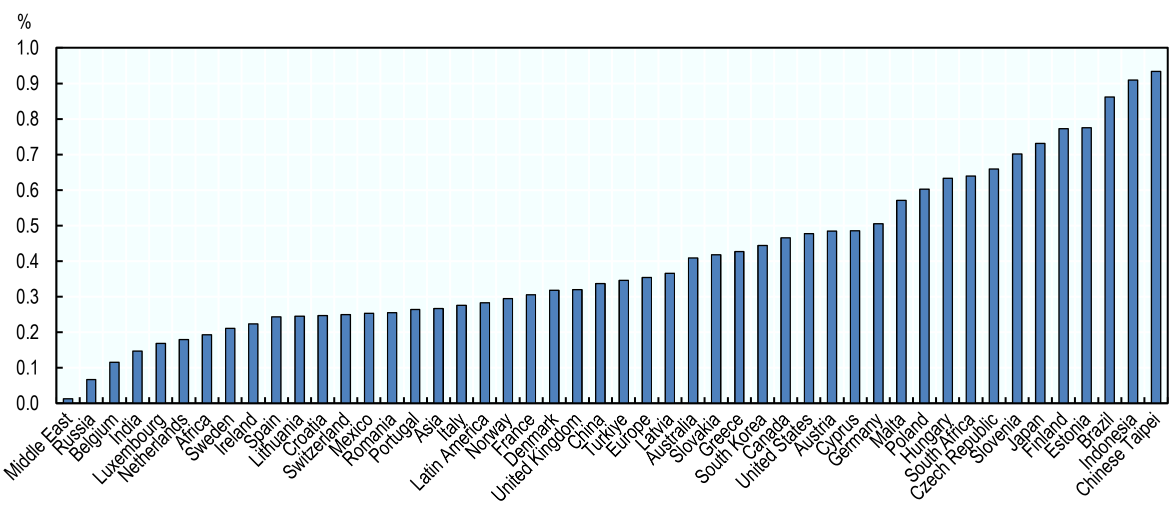
Table 4.1. Employment forecast for 2030 under the 2DS and the 6DS, Indonesia

Total employment, 2016 (baseline)	Total estimated employment, 2030, 6DS	Employment loss estimate, 2030, 2DS compared to 6DS	Employment gain estimate, 2030, 2DS compared to 6DS	Total estimated employment, 2030, 2DS	Estimated employment change, 2DS relative to 6DS (%)
120 648 000	126 300 000	31 000	1 120 000	127 389 000	0.86

Note: The employment forecast compares the 2DS with the 6DS in 2030. Employment loss and gain estimates are the difference between 6DS and 2DS. Net employment effect of 2DS compared to 6DS is 1 089 000 jobs created.
Source: Authors' calculations based on the Indonesia National Labour Force Survey, 2016 and Montt et al. (2018[12]).

Figure 4.2. Indonesia could be among the largest beneficiaries of the global energy transition

Net employment change by 2030 under the 2DS compared with the 6DS

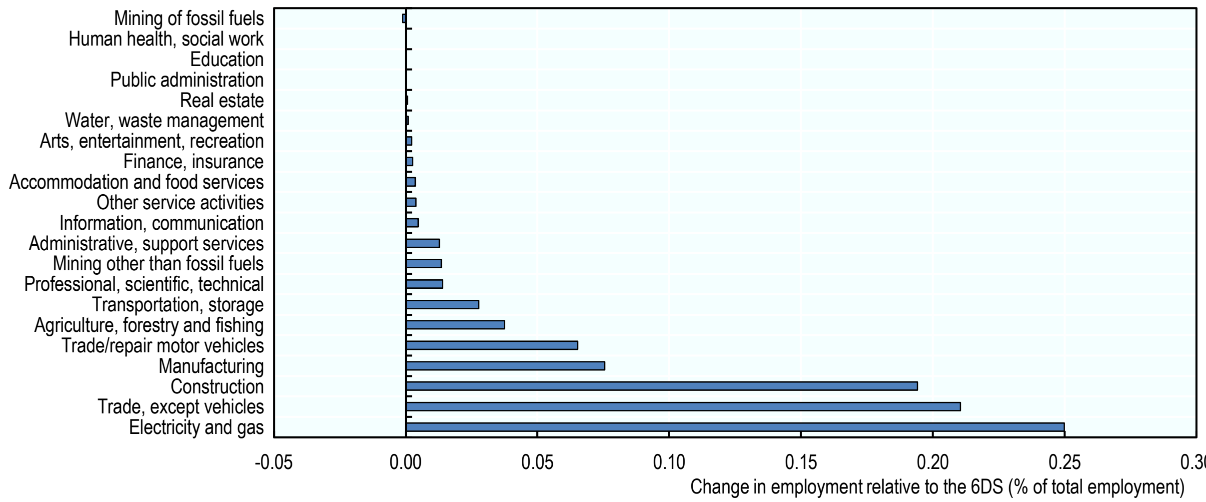


Note: This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Montt et al. (2018[12]).

Employment losing sector: fossil fuel-related activities

Sectoral analysis shows that the mining and processing of fossil fuel are the only sectors exhibiting a decline in employment. Under the 2DS compared to the 6DS, about 31 000 jobs are expected to be destroyed and 1 120 000 jobs created. In 2020, the coal mining businesses employed about 250 000 people (about 0.2% of total employment) (IESR, 2022[14]) including about 160 000 coal miners (Global Energy Monitor, 2023[15]). The "Electricity and gas" sector, as well as "Trade, except vehicles", "Construction" and "Manufacturing" sectors capture the largest employment gains. Public sector-oriented activities, such as those in the "Human health, social work", "Education" and "Public administration" sectors, remain virtually unaffected (Figure 4.3).

Figure 4.3. Fossil fuel-related activities will be most negatively impacted from an energy transition in Indonesia

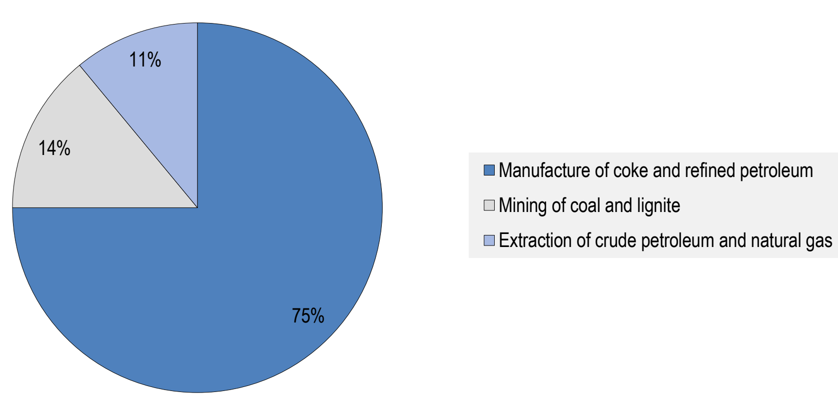


Note: This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Adapted from Montt et al. (2018[12]).

Estimated employment losses in the fossil fuel sector would occur in various activities of the value chain: the "Manufacture of coke and refined petroleum products" sector would account for 75% of the employment losses, followed by "Mining of coal and lignite" (14%) and "Extraction of crude petroleum and natural gas" (11%) (Figure 4.4).

Figure 4.4. Employment losses would be concentrated in fossil fuel extraction and processing in Indonesia

Distribution of the employment losses by sector (%)

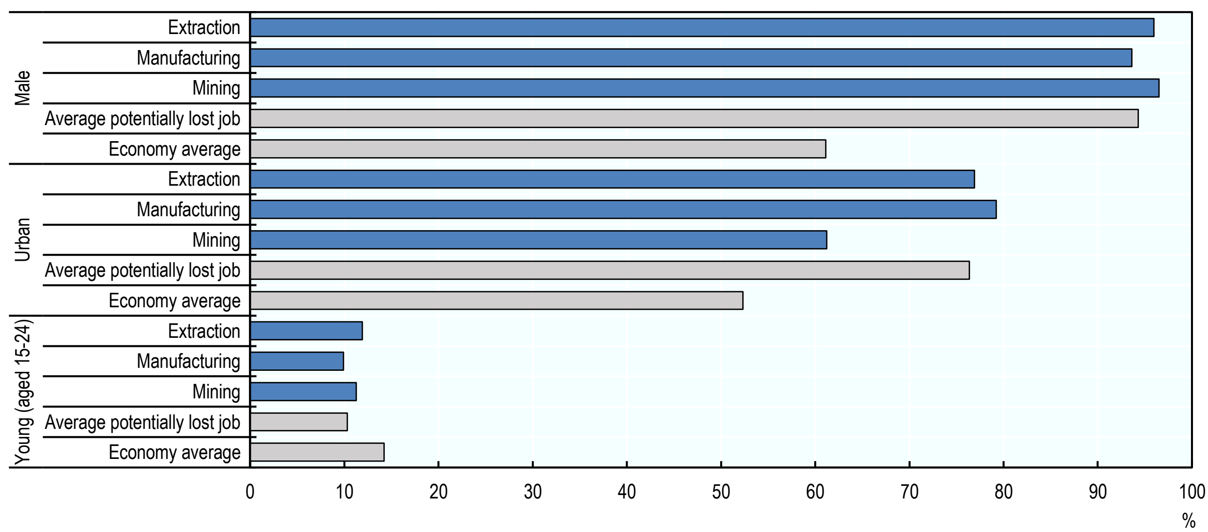


Note: Activities based on the International Standard Industrial Classification of All Economic Activities (ISIC), fourth revision. This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors' calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

Understanding the profiles of at-risk workers is key to designing support policies. The workers who would be negatively affected by an energy transition would mostly be men working in the formal economy. The findings of the simulation exercise conducted on sectors are combined here with labour force data – see Annex 4.A for the methodology. “Potentially lost jobs” refers to jobs that would be destroyed assuming that the sector characteristics (i.e. the profile of employed workers) would remain unchanged between 2016 and 2030. It appears that these jobs are overwhelmingly held by men (94% of average at-risk workers) and are more urban (76%) than the economy average (Figure 4.5). Workers in such jobs are also less likely to be young (aged 15-24 years) compared with the economy average.

Figure 4.5. At-risk workers are for the large majority male and urban workers

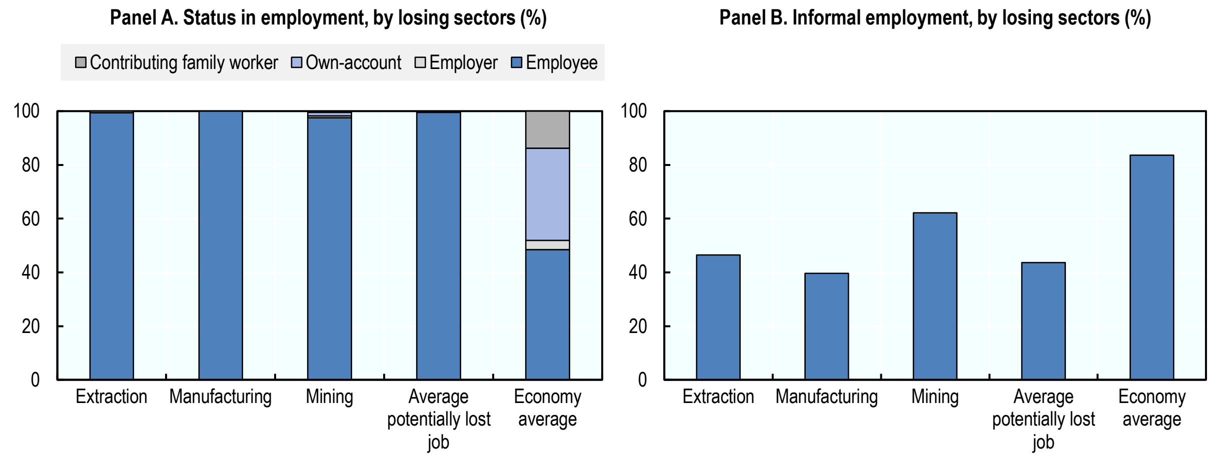
Demographic characteristics of workers in losing sectors, share of workers (%)



Note: Extraction: Extraction of crude petroleum and natural gas; Manufacturing: Manufacture of coke and refined petroleum products; Mining: Mining of coal and lignite. This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors’ calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

The employment status, i.e. whether workers have a formal job, matters for their capacity to cope with potential job loss. Under Indonesian Labour Law 13/2003, employees with a formal contract obtain up to nine months in severance payments in the case of employment termination (ILO, 2020[16]). In contrast, informal employees, as well as employers and own-account or contributing family workers (irrespective of their formal or informal status), do not benefit from this protection. In Indonesia, workers in the “losing” sector are predominantly wage employees. Estimates show that jobs at risk of being lost in fossil fuel-related activities are largely held by wage employees (more than 99%, compared with 48% across the economy). Out of fossil fuel workers, 44% of them are informal workers, compared with the country average of 83%. Workers in the “Mining of coal and lignite” sector are 62% informal (Figure 4.6).

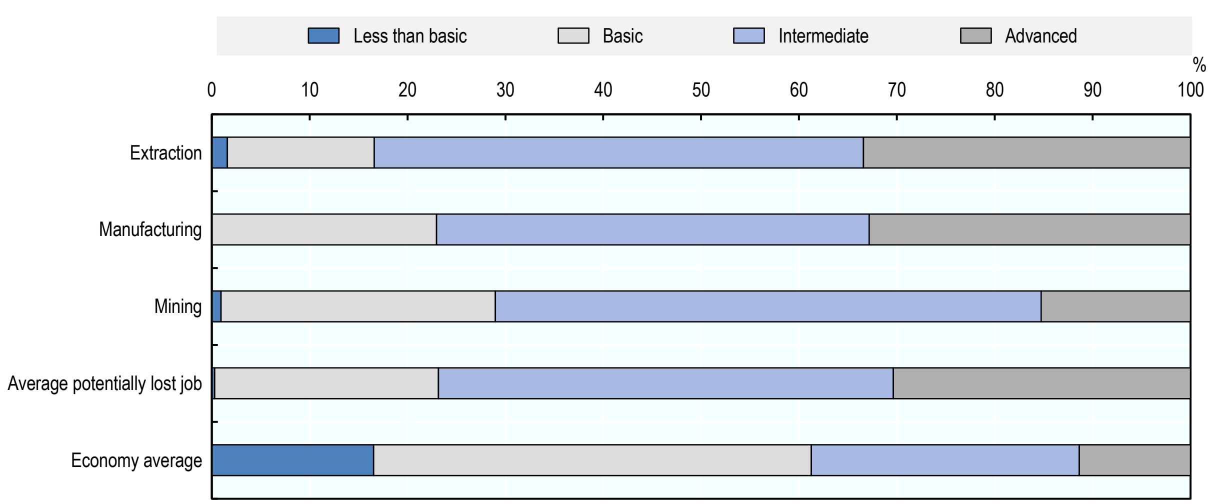
Figure 4.6. Workers in fossil fuel extraction and processing tend to be employees, with formal contracts



Note: Extraction: Extraction of crude petroleum and natural gas; Manufacturing: Manufacture of coke and refined petroleum products; Mining: Mining of coal and lignite. This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors' calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

Jobs in fossil fuel extraction and processing tend to pay higher salaries than other sectors of the economy. In fact, the median wage in the "Mining of coal and lignite" and "Extraction of crude petroleum and natural gas" is 2.5 times the national median wage and that of workers in the "Manufacture of coke and refined petroleum products" sector is 1.4 times the national median wage. Workers in these sectors are also more educated than the national average, with 46% having advanced education, compared with 27% on average for the country (Figure 4.7).

Figure 4.7. Workers in fossil fuel extraction and processing are more educated than the average Indonesian worker



Note: Extraction: Extraction of crude petroleum and natural gas; Manufacturing: Manufacture of coke and refined petroleum products; Mining: Mining of coal and lignite. This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors' calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

The relatively better working conditions in the fossil fuel extraction and processing sectors can be explained by the fact that mining fossil fuel is a relatively capital- and skill-intensive activity (Peszko et al., 2021[17]). The fact that current fossil fuel industry workers are more formal, relatively better paid and relatively more educated than the average worker in Indonesia might represent a source of resilience in facing the negative consequences of the energy transition: formal employee status generally implies severance payments in case of layoff; higher wages may be associated with higher savings, thus enabling workers to cope with job loss; and higher education is likely to favour reallocation to another sector. According to the Institute for Essential Services Reform, an Indonesian think tank, by 2050, job losses in coal industries could be anywhere between 25 000 and 252 000 depending on how rapid coal is phased-out and labor intensity decreased through improved productivity and automation (IESR, 2022[14]).

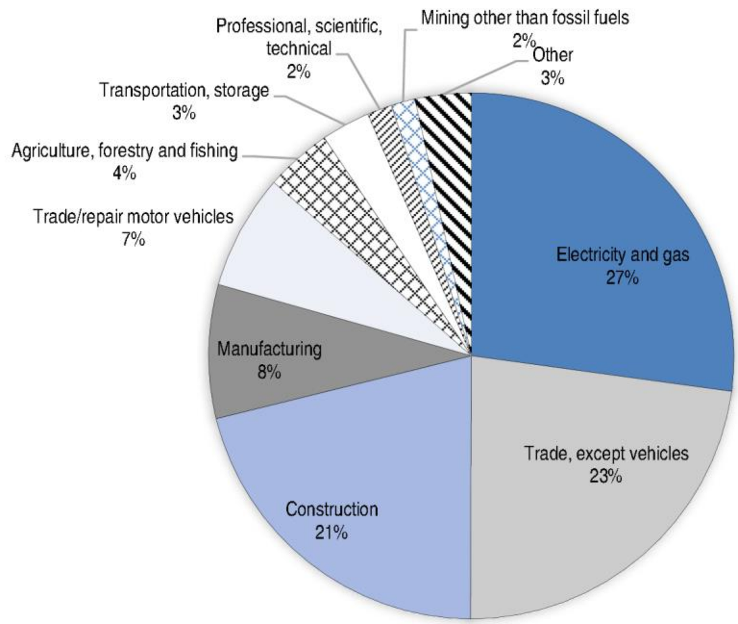
A more alarming aspect of this forecast is that job losses will be geographically concentrated in a specific region, namely the Kalimantan region (the Indonesian part of the island of Borneo), which specialises in fossil fuel extraction. The geographic concentration of extractive industries has important implications for the equity and acceptability of the energy transition. This geographic concentration poses challenges for labour reallocation given the possible lack of local employment alternatives and the difficulty for workers to relocate.

Relatedly, localised adverse economic shocks tend to induce a range of social challenges. Studies show that local shocks induce crime, illegal drug abuse, poor mental health and lower life satisfaction (Bartik, 2020[18]). In addition, geographic concentration of job losses has political economy implications, with often strong political backlash (Rodríguez-Pose, 2018[19]) and increased support for political movements that are opposed to environmental reforms (Lockwood, 2018[20]). In a developing country context, two patterns further aggravate this geographical concentration of job losses (Grover, Lall and Maloney, 2022[21]). First, it has been observed that internal mobility is much weaker in developing economies than in high-income countries, according to World Bank research. This lack of mobility prevents people in negatively affected regions from seeking opportunities elsewhere. Second, when internal mobility does occur, it often results in “sterile agglomeration”; that is, urbanisation without the productivity gains observed in high-income countries. Tackling these challenges requires policies that either help workers relocate to more productive areas or that invest in local development.

Employment winning sectors: Electricity and gas, trade, and construction

Employment gains would encompass a broad range of activities. The “Electricity and gas” sector would account for 27% of estimated new job creation from an energy transition. Indeed, under the 6DS, Indonesia would develop electricity generation with lower emissions technologies, including biomass and photovoltaic as well as gas, which have lower emissions per kilowatt-hour of electricity. The “Trade, except vehicles” sector would account for 23% of estimated job creation. This is the result of both indirect and induced effects: investments in new electricity technologies would increase demand for intermediary inputs, which would be provided by the “Trade, except vehicles” sector. In parallel, the overall increase in employment would result in higher overall demand, which would also contribute to increasing certain types of employment in the “Trade, except vehicles” sector. The “Construction” sector would account for 21% of employment gains by 2030 under the 2DS, which would largely be an indirect effect of the new infrastructure that will be required for the new power generation (Figure 4.8).

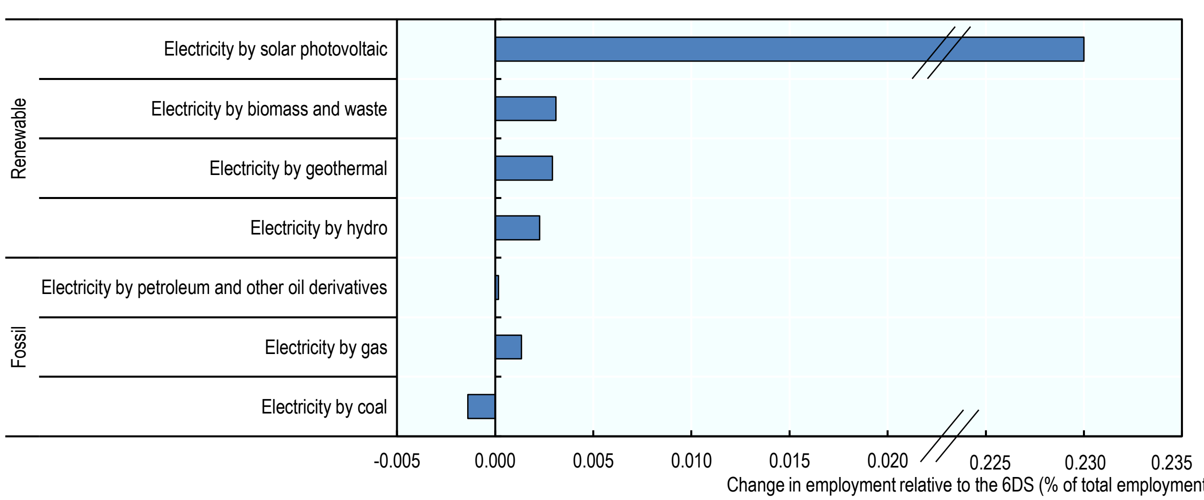
Figure 4.8. The job gains will be spread across several sectors



Note: This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors' calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

A disaggregated analysis of the electricity production sector shows that the largest increase in employment would occur in solar photovoltaic, increasing national employment by 0.23% (Figure 4.9). Other renewable energy sources would also see employment gains, in particular waste and biomass, as well as geothermal. Yet, production of electricity by gas, and to a lesser extent petroleum, would also see small gains due to their use as transition technologies to phase out the production of electricity by coal. Indeed, switching the production of electricity from coal to natural gas can play a role in reducing GHG emissions, as the latter typically emits 50% less carbon per kilowatt-hour (IEA, 2019[22]).

Figure 4.9. Among electricity producing sub-sectors, solar photovoltaic will experience the most employment gains



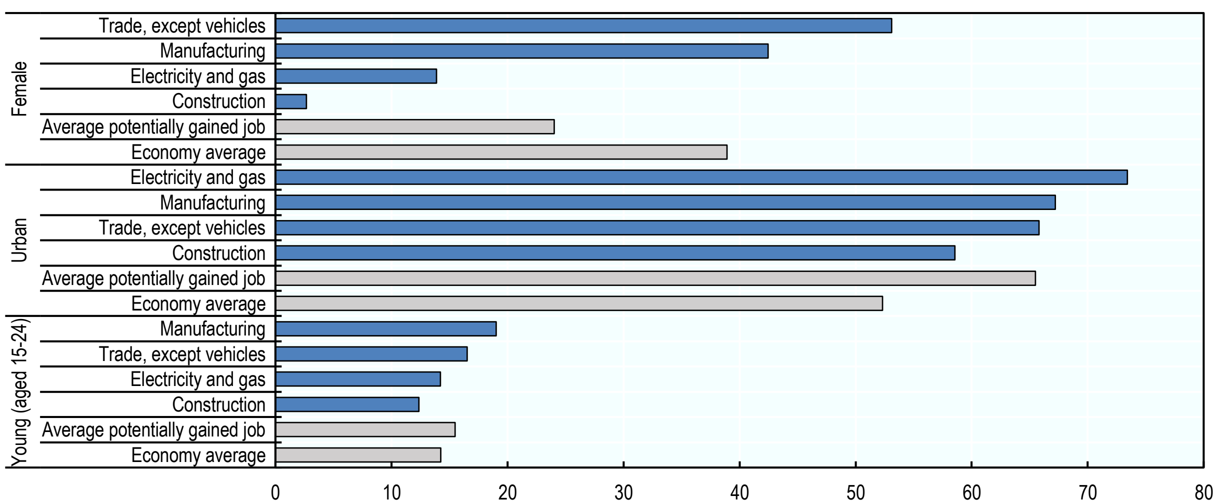
Note: EXIOBASE classification. This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Adapted from Montt et al. (2018[12]).

In terms of the profiles of workers in the sectors expected to experience employment gains from the energy transition, they tend to have a higher percentage of male and urban workers compared with the national average they tend to be more male and urban workers compared with the national average (Figure 4.10). The profiles of workers are similar to those in the sectors expected to experience employment losses. However, job requirements are not necessarily the same, therefore not interchangeable.

Assuming that sectors would keep the same gender composition, the "Manufacturing" and "Trade, except vehicles" sectors, where more women tend to be employed, will see the largest increase, and thus contribute to increasing female employment. These two sectors also typically employ younger workers (aged 15-24 years).

Figure 4.10. The energy transition is expected to create employment for women and youth

Demographic characteristics of workers in main gaining sectors, share of workers (%)

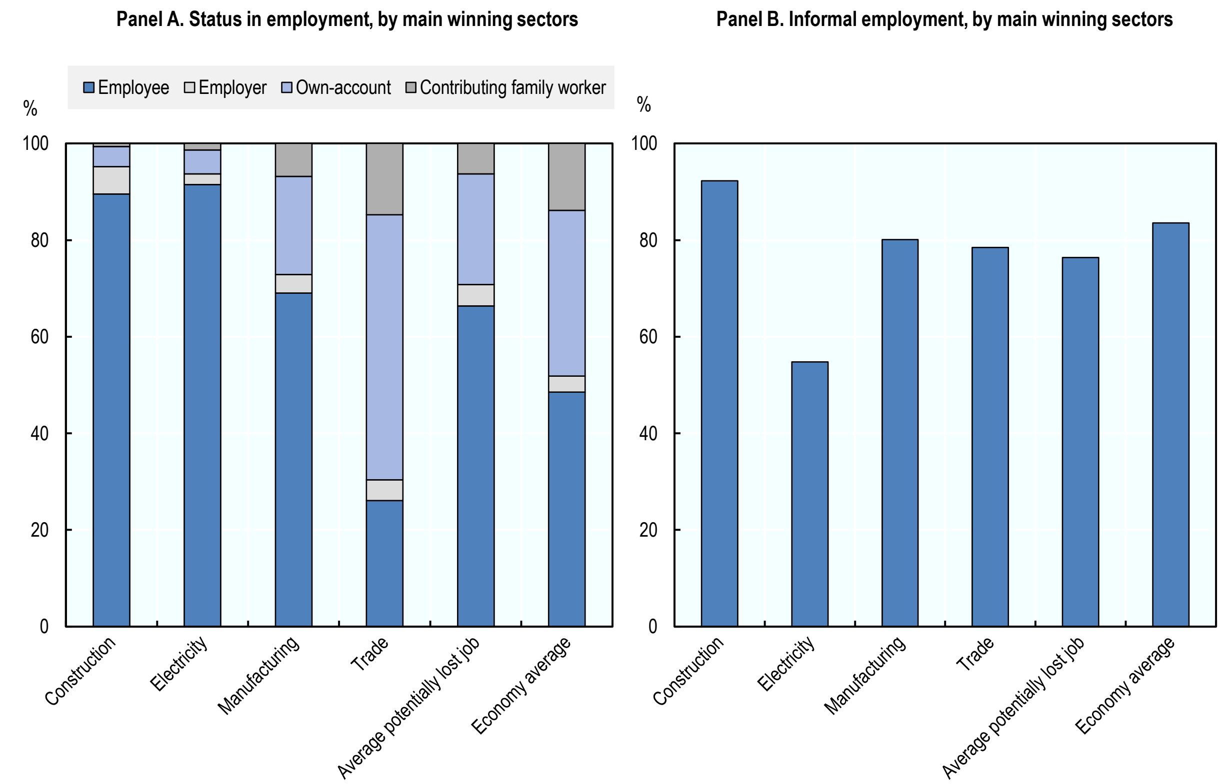


Note: This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors' calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

Status in employment is relatively similar in the sectors expected to gain employment compared with the economy average (Figure 4.11, Panel A). Yet, it depends on the sector: In the "Trade, except vehicles" sector, 55% of employment would be composed of own-account and contributing family workers. In contrast, in "Construction" and "Electricity and gas" sectors, most workers would be employees (90% of "Construction" sector workers and 92% of "Electricity and gas" sector workers). Informality remains high in Indonesia, at around 80% of total employment in 2019 (OECD, 2021[23]). Under 2DS, the winning sectors, particularly in "Construction", "Manufacturing" and "Trade", are estimated to have high shares of informal workers (Figure 4.11, Panel B).

Figure 4.11. Employment gains might result in more workers with employee status and formal contracts

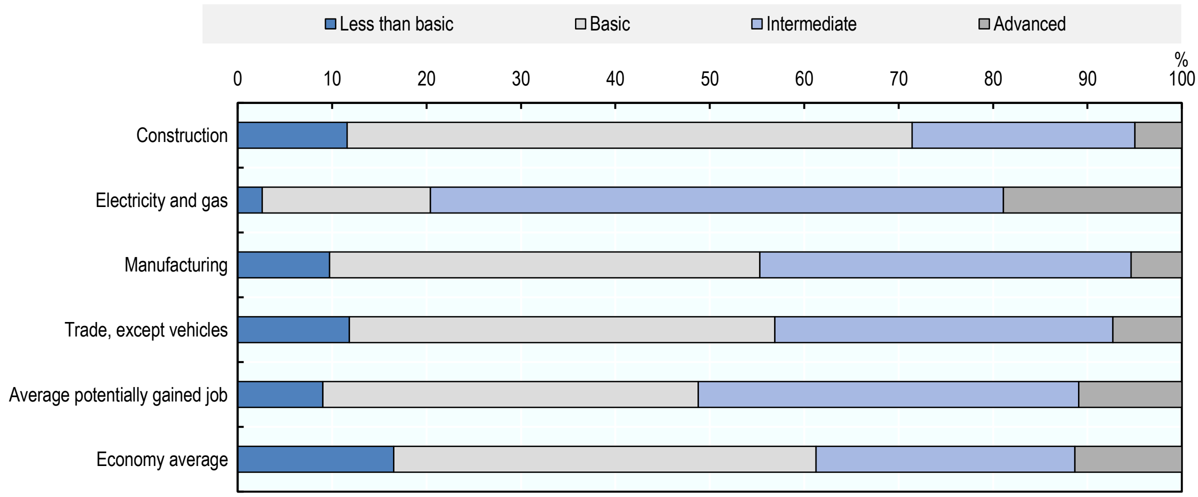
Status in employment of workers in main gaining sectors, and average potentially gained job (%)



Note: The trade sector excludes vehicles. This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors' calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

The energy transition would require workers to retrain and reskill. Newly created jobs would require higher levels of skills than those currently possessed by the average worker in Indonesia (Figure 4.12). An estimated 51% of these potential new jobs would require an intermediate education level or higher; however, only 39% of workers in Indonesia had reached this level of education in 2016. Less than one-half (49%) of these new jobs would require basic education or less, whereas 61% of jobs currently require such education. The requirements regarding advanced education achievement would be similar to the economy average, at 11%. The education requirements may vary across sectors with employment gains, however. For example, both the "Construction" and "Trade, except vehicles" sectors have educational profiles close to the national average. In contrast, the "Electricity and gas" sector will require a much higher level of skills.

Figure 4.12. Some of the main winning sectors will require more education than that of the average Indonesian worker

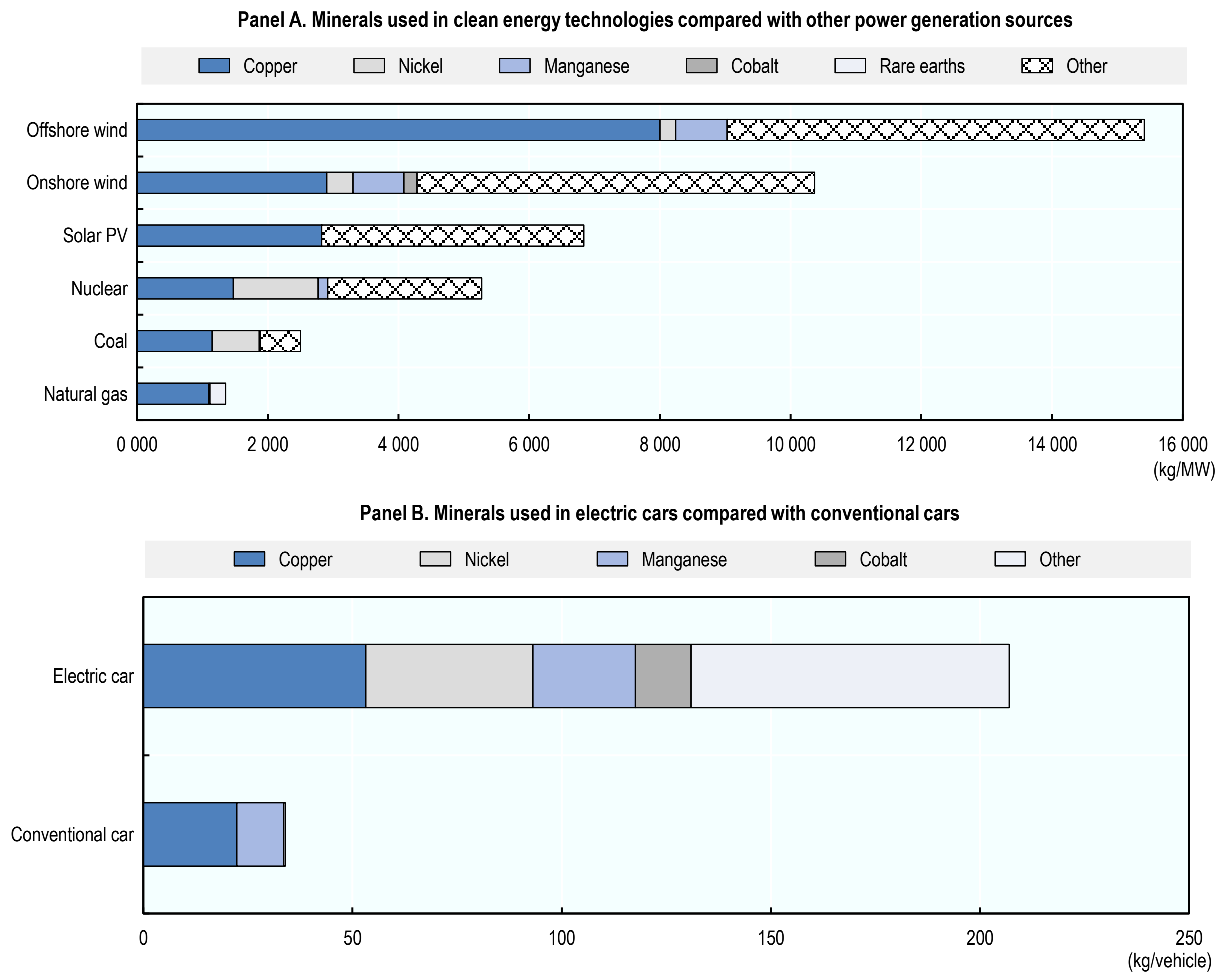


Note: This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors' calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

In focus: Pros and cons of metal mining as an alternative to fossil fuel mining

A world powered by low-carbon energy technologies will have different mineral resource needs compared with the 6DS (business-as-usual scenario) (Figure 4.13). Solar photovoltaic installations, wind farms and electric vehicles generally require more minerals to build than their fossil fuel-based counterparts (IEA, 2021[24]). For example, an electric car requires six times the mineral resources of a conventional car, and an onshore wind farm requires nine times more mineral resources than a gas-fired plant.

Figure 4.13. Low carbon technologies require more mineral inputs than fossil fuel-based equivalents

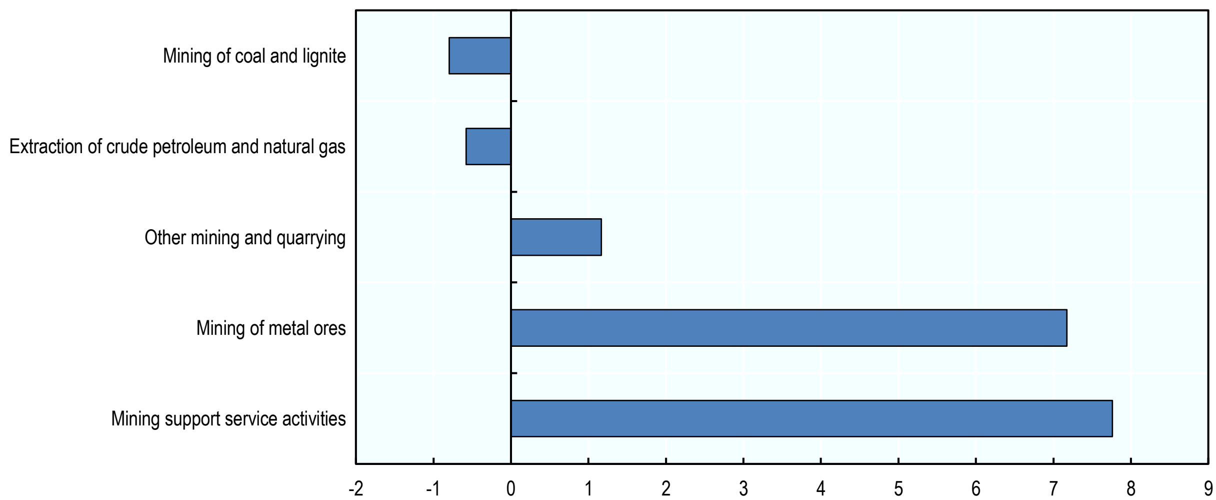


Note: Solar PV: Solar photovoltaic.
Source: Adapted from IEA (2021[3]).

Indonesia plays a large role in fossil fuel extraction. It is also the world's largest producer of nickel and is among the world's top 20 producers of copper, cobalt and manganese (World Mining Data, 2021[25]). There is also the potential for rare earth elements extraction in Indonesia (Handoko and Sanjaya, 2018[26]). For these reasons, the energy transition in Indonesia would produce both employment gains and losses in mining and quarrying. While most of the employment losses induced by the energy transition would be concentrated in the "mining of fossil fuels" sector, these losses would be more than offset by growth in the mining of metal ores, as well as in mining support services activities and other activities related to mining and quarrying (Figure 4.14).

Figure 4.14. Mining of metal ores and service activities could largely compensate employment losses in fossil fuels extraction

Employment change induced by the energy transition (2DS vs. 6DS), by sectors (thousands)

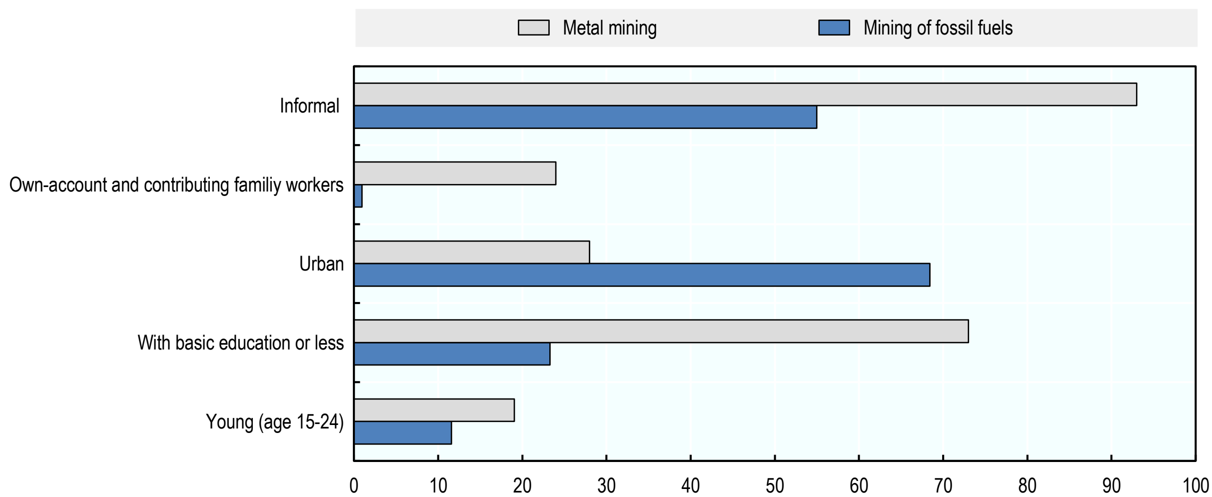


Note: This is obtained by comparing the 2DS with the 6DS in 2030.
Source: Authors' calculations based on Montt et al. (2018[12]) and the Indonesia Labour Force Survey (2016).

Despite this potentially good news, it is worth noting that working conditions vary across types of mining activities. Workers in the "Mining of fossil fuels" sector tend to have higher shares of formal employment, be more educated, and are less likely to be own-account and contributing family workers. They are also older and more urban. For all of these reasons, a policy aimed at reallocating workers from the "Mining of fossil fuels" sector to other forms of mining should also aim to improve working conditions in this latter sector (Figure 4.15): in the "Mining of fossil fuels" (coal, lignite, petroleum and natural gas) sector, only 1% of workers are own-account or contributing family workers (a status that is considered precarious), compared with 24% of workers in the "Mining of metal ores" sector. Similarly, informal employment is more prevalent in the "Mining of metal ores" sector (93%) than in the "Mining of fossil fuels" sector (55%). Education requirements are much lower in the "Mining of metal ores" sector (73% of workers have a basic education or less) compared with the "Mining of fossil fuels" sector (23% of workers have a basic education or less).

Figure 4.15. Mining of fossil fuels is very different from metal mining

Workers' characteristics, by type of mining (%)



Note: Basic education refers to completed lower secondary education.
Source: Authors' calculations based on the Indonesia National Labour Force Survey (2016).

In addition to the relatively poorer working conditions in metal mining compared with coal mining, the metal mining sector causes environmental degradation, which can itself affect working and living conditions (see Chapter 2). Globally, 79% of metal ore mining in 2019 was located in five of the six most species-rich ecosystems (Luckeneder et al., 2021[27]). Moreover, one-half of the world's metal mining takes place within 20 km of protected areas. In Indonesia, the Grasberg gold and copper mining site (one of the world's largest metal ore extraction projects) is located close to the Lorentz National Park, a World Heritage Site (Luckeneder et al., 2021[27]). The mine has polluted rivers and lakes in the area (Martinez-Alier, 2001[28]).

Developing circular economies could spur a more efficient use of mineral resources and therefore limit the need for additional metal mining. While this comes with clear environmental benefits, it also presents employment trade-offs. The ILO (2018[13]) estimates that adopting a circular economy that prioritises the reuse, recycling, remanufacturing, and repair of goods is projected to generate approximately 6 million net jobs globally by 2030. Yet, employment would be reduced in mining and manufacturing. Given their comparative advantage in manufacturing, Southeast Asian countries could face a small net employment loss with the adoption of a circular economy.

Policy implications: Active labour market policies needed to tackle the near-term unemployment effects of a green transition

Active labour market policies (ALMPs) can provide the job opportunities and skills needed for workforce reallocation during the green transition while social protection ensures a basic standard of living. ALMPs aim to create strong attachment to the labour market and good jobs, and can fulfil four main objectives: 1) retaining and/or creating employment; 2) supporting job-seeking activities; 3) developing human capital; and 4) improving labour market matching (Arthur and Hondo, 2022[29]). ALMPs' income-generating potential for the unemployed and at-risk workers is particularly relevant to Southeast Asia, whose workforce is greatly affected by environmental degradation and the green transition (Figure 4.2). However, the ALMP package has been underfunded and underutilised in Southeast Asia, and this is reflected in low programme participation rates, ranging between 1.2% (Cambodia) and 11.9% (Viet Nam) of the total population in 2006-19 (Niño-Zarazúa and Torm, 2022[30]).

Table 4.2. Active labour market policies in ASEAN countries

Percentage of direct and indirect ALMP participants, averaged out between 2006 and 2019

	National	Poorest quintile	Rural	Urban
Cambodia	1.22	0.56	1.27	1.02
Indonesia	5.62	4.79	7.48	5.33
Myanmar	2.34	0.78	1.26	5.41
Viet Nam	11.92	29.28	18.00	4.56

Note: ALMPs include training programmes (e.g. vocational training, life skills training, financial training assistance), employment incentives and wage subsidies, employment measures for people with disabilities, entrepreneurship support and start-up incentives (i.e. cash, in-kind, microcredits), and labour market services and intermediation through public employment services. Data from other ASEAN countries are unavailable.
Source: Niño-Zarazúa and Torm (2022[30]), *Active labour market policies in Asia and the Pacific: A review of the literature*.

Governments in Southeast Asia should create green job opportunities in order to address the problem of local unemployment in the areas most affected by decarbonisation policies. The job creation potential of a green transition could be limited in the absence of policies to support green jobs and industries. Through incentives for businesses and investments in green infrastructure and industry development, countries could seek to retain and create employment within the green transition hotspots. Supporting businesses that promote green practices and a green economy may increase the supply of green job opportunities that could absorb the displaced workforce from carbon-intensive sectors. For example, the Philippines passed a law that provided various financial incentives for green jobs creation, including tax deductions for skills training, research and development (R&D) for green jobs, and tax-free imports of capital equipment directly and exclusively linked to green jobs promotion (World Resources Institute, 2021[31]). Another way to retain and create local employment is to reuse the existing fossil fuel infrastructure to generate clean energy. Countries could consider supporting technical solutions, including retrofitting fossil fuel power plants with carbon capture, utilisation and storage (CCUS) technology or repurposing these sites for other energy sources (e.g. small modular reactors). By doing so, existing power supply infrastructure could continue to function for a longer period and could contribute to increasing local employment while satisfying climate objectives.

At the same time, it is important to develop pre-emptive plans for supporting workers' career transition and job seeking in declining sectors and to communicate with these workers at an early stage. Establishing a transition plan could begin with assessing the unemployment risk related to the green transition by sector and by workers' profiles. Employment services and supports for workers should be designed differently according to the sector and the risks assessed, providing more intense job search support for those workers facing a higher risk of losing their jobs. Separate sectoral policies might be required in order to support the re-employment of workers in those sectors anticipating large labour fluctuations, such as agriculture, tourism, built environment, energy and environmental services (e.g. water, wastewater, waste). Transparent communication with at-risk workers and trade unions should precede the phase-down/closure of the affected industries so as to reduce tensions and anxieties among workers. Indonesia's Pre-Employment Card Programme (Kartu Prakerja) is a competency development programme for job seekers. The programme combines temporary social assistance with skills development to help laid-off workers and job seekers (SPEC, 2020[32]). Poland offers a good example in creating effective communication when downsizing the fossil fuel sector. Information about generous retirement package and other transitional support was shared at an early stage in the divestment process for the coal sector and the gradual closure of coal mines by 2049 was successfully negotiated with trade unions (World Bank, 2018[33]; ETUC, 2020[34]).

Sharing the most recent information on green jobs and green skills vacancies with affected workers is also important. Governments can assist at-risk workers in carbon-intensive sectors with finding jobs in emerging green sectors by publishing vacancies in person or online by qualifications, sectors, locations and remuneration, preferably in partnership with public employment services. Canada has established the Industrial Adjustment Service to support workers in communities facing large-scale labour redundancies, such as due to mining closures. The service is rated as cost effective in reducing the duration of unemployment primarily by sharing information on early retirement options, employment programmes and action planning (World Bank, 2018[33]). Countries with stable Internet connection may prefer launching a national employment portal where green job vacancies are updated in real time by individual employers and employees. Like local employment service centres, an online employment portal should also provide information on relevant legislation and employment services; referral options for individualised worker profiling; and skill audits, job counselling and placement services.

During the green transition, ALMPs need to co-ordinate closely with social protection and other employment policy frameworks (e.g. for minimum wages and occupational health and safety) in order to create decent jobs and allocate displaced workers to those jobs (ILO, 2021[35]). Ideally, the ALMP frameworks can be developed in joint consultation with businesses and trade unions to make the desired policy effects durable and work well in the current and changing business environments regarding green growth.

Skills development is an important part of ALMPs that can address structural unemployment most effectively (ILO, 2022[36]). Investing in skills can help to increase the (re-)employability of the workforce affected by the green transition and to build capacity for green businesses. As a green growth process is known to favour a skilled workforce, developing skills for displaced low-skilled workers is a vital factor in facilitating their inclusion in a green economy. Upskilling and reskilling are also important for small and medium-sized enterprises (SMEs) to increase their capabilities to thrive in a new business environment (OECD, 2014[37]). It is encouraging that ASEAN has recently recognised the importance of upskilling and reskilling the region's workforce for green jobs (ASEAN-ILO, 2021[38]). However, in most ASEAN countries, the workforce's skills are largely distributed between medium and low levels of skills (Niño-Zarazúa and Torm, 2022[30]).

Governments need to increase training opportunities targeting green skills and transferable skills in order to accelerate workforce reallocation during the green transition. The absence of an agreed operational definition of green sectors/jobs/skills across Southeast Asia is a barrier to creating training for skills required by green sectors (ASEAN-ILO, 2021[38]). The training for green skills should aim at tackling the skills shortage in defined green sectors by retraining experienced workers in non-green sectors (and recruiting new trainees with little experience). The mode of training should be developed considering the skill distance between green and non-green skills and participant availability, accessibility and preference. For example, skills formation with short skill distance can be learned during on-the-job training with the same employer (ASEAN-ILO, 2021[38]). In addition, on-the-job training focused on transferable skills can facilitate job transitions, particularly for low-skilled workers from certain non-green sectors (e.g. construction, manufacturing) transitioning to similar green sectors in a relatively short period of time (ADB, 2022[39]; Bowen, Kuralbayeva and Tipoe, 2018[40]). This green skills training should be available for all individuals, but workers in need of immediate career transition due to environmental impacts or the green transition should be prioritised.

It is important to ensure that access to skills training for green jobs is available for all, particularly for workers most affected by the green transition. The workforce affected by green growth strategies is likely to be geographically concentrated in rural areas with limited access to training programmes and providers. Southeast Asia can make use of a network of public and private technical and vocational education and training (TVET) institutions to reduce the access gap for green skills development programmes in green transition hotspots. Creating opportunities for dialogue and knowledge sharing between policy makers, TVET experts and other relevant stakeholders could help them work towards a solution for improved training delivery (ASEAN-ILO, 2021[38]). Promoting enterprise awareness of and engagement in on-the-job training for green skills is also essential in order to broaden access to training. Countries can use various policy instruments to promote enterprises' participation, including financial incentives, awareness campaigns and information sharing, with prioritised support for SMEs (ADB, 2022[39]). On the participant side, removing barriers to training participation among workers is also crucial. Training cost, location, family obligations and low motivation are some of the known barriers to training participation, particularly for low-income and poor workers. Policy makers need to develop and implement policy support for reducing these barriers.

An integrated approach to skills development in co-ordination with social protection and other ALMPs is the key to maximising the policies' desired social impacts. Skills development training cannot be a stand-alone measure to facilitate the green transition in the labour market. Indeed, ALMPs (of which skills training is a component) and social protection often intersect with and complement each other. Examples include unemployment insurance benefits or cash transfers that require enrolment in job-seeking or training programmes (e.g. the Philippines) (Niño-Zarazúa and Torm, 2022[30]). The right mix and good co-ordination of different policies could lead to greater employability of workers, better matching of skills, and eventually a smooth green transition in the labour market (ADB, 2022[39]; Niño-Zarazúa and Torm, 2022[30]).

Conclusion

Global efforts to achieve the energy transition will result in profound changes in energy demand and production. The Government of Indonesia is committed to mitigating GHG emissions through the *Indonesia Long-Term Strategy for Low Carbon and Climate Resilience 2050*. This represents a significant challenge for the country, as it is highly dependent on fossil fuels, both for its own consumption and for its exports.

The results of the simulation exercise presented in this chapter show in particular that Indonesia is projected to experience a net gain in national employment if ambitious GHG emissions reduction policies are implemented globally by 2030. Employment losses are small but concentrated in relatively high-earning, high-skilled and formal sectors related to fossil fuel extraction and processing. While other forms of mining (e.g. mining of metal ores) could potentially see employment gains, their working conditions are currently worse than those in mining of fossil fuels. Moreover, mining of metal ores entails the risk of environmental degradation. Employment losses will also be geographically concentrated in the Kalimantan region, due to local specialisation in coal extraction.

Therefore, mitigating the distributional effects of the energy transition in Indonesia will require ALMPs, especially reskilling for affected workers. Only careful consideration of the social consequences of climate action can ensure broad public support and unlock a "triple dividend" of environmental sustainability, economic efficiency and equity (Vona, 2021[41]).

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Annex 4.A. Methodology

There are two simulation methods available to assess the future effects of environmental policies on the economy: computational general equilibrium and input-output. The former generally does not enable us to assess the effects on employment levels (yet, it enables to assess the effects on wages). As the primary policy concern is often stated to be employment levels, input-output is more suitable here.

The sector-level estimates of employment gains and losses in Indonesia in 2030 are based on a previous modelling exercise (Montt et al., 2018[12]), where two scenarios of global energy production are implemented in a multi-regional input-output model, resulting in direct and indirect employment change estimates.

The two scenarios, developed by the IEA (2015[11]), describe the possible evolutions of energy generation over the coming decades in terms of the energy generation sector (energy supply) and the construction, industry and transport sectors (final energy demand). The two scenarios are summarised as follows:

- The "business-as-usual" scenario, or the 6DS, should be interpreted as a particularly pessimistic pathway, where CO_2 emissions reach 44 gigatonnes in 2030. In that case, the global average temperature is on a path to increase by approximately 5.5°C by 2050 and then stabilise at approximately 4°C by 2100.
- The 2DS consists of a hypothetical alternative pathway ensuring that there is at least a 50% probability of the average global temperature not increasing by more than 2°C compared to pre-industrial levels. This means reducing the 34 gigatonnes of CO_2 emissions recorded in 2012 to 27 gigatonnes in 2030, 39% lower than the emissions in the 6DS, limiting the atmospheric concentration of GHGs to 450 parts per million. This entails, on the one hand, a transition to low-carbon energy technologies that help ensure secure and affordable energy in the long term, and, on the other, increased efficiency across industry, transport and construction. In this regard, by 2030, total energy demand would drop by 20% in the industrial sector, 29% in the transport sector and 14% in the construction sector when compared with the 6DS.

This latter scenario is close to the Sustainable Development Scenario presented in a more recent IEA publication and is less ambitious than the global "Net Zero Emissions by 2050" case (IEA, 2020[42]). The Sustainable Development Scenario is slightly more pessimistic, in terms of 2030 emissions, than the Stated Policies Scenario (STEPS), where all policy intentions and targets that were announced as of 2020 are implemented, insofar as they are backed up by detailed measures for their realisation, resulting in 36 gigatonnes of CO_2 emissions in 2030.

From the 2DS and 6DS, one obtains the demand (final and intermediate) for the different types of electricity sources, which are then used as exogenous shocks in a multi-regional input-output model (EXIOBASE 3), which enables us to estimate resulting employment changes in 44 countries and 5 world regions across 163 industries. Importantly, the model enables us to estimate indirect employment for the industries connected to the energy sector through value chain linkages.

The model follows typical key assumptions that are common to all multi-regional input-output scenario exercises: 1) Prices are not endogenised (in other words, relative prices between products do not change); changes in relative prices resulting from technological change would, for example, lead to changes in the production structure and location through substitution or complementary effects; 2) all changes implemented in the model are exogenous, implying that general equilibrium rebound effects, such as macroeconomic growth effects, are not taken into account; and 3) market shares and bilateral trade shares remain constant.

Based on this procedure, we obtain employment gains and losses in the “green” (2DS) scenario relative to the business-as-usual scenario (6DS) in 2030 at the sector level, which are then linked to the characteristics of workers active in those sectors, in order to provide profiles of likely winners and losers.

5 The green transition in agriculture: Labour implications of a conversion to organic rice

Southeast Asia is one of the world's major exporters of agricultural products. Agriculture is the major source of livelihoods for millions of people in the region. However, the sector faces challenges from unsustainable agricultural practices and increasing climate change-induced natural disasters. A transition to sustainable agriculture is urgently needed in order to curb soil degradation, deforestation and biodiversity loss. This chapter presents the findings from a simulation exercise that looks at the effects on employment and income of a transition from conventional to organic rice farming in Southeast Asia.

Agriculture plays a critical role in the economic development and rural livelihoods of people living in Southeast Asia. Members of the Association of Southeast Asian Nations (ASEAN) are some of the top exporters of rice, maize, soybeans, cassava and sugar, as well as palm oil, coconut and rubber, which accounted for 8.3% of the world's agricultural products traded in 2021 (Teng and Oliveros, 2016[1]; FAO, 2023[2]). The growth in rural economies and agricultural labour productivity, together with outmigration from rural areas, have alleviated extreme and moderate poverty substantially since the late 1980s (FAO, 2020[3]; IFAD, 2019[4]). Similarly, the region successfully reduced the prevalence of undernourishment from 20.6% in 2000 to 7.3% in 2020, lower than the world average of 9.9% (FAO/UNICEF, 2021[5]).

Agriculture and the agri-food system as a whole hold great potential for green growth in the region (ADB, 2022[6]). Agriculture is closely linked to natural resources such as land, water and biodiversity. Implementing sustainable agricultural practices could therefore reduce environmental impacts while fostering technological innovation and development. The structural transformation of the agri-food system could also create new jobs across agri-food value chains and closely related sectors. Agri-food value chains include various sectors and sub-sectors ranging from manufacturing, importing and distributing immediate agricultural inputs to processing, storing, packaging and transporting the final outputs to markets (Greenville and Kawasaki, 2018[7]; CARE, 2021[8]). The Asian Development Bank (ADB) estimates that green growth in the agriculture and food system could create 6.5 million jobs by 2030, including 2 million jobs in the organic food and beverage sectors in Southeast Asia, provided there is an annual capital expenditure of USD 6.9 billion (United States dollars) until 2030 (ADB, 2022[6]). However, a green transition would be accompanied by a restructuring of the agriculture and food-related sectors and would necessarily lead to job redistribution, with some sectors experiencing job losses.

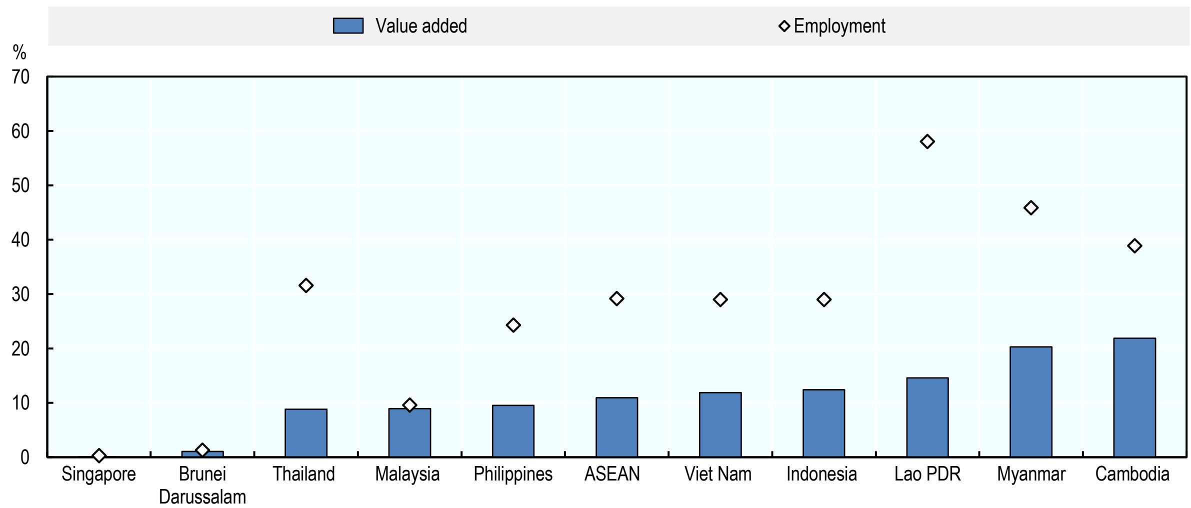
Understanding the green transition in agriculture and its potential effects on employment is essential in order to ensure that policies and interventions are designed to mitigate any adverse effects on rural livelihoods and vulnerable workers while maximising the benefits of sustainable agriculture. This chapter reviews the trends in socio-demographic and environmental conditions that call for a green transition in agriculture in Southeast Asia and the current policy frameworks for transitioning to sustainable agriculture at the regional and national levels. It then presents the findings of a simulation exercise that looks at the potential effects of a conversion from conventional to organic farming for rice in Indonesia, the Philippines and Thailand, as well as a proxy estimation for the whole region. The exercise aims to demonstrate the effects of such a transition on employment and income.

Southeast Asian agriculture: The case for a green transition

Despite its declining share of gross domestic product (GDP), agriculture still holds an important place in Southeast Asian economies and societies. In 2022, value added from the agricultural sector (including forestry and fishing) was approximately USD 323 billion, representing about 10% of the region's GDP (World Bank, n.d.[9]). Agriculture contributes on average to about 11% of GDP in ASEAN countries, with the share reaching 14% in Lao People's Democratic Republic (hereafter "Lao PDR") and 20% in Myanmar (Figure 5.1). The sector remains an important source of livelihoods for millions of Southeast Asians, accounting for about 96 million workers, or 27% of the total workforce in 2020 (FAO, 2023[10]), despite this share decreasing from about 40% in 2000.

Figure 5.1. Agriculture holds an important place in the economies and societies of Southeast Asia

Value added (% of GDP) and employment (% of total employment) in agriculture, forestry and fishing



Note: Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs as of 2022. Employment is the share of employment in agriculture, forestry and fishing out of total employment, estimated by International Labour Organization (ILO) models in 2021. The value for ASEAN is the mean value across the ten ASEAN countries.
Source: World Development Indicators.

Agriculture is particularly vital for the livelihoods and food security of smallholder farmers and the rural poor (USAID, 2022[11]). In Southeast Asia, there are about 100 million smallholder farmers with less than 2 hectares of farmland who produce roughly 30% of most food commodities in the region (Teng and Oliveros, 2016[1]; WWF, 2021[12]; Lowder, Sánchez and Bertini, 2021[13]). Most of these smallholder farmers are subsistence farmers who operate low-technology farming practices (ADB, 2022[6]). Southeast Asian smallholders depend more heavily on farm income than on any other source of earnings (68% in Asia, compared with 60% of farmers in Latin America or 58% of farmers in Africa) (Charlton, Rutledge and Taylor, 2021[14]).

Growing populations, rising incomes and rapid urbanisation have changed Southeast Asians' dietary preferences. In order to respond to changing food demand, the agricultural sector has diversified and intensified outputs. Total food consumption and non-cereal crop consumption, particularly animal products and fruits and vegetables, increased significantly in the region between 1990 and 2013 (IFAD, 2019[4]). Southeast Asia will continue to see an upward trend in domestic demand for food as population, income and urbanisation growth persists in the medium term. Southeast Asians are forecast to continue to spend more on food and lead market growth at an annual rate of 4.7% between 2019 and 2030 (PwC, Rabobank and Temasek, 2021[15]). By 2030, food and beverages will be the largest spending category for consumption in ASEAN countries, representing 30% on average and up to 40% for the Philippines and Viet Nam (World Economic Forum/Bain & Company, 2020[16]). By 2031, average calorie availability in South and Southeast Asia is projected to increase by almost 200 kilocalories (kcal) per person per day to average about 2 850 kcal, just 6.5% below the world average. The increase will be mainly driven by consumption of dairy products, meat and vegetable oils (OECD/FAO, 2022[17]).

Demographic and lifestyle changes have also led to a transformation of agri-food value chains, with a growing focus on improving productivity, efficiency and sustainability. Agriculture in Southeast Asia has achieved stable and sustained productivity growth, recording the highest agricultural value added per worker compared with other regions in the world (OECD/FAO, 2017[18]; IFAD, 2019[4]). This improvement in agricultural productivity has been a key driver of agricultural output growth, accounting for over 60% of output growth between 2001 and 2013, compared with 13% in the 1980s (OECD/FAO, 2017[18]). However, this output growth has been significantly influenced by increased input use (including land, labour capital – animals and machinery, fertiliser and feed use), which are due to a combination of increased intensification of activities and area expansion, particularly linked to palm oil production (ibid.).

Behind Southeast Asia's growing agri-food industry, however, is the degradation of its ecosystem. While agricultural production is heavily reliant on biodiversity, natural cycles and ecological processes, paradoxically, current agricultural practices accelerate freshwater depletion, soil degradation and air pollution in Southeast Asia (ADB, 2022[6]; ILO, 2018[19]). The increased need for arable land for livestock and higher-value crops has led to the massive conversion of primary forests for agriculture (IFAD, 2019[4]). Indonesia and Malaysia, where this land conversion has been particularly pronounced, are reported to have lost vast areas of biodiversity-rich tropical forests and observe an increase in carbon emissions from agriculture (OECD/FAO, 2017[18]). Palm oil production has been the leading cause of deforestation, with foreign demand being the main driver. Half of the production in Indonesia was exported and three quarters of the production in Malaysia was exported in 2021 (FAOSTAT, 2022[20]). The case of palm oil raises concerns as it is increasingly used for biofuels and other non-food demand. In 2018, more than half (53%) of all palm oil imported to the EU was used to make biodiesel for cars and 12% to generate electricity and heating (Muzii, 2019[21]).

The intensification of fertiliser inputs, which surpassed growth in labour inputs since the 1990s, has also worsened the quality of soil, water and air (IFAD, 2019[4]; OECD, 2017[22]). The use of heavy machinery releases harmful gases and contributes to soil compaction, erosion, and eventually air pollution and loss of habitat for wildlife. At the same time, agriculture produces more greenhouse gas (GHG) emissions than any other sector in Southeast Asia, including rice farming, a major source of methane gas emissions (Aryal, 2022[23]). The Agriculture, Forestry and Other Land Use sector contributes to 23% of global greenhouse gas (GHG) emissions (IPCC, 2007[24]). In Southeast Asia, the agri-food makes up 50% of all emissions (PwC et al., 2023[25]). Such environmental degradation increases agricultural sectors' vulnerability to natural disasters and climate change and intensifies sectoral competition with domestic and industrial users of land and freshwater (OECD, 2017[22]; IFAD, 2019[4]).

Social challenges related to the agricultural sector also continue to linger. One such challenge is the difficulty for smallholders and small agribusinesses to integrate into global agri-food value chains. In Southeast Asia, there has been a shift towards large-scale, commercial agriculture, with the emergence of large agribusinesses that are involved in the entire value chain, from production to processing and marketing. This has led to greater consolidation and integration of the agri-food sector, with larger enterprises acquiring smaller ones and expanding their operations across the value chain (Meemken et al., 2021[26]; Marques Vieira et al., 2013[27]). This approach to value chain development, often supported by governments, has excluded small-scale producers, low-income producers and the extensive network of informal traders and small businesses in the region (OECD, 2021[28]). Another challenge is persistent rural poverty. Across Southeast Asian countries, between 40% and 95% of the extremely poor live in rural areas (IFAD, 2019[4]). The increase in agricultural productivity based on capital and non-labour investment did not necessarily translate into better earnings for smallholders and the rural population.

An alternative approach is increasingly needed in Southeast Asian agriculture. The region offers several enabling conditions for boosting sustainable agriculture and developing organic markets. First, there is a growing demand for organic consumption in the region. A World Economic Forum survey shows that 80% of the region's consumers appreciate sustainability and an eco-friendly lifestyle and strongly prefer fresh and healthy food (World Economic Forum/Bain & Company, 2020[16]). Second, sustainable agri-food systems could offer lucrative business opportunities for investors. Agri-food technology investments in the region quadrupled to USD 423 million between 2014 and 2019, and the region's continued transition towards sustainable agriculture offers USD 1.6 trillion in investment opportunities (PwC, Rabobank and Temasek, 2021[15]). Finally, Southeast Asian governments are increasingly cognisant of the fact that more sustainable agricultural practices are needed. Countries are now integrating the sustainability concept into their agricultural development plans and putting forward policy measures to promote sustainable agricultural practices, including establishing standards and certification for organic products (Indonesia), promoting a Participatory Guarantee System (PGS) (the Philippines and Viet Nam) and providing training and raising awareness on organic farming practices (the Philippines) (FiBL/IFOAM, 2022[29]).

Southeast Asia's policy frameworks for sustainable agriculture

Policies and institutional frameworks facilitate the green transition in agriculture and pave the way for potential green jobs in the future. Southeast Asia is committed to promoting the development of a green and sustainable agri-food sector, albeit with varying degrees of enforcement across countries. At the regional level, pursuing ecologically sound agriculture has become one of ASEAN's core principles to ensure food security and rural development in order to combat hunger and poverty in the medium to long term, as shown in the *ASEAN Integrated Food Security (AIFS) Framework and Strategic Plan of Action on Food Security in the ASEAN Region (SPA-FS) 2021-2025* (ASEAN, 2020[30]). The political direction towards the sustainable development of agriculture was reaffirmed by ASEAN's ambitious long-term vision of transitioning into a low-carbon economy, which was announced in 2021 (ASEAN, 2021[31]). Specifically, the *Strategic Plan of ASEAN Cooperation in Food, Agriculture and Forestry,* (*2016-2025)* defines the vision and goals for the food, agriculture and forestry sector. The aims of this ten-year plan include ensuring equitable, sustainable and inclusive growth in the agri-food and forestry sectors and increasing resilience to climate change, natural disasters and other shocks (ASEAN, 2017[32]). Other policy documents such as on the *ASEAN Guidelines for Sustainable Agriculture* provide additional resources to ensure sustainable development of the food, agriculture and forestry sectors (ASEAN, 2022[33]). Recognising the substantial challenges posed by highly hazardous pesticides to human health and the environment, the ASEAN Ministers on Agriculture and Forestry (AMAF) issued a Statement to reduce the use of harmful agrochemicals for food safety, public health, occupational safety, and environmental protection on the occasion of the 45th AMAF Meeting in Kuala Lumpur, on 4 October 2023.

ASEAN has established two major voluntary quality standards for safe food product aimed at supporting sustainable agriculture. One is the ASEAN GAP: good agricultural practices for production of fresh fruit and vegetables in the ASEAN region. It is a voluntary standard, adopted in 2006, for handling fruit and vegetables throughout the producing, harvesting and post-harvesting processes. Although the ASEAN GAP was originally designed to promote food safety, it contains quality guidelines that encourage minimal use of chemical fertilisers and soil additives in order to reduce the risk of environmental harm during food production and environment management (ASEAN/AusAID, 2021[34]). The ASEAN GAP has been the agreed benchmark for national good agricultural practices (GAPs) in the Southeast Asia region. Subsequently, in 2014, ASEAN approved the aquaculture equivalent of this standard, Good Aquaculture Practices (GAqP). Another guiding document is the ASEAN Standard for Organic Agriculture (ASOA). The ASOA, which was adopted in 2014, sets the standards for organic food products at every stage of the supply chain from production to labelling.

ASEAN has produced various policy frameworks promoting sustainable agriculture, mainly in the form of voluntary guidelines to expand sustainable and organic farming in the region. The documents clearly identify those responsible for the strategies, but the performance review of these activities is less obvious. Although these policy documents are intended to support ASEAN Member States to introduce binding laws and directives (GrowAsia, 2022[35]), it is difficult to assess how much these measures actually lead to regulatory changes in the countries. Furthermore, their effects on the actual adoption of sustainable farming remain to be further evaluated.

At the national level, each of the ASEAN countries has created legislative or regulatory frameworks with varying degrees of enforcement and support in order to encourage the growth of sustainable agriculture. Indonesia, the Philippines, Thailand and Viet Nam are key agricultural economies in the region that had been encouraging fertiliser and nitrogen overuse through subsidies since the 1970s (ADB, 2021[36]). However, more recently, Lao PDR, the Philippines and Viet Nam have put in place stand-alone frameworks that include targeted policies, laws and initiatives to support the transition to sustainable agriculture. Other countries in the Southeast Asian region have developed legislative frameworks to promote sustainable agriculture as part of larger policy documents, such as national agriculture or economic development plans. Given that these frameworks are included among other development objectives, the level of material support given to sustainable agriculture varies widely across countries. An overview of these policy frameworks and instruments is provided in Table 5.1.

Table 5.1. Policy frameworks for promoting sustainable agriculture in Southeast Asia vary at the national levels

Region/country	Legislative frameworks	Mainstreaming mechanisms	Policy instruments
Philippines	Organic Agriculture Act of 2010	National Organic Agriculture Board	National Organic Agriculture Program
Indonesia	Master Strategy on Agricultural Development (2013-2045)	Competent Authority for Organic Food (OKPO)	SNI 6729:2016 organic agriculture standard
Thailand	*The Thirteenth National Economic and Social Development Plan (2023-2027)* *National Organic Agriculture Development Strategy (2017-2021)*	National Organic Development Strategic Committee	Programme for the Promotion of Organic Rice Production
Viet Nam	Decree 109/2018 ND-CP on Organic Agriculture (2018) Plan on restructuring of agriculture in 2021-2025	Ministry of Agriculture and Rural Development	Vietnamese Good Agricultural Practices (VietGAP)
Cambodia	Five-Year Strategic Plan for Agriculture Sector (2019-2023)	Conservation Agriculture and Sustainable Intensification Consortium	Cambodia Partnership for Sustainable Agriculture Cambodian Good Agricultural Practices (CamGAP)
Lao PDR	Green and Sustainable Agriculture Framework for Lao PDR to 2030 National Green Growth Strategy of the Lao PDR till 2030	X	Clean Agriculture Development Project Laos Certification Body (organic)
Malaysia	Department of Agriculture Strategic Plan (2016-2020)	X	Malaysian Organic Certification Scheme (myOrganic)
Singapore	Sale of Food Act: Food Regulations (2005) Singapore Standard: Specification for Organic Primary Produce (2017)	Singapore Food Agency	"30 by 30" and Agri-food Cluster Transformation (ACT) Fund (Singapore Food Agency)
Myanmar	*Myanmar Agriculture Development Strategy and Investment Plan (2018-19 ~ 2022-23)*	X	X
Brunei Darussalam	X	X	X

Note: Legislative frameworks include laws, policies, initiatives and statements focused on creating an enabling environment for, and facilitating, sustainable agriculture. Mainstreaming mechanisms refer to the implementation and monitoring structures aiming to bring about the targeted effects of the legislative frameworks (e.g. public expenditure review, strategic assessment, councils for sustainable development). Policy instruments for sustainable agriculture may include certification of sustainable agri-food production and trade, subsidies for sustainable farming, financial support for sustainable farmers and landowners, sustainable agriculture investment frameworks and incentives, inclusive green social enterprises, sustainable public procurement, and green innovation. The three dimensions are based on the Organisation for Economic Co-operation and Development (OECD) policy framework for greening growth in developing countries (OECD, 2012[37]). Green cell shading indicates that there is targeted support (bodies or documents dedicated to developing sustainable agriculture), yellow cell shading indicates that there is auxiliary support (the existence of sustainable agriculture policies as part of a larger plan or strategy) and pink cell shading indicates that there is little or no policy support for sustainable agriculture.
Source: Authors' own elaboration

Relative to the steady progress in legislative support, the mainstreaming mechanisms for implementing the regulations and rules created for sustainable agriculture remain underdeveloped. Four out of ten ASEAN countries have developed some form of overseeing committee for sustainable agriculture with varying degrees of intervention. Indonesia, the Philippines, and Thailand have established oversight boards with the aim of promoting and regulating organic agriculture in these countries, whereas Cambodia has created a consortium to monitor sustainable agriculture more broadly. In the remaining ASEAN countries, the monitoring of sustainable agriculture either falls under the scope of larger bodies or is non-existent. However, even when countries appoint an organisation responsible for overseeing policy implementation, they often leave the precise monitoring and evaluation processes and mechanisms remain obscure.

Most ASEAN Member States have policy instruments to support the transition to sustainable or organic farming. The most common policy tools include nationwide quality assurance standards, direct and indirect subsidies for farmers converting to organic farming, or other fixed-term one-off farm development programmes. Thailand has provided financial incentives and subsidies to encourage organic farming and has developed a peer-to-peer certification system (ADB, 2017[38]). For example, farmers who participate in organic rice cultivation are eligible for a government subsidy of 2 000-4 000 Thai baht (USD 58-115) per rai (1 600 square metres) for a period of three years (National News Bureau of Thailand, 2023[39]). Many countries have developed a certification body for organic agriculture, which often includes programmes that reduce the financial burden of certification for farmers. Although Singapore does not provide direct support for sustainable agriculture, it employs several satellite support measures through programmes such as “30 by 30” and the ACT Fund, which encourages sustainable urban agriculture projects in a bid to boost food security.

Overall, sustainable agriculture frameworks in Southeast Asia require improvement, despite varying levels of commitment across different countries. Legislative frameworks for sustainable agriculture should have more prominence in high-level documents, while mainstreaming mechanisms and policy instruments need concrete programmes as well as monitoring and evaluation systems in order to measure achievements. Governments in Southeast Asia need to invest more in the relevant policy measures put in place and enhance regulatory frameworks for sustainable agriculture.

The potential of organic agriculture in the green transition

An arguably more sustainable alternative to conventional agriculture is organic farming, which offers a strict framework for agricultural practices based on principles of natural resource protection and sustainability (FiBL/IFOAM, 2022[29]; ADB, 2021[36]). A shift towards organic agriculture has been associated with a 20% reduction in GHG emissions through abstention from using fertiliser (Scialabba and Müller-Lindenlauf, 2010[40]). In some cases, organic farming has been associated with increased carbon sequestration by 40-72% (ibid.). Organic farming methods avoid the use of non-natural inputs (such as artificial fertilisers, synthetic chemicals and genetically modified organisms) during the farming process (ILO, 2018[19]). In 2020, organic agricultural land in Asia accounted for 8% of global organic agricultural land, an increase by almost 14 times since 2001 (FiBL/IFOAM, 2022[29]). Despite this promising trend, organic farming represents a small percentage of overall agriculture in Southeast Asia (Table 5.2). There is, however, large potential for conversion, with Indonesia, the Philippines, Thailand and Viet Nam ranked in the top ten countries with the largest organic agricultural land area in Asia in 2020 (FiBL/IFOAM, 2022[29]).

Table 5.2. Organic agricultural land area in Southeast Asia in 2020

Country	Organic farmland (in hectares)	Organic farmland area (in percentage of total agricultural land)
Cambodia	35 879	0.6
Indonesia	75 793	0.1
Lao PDR	3 266	0.1
Philippines	191 770	1.5
Thailand	160 802	0.7
Viet Nam	63 536	0.5

Note: There are large variations between Research Institute of Organic Agriculture (FiBL) data and National Statistics Office of the Philippines data, which estimated the amount of organic agricultural land at 350 000 hectares in 2016.
Source: FiBL/IFOAM (2022[29]).

Local demand for organic food in Southeast Asia has been steadily increasing, despite the majority of organic products produced in Southeast Asia being exported to other regions. The COVID-19 pandemic dealt a heavy blow to the agri-food trade, but the organic food market has rebounded strongly due to heightened awareness of health and nutrition (ADB, 2021[36]). In 2018, organic retail sales in Thailand were valued at EUR 12 million and at EUR 18 million in Viet Nam (FiBL/IFOAM, 2020[41]). Southeast Asian food markets forecast a 4.7 annual growth rate between 2019 and 2030, totalling USD 500 billion in consumer-driven spending on food (PwC, Rabobank and Temasek, 2021[15]). A market survey by PwC shows that Southeast Asian consumers value freshness and health-based products over price factors when making a purchasing decision (ibid.), which are characteristics associated to organic food products. Other significant markets for the organic food industry are in Japan, India, South Korea and Chinese Taipei. Organic farming provides one avenue the region can explore further in order to recover from pandemic-induced setbacks and contribute to food security.

New production methods and input changes in organic agriculture could increase employment, particularly in the upstream activities of the agriculture value chain. Higher labour intensity for organic practices than for conventional practices provides more on-farm jobs and wage work (Prihtanti et al., 2014[42]; ILO, 2018[19]). The ILO estimates that a transition to sustainable farming (measured by conservation and organic farming) would moderately increase labour demand in livestock farming, as well as waste management, construction, renewable energy and services (ILO, 2018[19]). On the other hand, labour demand in primary cereal production would significantly decrease, with a minor decrease in the mining and manufacturing of fossil fuels, and nuclear sectors as well (ILO, 2018[19]). Farmers and wage workers engaged in organic agriculture could also have greater opportunities for longer-term employment and a secure income, as organic crop diversification and rotation need more farm labour all year round or for extended periods (Finley et al., 2018[43]; Feliciano, 2019[44]).

Organic farming requires different types of inputs (e.g. fertilisers and pesticides) and techniques (e.g. crop diversification and cross-crop cultivation) which are less harmful for the environment than those used in conventional farming. Expanding organic agriculture will, by definition, reduce the demand for genetically modified, synthetic, or mineral inputs and increase the demand for organic equivalents, together with waste management and renewable energy (ILO, 2018[19]; Hijbeek et al., 2019[45]). Studies confirm that organic farming systems are consistently favourable for soil carbon levels, soil quality, plant diversity and biodiversity, and energy efficiency (Reganold and Wachter, 2016[46]). However, organic production methods tend to have 20% lower yields on average than conventional agriculture (Meemken and Qaim, 2018[47]), which would require organic farming to use more land for comparable output volumes. There are exceptions with certain organic farming techniques (e.g. crop diversification, intercropping) that perform better and achieve higher margins for a longer period than conventional sole cropping (Bedoussac et al., 2015[48]). The above studies relate mostly to developed countries, as data from developing countries are scarce.

When compared with conventional farming, organic farming could, in theory, improve incomes of farmers and wage workers. Price premiums for organic products, which are on average 50% above conventional products (Meemken and Qaim, 2018[47]), are the main mechanism for these economic returns, together with reduced production cost, diversified crops and income sources, and increased resilience to input price volatility on the supply side (Reganold and Wachter, 2016[46]; Seufert and Ramankutty, 2017[49]). Several studies show that organic premiums at the farmer level in developing countries can range from 6% to 44% (Setboonsarng, Leung and Cai, 2006[50]; Doanh, Thuong and Heo, 2018[51]; Beuchelt and Zeller, 2011[52]; Ibanez and Blackman, 2016[53]). However, the price premium at the retail level is often not necessarily reflected in what farmers actually receive; this is due to numerous actors along the value chain capturing some of the benefits (Minten et al., 2018[54]), with payment received by organic farmers in some cases not being any higher than that in conventional markets (Meemken and Qaim, 2018[47]). Price premiums captured will depend on multiple external factors, such as the efficiency of the organic value chain, the distance between major urban areas and rural organic areas, accessibility of the certified markets, and transport and retail infrastructure (Finley et al., 2018[43]; Meemken and Qaim, 2018[47]).

Despite optimistic employment and income prospects, the effects of a conversion to organic farming on job quality or the bargaining power of small-scale producers are less clear. How organic certification schemes affect power hierarchies, working conditions, and the redistribution of certificate-oriented benefits for wage labourers (particularly those employed in small farms) is relatively unclear (Meemken et al., 2021[26]). Whether the conversion to organic farming boosts decent work opportunities for farmers is also debatable, and there is little evidence from which to draw conclusions (Orsini, Padel and Lampkin, 2018[55]). Moreover, sustainable certification has generated more power and revenues for large companies in food manufacturing, retail and transportation, influenced by the consolidation of the market for organic produce (Meemken et al., 2021[26]; Marques Vieira et al., 2013[27]). Farmers do not always receive a share of wider retail profit margin due to their weaker bargaining power in the distribution structure. More research is needed in order to determine how the adoption of organic farming affects full and productive employment, rights at work, social protection, and the promotion of social dialogue among farm workers.

The social outcomes of organic agriculture are consistently positive. The adoption of organic agriculture encourages women's engagement in paid employment by opening up new employment opportunities along the organic value chain, as well as increasing women's access to information and technical training (German et al., 2020[56]; Setboonsarng and Gregorio, 2017[57]). It also helps to promote local and indigenous agricultural knowledge and preserves cultural heritage (Jouzi et al., 2017[58]). Organic agriculture offers social benefits indirectly through the services provided by farmers' organisations. Transitioning to organic farming promotes certified farmers' organisations at local and regional levels and gives small-scale farmers a chance to define new responsibilities and rules for the management of resources (UNCTAD/UNEP, 2008[59]). Farmers' organisations provide financial and technical support, training and education for agricultural productivity and invest in community development and social services (e.g. education, healthcare) (Lin et al., 2022[60]; Jouzi et al., 2017[58]; Qiao et al., 2016[61]). The services for capacity building and organic technology are particularly important for integrating small and medium-sized farms, as well as women and young rural workers, into the agri-food value chain (ADB, 2022[6]). Farmers' organisations can also help farmers improve the profitability of their organic products by offering bargaining power, collective marketing and access to credits and markets (Meemken and Qaim, 2018[47]). Sustainable and diversified farming systems could eventually lead to the enhanced resilience of rural communities to food insecurity, climate change and other external shocks.

Understanding the labour implications of a green transition in agriculture is essential in order to inform Southeast Asian policy makers about how to make the transition more inclusive for all. The employment risks associated with the transition are particularly important for the livelihoods of farmers and other actors in the agri-food value chain. Among sustainable farming methods and practices, organic agriculture is relatively well defined and regulated, which is advantageous for measurement and analytical purposes. Nonetheless, at the same time, organic agriculture is a contentious farming method in terms of its environmental and nutritional merits, and uptake remains very limited (Paarlberg, 2021[62]). An analysis of the conversion to organic farming and labour market changes can help to identify the most vulnerable sectors and workers during the agricultural green transition and to anticipate the policies and programmes that will support their inclusion. By considering the interconnections between organic agriculture and other policy objectives, policy makers can develop coherent and effective policies that promote more sustainable and resilient food systems.

Understanding the impact of a green transition in agriculture: A simulation using organic rice farming

This section illustrates the effects of a conversion from conventional to organic farming practices on output, employment and income. Organic agriculture provides a number of environmental benefits, such as enhanced soil fertility, increased biodiversity and reduced pollution (IFOAM, 2021[63]). Given these advantages, several countries in Southeast Asia have enacted policies to encourage farmers to transition to organic farming. The Philippines and Thailand in particular have set targets for the expansion of organic agriculture which we used to create scenarios for this analysis. Organic agriculture is also clearly defined by international standards and certifications, which confirms that definitions of "organic" are harmonised between the literature and surveys (ILO, 2018[64]). At the regional level, ASOA provides standards for organic practices across countries in the region as part of the Standards in the Southeast Asian Food Trade (SAFT) (ASEAN, 2017[65]).

This section presents the results of a simulation exercise done for three scenarios of rice farmland conversion from conventional to organic farming practice. The model looks at reaching a 3%, 5% and 7% share of organic rice farmland, reflecting the national targets set by the Philippines and Thailand as closely as possible. The Philippines' overall goal was to reach 5% of organic agriculture land area by 2020 (Philippines Bureau of Agriculture and Fisheries Standards, 2018[66]). In its *National Organic Agriculture Development Strategy* (2017-2021), Thailand also provides a target to specifically increase organic rice farming to 400 000 hectares of land area by 2021, which represents 2.5% of total arable land area (FAOSTAT, 2022[20]; Thailand Government Public Relations Department, 2017[67]).

The simulation exercise is based on input-output table (IOT) modelling. IOTs describe the sale and purchase relationships between producers and consumers within an economy, using data from a broad range of sources. IOTs are an optimal choice for evaluating cascading effects of the growth or change in demand in one sector by identifying the impact on sectors closely linked to agriculture. Alternatives like computable general equilibrium (CGE) models would allow simulating changes in the prices of outputs and inputs of the different sectors, thus affecting the new equilibrium. Nonetheless, the choice of IOT modelling is appropriate for simulating small shocks like done here. IOTs are readily available for most countries and are transparent in their assumptions. The challenge is that most national IOTs do not include a predefined sector for organic agriculture, and therefore this was estimated and constructed within pre-existing tables (see Annex 4.A for details on the methodology used).

Due to data limitations on organic crops, rice was selected for this exercise, as it is the single most critical crop in Southeast Asia, responsible for 50% of the calorie intake of the region's population. Rice is also the highest emitter of methane, the second most important greenhouse gas contributor to climate change following carbon dioxide. Rice is responsible for 10% of global methane emissions (FAO, 2020[68]). In Southeast Asia, rice cultivation accounts for as much as 25-33% of the region's methane emissions (Umali-Deininger, 2022[69]). Rice is cultivated in more land areas than any other crops in Cambodia, Lao PDR, Myanmar, Thailand and Viet Nam (IRRI, 2020[70]).

The simulation using rice provides useful insights for Southeast Asia's labour force engaged in agriculture and the sectors that are directly and indirectly linked to agriculture. Data for three countries (Indonesia, the Philippines and Thailand) were available for the simulation. An average for Southeast Asia is derived using the rice sector estimates in Thailand's IOTs as a proxy for Cambodia, Lao PDR and Viet Nam's rice industries, which do not exist in their national IOTs.

Data on the organic farmland area come from the Research Institute of Organic Agriculture (FiBL) and are the result of a global survey on organic farming (FiBL/IFOAM, 2021[71]). The organic indicators begin in 2000 and are broken down by crops, the organic area covered (in hectares) and the share of the organic farmland area compared with the total farmland are. Due to the volatility in agricultural production unrelated to organic production (e.g. rainfall, crop cycling, etc.), as well as gaps in data collection, organic farmland area is estimated as the average of the last five to ten years between 2010 and 2020, due to high data volatility (Table 5.3). This evens out production and provides a more stable estimate of organic production, particularly given some notable variations in FiBL estimates and what has been published in national reports.

There is limited literature exploring the cascading effects of a shift from conventional to organic agriculture in developing countries. Much of the literature focuses on the effects on farm costs and profitability in developed countries or requires intensive data collection through the design of specific projects or surveys (Reddy et al., 2022[72]; Seufert, 2012[73]; Meemken and Qaim, 2018[47]; Reganold and Wachter, 2016[46]). Furthermore, the literature often does not look explicitly at the economic impacts of the switch to organic agriculture on the food system. There are examples where life cycle assessment is applied to organic agriculture, but the focus tends to be on the practice's environmental benefits rather than on economic outcomes (van der Werf, Knudsen and Cederberg, 2020[74]; Meier et al., 2017[75]). This simulation using rice provides insights into the economic effects of a shift towards organic agriculture and the possible changes it brings to the food system, including food processing industries and food-related services, as well as chemical industries that provide inputs to the sector.

Table 5.3 Organic rice farmland area in Southeast Asia

Country	Organic rice farmland area (hectares)	Total rice farmland area (hectares)	5% share of organic rice farmland area (hectares)
Cambodia	18 938	2 960 692	148 035
Indonesia	32 803	14 005 135	700 257
Lao PDR	3 722	931 885	46 594
Philippines	2 487	5 150 700	272 535
Thailand	86 910	9 787 281	489 364
Viet Nam	7 611	7 768 692	388 434

Source: FiBL, IFOAM (2021[71]).

A conversion to organic rice farming practice has positive effects on output, employment and income

A simulated increase in the farmland area dedicated to organic rice farming generally yields more employment and income than an equivalent increase in farmland area dedicated to conventional agriculture. "Employment" is expressed in the number of full-time equivalent (FTE) jobs and includes direct and indirect jobs created. "Income" is expressed in the monthly earnings of workers in the sector in USD.

The expansion scenarios simulated are the targets of a 3%, 5% and 7% share of organic farmland area out of total rice farmland area. The expansion refers to a conversion from conventional rice farms to organic rice farms, no additional land use. The results are compared with the same hectare increase in conventional rice farmland area. For example, if an organic conversion to reach 5% land share is equivalent to 300 000 hectares, the comparison is done for the same nominal increase in conventional rice farmland. The effects of this expansion on employment and income are described first for the rice sector, then for the agricultural sector (including hunting and forestry) and, finally, for sectors closely linked to the agri-food system.

An increase in organic rice farmland results in more jobs and income than an equivalent increase in conventional rice farmland

An expansion of organic rice farmland to reach a 5% share of total rice farmland area (medium scenario) results in an increase in employment of 27 FTE jobs in the organic rice sector, on average for countries in Southeast Asia. This can be considered as the direct effect of the expansion. With an equivalent expansion of conventional rice farmland area, only 5 FTE jobs are created in the conventional rice farming sector (Table 5.4).

The gains in income from an expansion in organic rice farmland are also greater for organic rice workers than for conventional rice workers. Organic rice farmers/workers can earn USD 7.52 more per month from a medium expansion scenario. The model assumes that the output value increase is captured by farmers and workers in the organic rice sector. In countries where farmers' monthly income ranges from USD 20 to USD 400, this increase can represent a significant contribution. On the other hand, an equivalent expansion of conventional rice farmland area increases rice farmers'/workers' income by only USD 0.42 per month on average for countries in the region (Table 5.4).

Table 5.4. Effects of rice land expansion on output, employment and income in the organic rice sector compared with the conventional rice sector

Country	Land increase scenario	Employment (FTE jobs)		Income (Monthly, USD)	
		Conventional	*Organic*	*Conventional*	*Organic*
Southeast Asia, average	3%	6	16	0.43	4.37
	5%	5	27	0.42	7.52
	7%	5	38	0.41	10.68
Indonesia	3%	23	68	2.53	20.40
	5%	22	117	2.48	35.15
	7%	22	166	2.43	49.91
Philippines	3%	0.2	3	0.14	N/A
	5%	0.2	6	0.14	N/A
	7%	0.2	8	0.14	N/A
Thailand	3%	6	3	0.00	0.02
	5%	6	6	0.00	0.02
	7%	6	9	0.00	0.03

Note: Southeast Asia values include the average of six countries: Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam. The rice sector estimated in Thailand's IOT is used as a proxy for Cambodia, Lao PDR and Viet Nam due to missing data in respective national IOTs. Employment does not include part-time and seasonal employment. Reading: In Indonesia, an increase in organic rice farmland to reach 5% share of total rice farmland creates 117 additional FTE jobs in the organic rice sector. An equivalent size expansion of conventional rice farmland creates 22 jobs in the conventional rice sector.
Source: Authors' own calculations based on OECD IOTs.

The effect on employment in the overall rice sector is greater for an expansion in organic rice farmland than for an expansion in conventional rice farmland. In the medium scenario, the rice sector in Southeast Asia would create an average of 126 more FTE jobs, compared with an average of only 6 more FTE jobs created under an equivalent conventional rice farmland expansion (Table 5.5). In Indonesia, the medium scenario increase in organic rice farmland would create 543 FTE jobs in the rice sector compared to 22 FTE jobs for the equivalent conventional expansion. This can be explained by the fact that organic farming practice requires higher labour inputs than conventional farming, but also includes indirect employment effects in the overall rice sector. The simulation does not include part-time and seasonal employment, which is likely to experience similar positive gains and is very relevant for the agricultural sector.

The income gains in a medium scenario are also greater with organic rice farmland expansion than with conventional rice farmland expansion. Rice farmers/workers in Southeast Asia, on average, can earn USD 8.11 more per month from an expansion in organic rice farmland. On the other hand, a conventional rice farmland expansion of the same magnitude increases income by only USD 0.21 per month, on average, for countries in the region (Table 5.5).

Table 5.5. Effects of organic and conventional rice farmland expansion on employment and income in the rice sector

Country	Land increase scenario	Employment (FTE jobs)		Income (monthly, USD)	
		Conventional	*Organic*	*Conventional*	*Organic*
Southeast Asia, average	3%	6	71	0.22	4.63
	5%	6	126	0.21	8.11
	7%	5	185	0.21	11.72
Indonesia	3%	23	307	1.28	23.47
	5%	22	543	1.26	41.22
	7%	22	792	1.24	59.70
Philippines	3%	0.2	15	0.07	4.08
	5%	0.2	27	0.07	7.07
	7%	0.2	38	0.07	10.27
Thailand	3%	6	16	0.001	0.01
	5%	6	32	0.001	0.02
	7%	6	49	0.001	0.03

Note: Southeast Asia values include the average of six countries: Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam. The rice sector estimated in Thailand's IOT is used as a proxy for Cambodia, Lao PDR and Viet Nam due to missing data in respective national IOTs. Employment does not include part-time and seasonal employment.
Source: Authors' own calculations based on OECD IOTs.

Expansion of organic rice farmland area creates winning and losing sectors

Observing the changes at the sectoral level provides a dynamic picture of how output, employment and income are affected in different sectors through direct and indirect input-output linkages. Not surprisingly, the agricultural sector (including hunting and forestry) sees the largest return from the expansion of organic rice farmland; it is followed by several closely linked sectors in the agri-food system such as food products, beverages and tobacco, and wholesale and retail trade.

The medium scenario expansion creates an additional USD 2.2 million in agricultural output, on average, for countries in the region. The equivalent area expansion of conventional rice farmland results in an overall agricultural output increase of USD 1.5 million, or 68% of the organic rice farmland expansion scenario. Agricultural output value increases by USD 7.22 million in Indonesia, by USD 1.60 million in the Philippines, and by USD 1.42 million in Thailand. Organic rice farmland expansion yields higher outputs than for an equivalent expansion in conventional rice farmland, for most countries, except Thailand (Table 5.6).

Employment gains in the agricultural sector in the medium scenario is 43% higher for an expansion in organic rice farmland scenario compared with the equivalent increase in conventional rice farmland. Employment in the agricultural sector increases by an average of 0.023 FTE jobs in the 5% organic rice farmland expansion scenario, compared with 0.013 FTE jobs for the equivalent size expansion in conventional rice farmland (Table 5.6). Regarding income, workers in the agricultural sector do not see significant gains, with an average increase of USD 0.017 in monthly income for workers across countries in Southeast Asia (Table 5.6), but still 30% higher than for conventional rice farmland increase. The small nominal increases, in both employment and income, likely relates to the small contribution that rice farming makes to overall employment and wages compared with other sectors in the economy, as well as the small percentage of land increase simulated.

Southeast Asian workers in the agricultural sector (including hunting and forestry) are older, are less educated, are paid less, and are more likely to live in rural areas than workers in non-agricultural sectors. Farmers are more likely to be men than women. With regard to their occupation, 71% of agricultural workers are skilled agricultural and trade workers, while the rest are elementary workers. These jobs require a medium to low level of skills. Most farmers (80%) are self-employed, and more than 80% are working informally with little access to social protection programmes. A significant shift towards greener production practice – using organic or other more sustainable methods – implies that farmers and workers in the agricultural sector will adopt these practices. Given the profiles of agricultural workers, technical training and financial support will be needed in order to overcome the initial barriers created by the transition.

Table 5.6. Top three winning sectors from a medium scenario expansion in organic rice farmland area, compared with equivalent conventional rice farmland expansion

Country	Dimension	Sector	Conventional rice farmland expansion	Organic rice farmland expansion
Southeast Asia, average	Output (in USD million)	Agriculture, hunting, forestry	1.500	2.205
		Food products, beverages and tobacco	0.084	0.109
		Machinery and equipment, including motor vehicles	-0.003	0.019
	Employment (FTE jobs)	Agriculture, hunting, forestry	0.013	0.023
		Food products, beverages and tobacco	<0.001	<0.001
		Other service activities	<0.001	<0.001
	Income (monthly, USD)	Agriculture, hunting, forestry	0.012	0.017
		Wholesale and retail trade; repair of motor vehicles	0.002	0.013
		Manufacturing	-0.001	0.002
Indonesia	Output (in USD million)	Agriculture, hunting, forestry	3.665	7.220
		Food products, beverages and tobacco	0.131	0.086
		Financial and insurance activities	0.022	0.073
	Employment (FTE jobs)	Agriculture, hunting, forestry	0.062	0.122
		Wholesale and retail trade; repair of motor vehicles	<0.001	0.001
		Other service activities	<0.001	<0.001
	Income (monthly, USD)	Agriculture, hunting, forestry	0.026	0.053
		Wholesale and retail trade; repair of motor vehicles	0.001	0.007
		Financial and insurance activities	0.001	0.001

Philippines	Output (in USD million)	Agriculture, hunting, forestry	0.221	1.597
		Professional, scientific, administrative and support services	0.001	0.067
		Wholesale and retail trade	0.012	0.047
	Employment (FTE jobs)	Agriculture, hunting, forestry	<0.001	0.003
		Accommodation and food service activities	<0.001	0.001
		Postal and courier services	<0.001	<0.001
	Income (monthly, USD)	Effect too small	-	-
Thailand	Output (in USD millions)	Agriculture, hunting, forestry	2.103	1.425
		Food products, beverages and tobacco	0.012	0.068
		Machinery and equipment, including motor vehicles	-0.024	0.024
	Employment (FTE jobs)	Agriculture, hunting, forestry	0.006	0.005
		Food products, beverages and tobacco	<0.001	<0.001
		Fabricated metal products	<0.001	<0.001
	Income (monthly, USD)	Agriculture, hunting, forestry	0.036	0.015
		Wholesale and retail trade; repair of motor vehicles	0.005	0.004
		Manufacturing	-0.001	0.001

Note: Conventional rice farmland expansion refers to the medium scenario of increasing organic rice land area to reach 5% of total rice land. Conventional farmland expansion refers to the equivalent land size expansion of conventional rice farm. Output results are the sum of direct and indirect effects of the change in final demand and indicate additional monthly income in USD in the medium scenario. Income results aggregate 15 sectors according to ILO designations, rather than the 40-sector aggregation of output and employment. Employment does not include part-time and seasonal employment.
Source: Authors' own calculations based on OECD IOTs.

The chemicals and chemical products sector consistently experiences the highest losses from a transition to organic farming across all dimensions. With the medium scenario, the chemicals and chemical products sector is estimated to lose USD 1.17 million in output. The sector's loss in output ranges from USD 0.4 million (the Philippines) to USD 2.5 million (Indonesia) relative to 2018 levels. Both organic and conventional rice farming conversions put a very slight downward pressure on employment in other sectors, between -0.006 FTE jobs (the Philippines) and -0.033 FTE jobs (Indonesia). No sector experiences a loss in income with the increase in organic rice farming (Table 5.7).

Table 5.7. Top three losing sectors from an expansion in organic rice farmland area

Country	Dimension	Sector	Conventional rice farmland expansion	Organic rice farmland expansion
Southeast Asia, average	Output (in USD million)	Chemicals and chemical products	0.146	-1.172
		Mining and quarrying, energy-producing products	0.008	-0.134
		Coke and refined petroleum products	0.007	-0.106
	Employment (FTE jobs)	Wholesale and retail trade; repair of motor vehicles	<0.001	< -0.001
		Other non-metallic mineral products	<-0.001	< -0.001
		Chemicals and chemical products	<-0.001	< -0.001
	Income (monthly, USD)	Effect too small	-	-
Philippines	Output (in USD million)	Chemicals and chemical products	0.006	-0.437
		Coke and refined petroleum products	0.001	-0.030
		Mining and quarrying, energy-producing products	0.001	-0.021

	Employment (FTE jobs)	Chemicals and chemical products	0.002	-0.006
		Coke and refined petroleum products	<0.001	-0.003
		Construction	<0.001	-0.002
	Income (monthly, USD)	Effect too small	-	-
Indonesia	Output (in USD million)	Chemicals and chemical products	0.162	-2.515
		Mining and quarrying, energy-producing products	0.003	-0.377
		Coke and refined petroleum products	0.037	-0.107
	Employment (FTE jobs)	Chemicals and chemical products	0.012	-0.033
		Mining and quarrying, energy-producing products	<0.001	-0.028
		Coke and refined petroleum products	<0.001	-0.001
	Income (monthly, USD)	Effect too small	-	-
Thailand	Output (in USD million)	Chemicals and chemical products	0.494	-1.272
		Mining and quarrying, energy-producing products	0.061	-0.184
		Coke and refined petroleum products	0.069	-0.151
	Employment (FTE jobs)	Mining and quarrying, energy-producing products	<0.001	-0.021
		Chemicals and chemical products	0.001	-0.012
		Coke and refined petroleum products	0.001	-0.006
	Income (monthly, USD)	Effect too small	-	-

Note: The simple (output) multiplier is the sum of direct and indirect effects of the change in final demand and indicates additional monthly income in USD with a 5% increase in land used for organic rice farming. Income sectors for Southeast Asia and Thailand are aggregated into 15 sectors according to ILO designations, rather than the 40-sector aggregation of output and employment. Employment does not include part-time and seasonal employment.
Source: Authors' own calculations based on OECD IOTs.

The concentration of losses in the chemicals and chemical products sector can be attributed to the prohibition of synthetic fertilisers and pesticides in organic farming. Losses in the chemicals and chemical products sector will be felt most acutely in the fertiliser-producing countries of Southeast Asia. The Philippines and Thailand will likely feel a smaller impact than estimated because they import the majority of the fertiliser used in their agricultural production. Between 2018 and 2021 the average fertiliser consumption was 17.5 times the production for Thailand and 6.8 times for the Philippines (World Bank, 2023[76]). Indonesia consumes more domestically produced fertiliser compared with other countries in the region, with the ratio of fertiliser consumption to fertiliser production standing at 1.39 for the same period average (ibid.). This explains the losses in the chemicals and chemical products sector being larger in Indonesia than in the other Southeast Asian countries examined. Finally, the energy production and petroleum sectors see the second largest decrease in both output and employment in the region from a transition to organic farming, likely related to reduced reliance on heavy machinery in agricultural production in this scenario.

Although not overly large, a conversion to organic rice farming practice would affect jobs and incomes for workers in the chemicals and chemical products sector. Relative to other sectors, Southeast Asian workers in this sector are younger, are more educated, are paid more and are more likely to live in urban areas. Workers in chemical manufacturing sectors are more likely to have intermediate or basic education and tend to be men. While plant/machine operators and assemblers (28%) and basic occupations (23%) account for just over one-half of the workforce, managers, professionals and technicians represent 21% of total employment. One-half of jobs demand a medium level of skills, while 21% of jobs require a high level of skills. With regard to workers' status, employees are prevalent in the manufacture of chemicals and chemical products. Likewise, a little less than one-half of the workforce has access to social security (49%), paid leave (54%) and sick leave (44%), although access to parental leave is relatively limited, at 24%.

An increase in organic farmland combined with additional final demand spending can help offset sectoral losses

When an increase in organic farmland is combined with an increase in final demand spending for organic rice, sectoral losses can be minimised with relatively small increases in spending. The medium scenario of a 5% expansion of organic farmland area is estimated alongside an increased in final demand spending for organic rice of USD 100 000. As a reference, Indonesia currently spends USD 16.2 million on all organic food products (Organic Trade Association, n.d.[77]). Demand value is kept relatively small in order to avoid violating key assumptions for IOTs. Table 5.8 shows the effects of the additional spending in conjunction with organic farmland area expansion.

An increase in demand for organic rice combined with an expansion of organic rice farmland area leads to a more robust and positive impact on output and employment. On average in the region, there is an additional USD 3.05 million increase in output under the medium scenario combined with a USD 100 000 increase in final demand spending. At its highest, the output increases by a factor of nine in Indonesia and more than triples in the Philippines. When compared with the medium scenario, the boost in employment from an additional USD 100 000 in final demand spending increases the number of FTE jobs by 0.042 for the region as a whole, by 0.009 in the Philippines and by 0.223 in Indonesia.

Table 5.8. Changes in output, employment and income from medium scenario expansion of organic rice farmland combined with final demand spending increase

Country	Demand category	Output	Employment	Income
Southeast Asia[1]	5% organic expansion + 100 000 USD final demand increase	3.05	0.042	0.078
Philippines	5% organic expansion + 100 000 USD final demand increase	4.06	0.009	0.005
Indonesia	5% organic expansion + 100 000 USD final demand increase	9.11	0.223	0.119
Thailand	5% organic expansion + 100 000 USD final demand increase	1.30	0.002	0.014

Note: Southeast Asia regional estimates are the average of six countries: Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam. The Cambodia, Lao PDR and Viet Nam rice sectors are estimated using Thailand as a proxy. Employment does not include part-time and seasonal employment.
Source: Authors' own calculations based on OECD IOTs.

When these changes are examined at the sectoral level, with the increase in demand, even the chemicals and chemical products sector is expected to experience considerably less employment losses than the scenarios without increase in demand. Indonesia sees a decrease in the number of FTE jobs from 0.033 FTE jobs loss in the medium scenario to 0.002 FTE jobs gain in the USD 100 000 spending combined scenario, almost completely compensating for the downward pressure that an expansion of organic agriculture could have on the sector. This highlights the distributional effects of additional consumer spending on organic rice, which boosts overall economic benefits and slows down job losses caused by the conversion to organic rice farming.

The estimated boost from an increase in consumption demand for organic rice, rather than from an expansion in organic rice farmland area alone, suggests positive linkages from increased spending on organic rice. The organic rice market in Southeast Asia has room for further development. In support of this, studies have highlighted the growing demand for organic agriculture in the region. One analysis conducted in the Greater Mekong Subregion highlighted that as incomes in the region rise, so does the demand for more premium foods such as organic products (ADB, 2017[38]). A similar report designates Viet Nam as a potential growth market for organic goods, citing the growing middle class, consumer concerns about health and the limited domestic supply of organic products as driving factors for a recent increase in the import of organic products in the country (USDA, 2021[78]). This demand forecast provides an incentive for policy makers to support the growth of domestic organic markets to meet growing consumer demand.

Policy implications to make the green agricultural transition more inclusive

In the organic farmland area expansion scenarios, Southeast Asia would likely experience increases in output, employment and income in the agricultural sector. Comparing an equivalent increase in conventional agriculture farmland area yields lower output (in value), employment creation and income gains. The simulation, using organic rice farming practice to illustrate a green transition in agriculture, shows that a more sustainable agricultural model has the potential to achieve the triple objectives of better livelihoods of farmers, economic gains and environmental sustainability.

Facilitate the transition by ensuring social protection and job reallocations for workers in losing sectors

Employment losses in upstream sectors like chemical manufacturing and energy production are relatively small and manageable. Workers in the affected sectors tend to be younger, more educated and paid more compared with the national average, and are more likely to live in urban areas. Facilitating their labour mobility through a combination of reskilling/upskilling and social protection will likely be cost-effective. The simulation also indicates that an increase in organic rice agriculture combined with increased final demand spending could help to balance out the losses in negatively affected sectors. To achieve a smooth transition to greener agriculture, the transition plans would also need to include policies that promote consumer awareness about the benefits of organic food and other sustainable production methods.

As a green transition could create jobs and increase income in the agricultural sector, making this sector attractive in order to recruit new talent should be a priority. Countries could launch campaigns highlighting the employment benefits and opportunities in sustainable agriculture, such as organic farming, in order to attract new recruits among the youth population. At the same time, governments should collaborate with educational institutions, research centres and industry stakeholders to develop vocational training programmes focused on sustainable agricultural practices and technologies. This could include courses in organic and conservation farming techniques, precision farming, integrated pest management, and soil science, which would allow to reduce the yield gap between organic and conventional production techniques. Marketing and business development skills focused on organic products and food processing would support entrepreneurs and SMEs engaged in organic or value-added food products. OECD countries provide good examples of preparing young people for “green jobs” in agriculture. The Netherlands’ Green Pact helps to strengthen the connection between green education and industry in order to attract students and young professionals to the agricultural sector (Box 5.1).

Box 5.1. Improving the connection between green education and the job market: The Dutch Green Pact

The Green Pact (Groenpact) is a national initiative aimed at improving green education in agriculture, horticulture, food, and nature and the living environment through the renewal of the Dutch knowledge and innovation system and professional practices. It is a co-operative initiative between the government (specifically the Ministry of Agriculture, Nature and Food Quality (Ministerie van Landbouw, Natuur en Voedselkwaliteit or LNV)), education institutions and business communities that was started in 2016. The Green Pact seeks to broaden knowledge and innovation by creating stronger connections between education and business; to enhance the internationalisation of education; to promote lifelong learning through closer relationships with other fields such as healthcare, engineering, and information and communication technology (ICT); and to invest in the enrolment of students in Dutch green education programmes and related institutions.

The Green Pact implements acceleration programmes, practice-oriented research through clusters, knowledge-sharing activities, practical co-financing arrangements, and subsidies. The acceleration programmes focus on promoting progress in four specific subjects:

1. education-labour market alignment
2. knowledge sharing and application for organisations in education, research, civil society and policy development
3. internationalisation of the Dutch green knowledge and education system
4. digitalisation and technology in green education of all levels.

In addition, the Green Pact Monitor will soon be introduced in order to identify skills gaps and develop a new lifelong learning strategy. Research is being conducted to forecast the skills that will be required in the green sectors.

The Green Pact promotes younger generations' interests in agriculture and food-related careers in various ways. One way is by partnering with youth organisations in agriculture, food and climate to generate fresh ideas and knowledge from students and young professionals. Another way is through the Green Pact Impact Prize, an annual competition for students studying green impacts or launching start-ups in agri-food, horticulture, nature and the living environment. Eligible students in secondary or higher education can participate in the competition to win EUR 2 500 (euro).

The Green Pact is funded annually by LNV with a budget of around EUR 4.2 million and by participating organisations with cash and in-kind contributions (in line with their areas of interest). Between 2022 and 2023, the number of participating organisations increased from about 80 to more than 90. The participants operate in various sectors, including education/knowledge, biodiversity, the food chain, water management and area development across the public and private sectors.

Source: Groenpact (2023[79]); OECD (2023[80]); van Leeuwen (2022[81]).

Supporting existing farmers to convert to sustainable agricultural practices is also important. Converting conventionally farmed land to organically farmed land can take up to three years, during which time farmers can expect both yield and income losses. Subsidies and access to low-cost financing schemes during this transition phase will be necessary in order to protect the livelihoods of farmers. Examples include specialised financial products and services tailored to the needs of smallholders, including micro-loans, crop insurance and weather-based index insurance. The Philippines, through its Organic Agriculture Act of 2010, provides various tax incentives to organic farmers and Thailand subsidises rice farmers during the first three years of conversion to organic rice (Box 5.2). At the same time, providing technical assistance and training to rural financial institutions (e.g. farmers' co-operatives and community-based organisations) could enhance their ability to support smallholder farmers in the green transition. These supply-side interventions include support for technology upgrades, inclusion of digital inventions, delivery of resources and irrigation system improvements (World Bank, 2022[82]). Furthermore, improving market access can help small-scale producers to integrate into the sustainable agri-food value chain. Reliable market access is crucial for promoting sustainable (and organic) agriculture, ensuring reasonable prices for sustainable food products and decent livelihoods for farmers (Ume, 2023[83]; Guarín et al., 2022[84]).

Box 5.2. Incentive schemes for organic farmers in the Philippines and Thailand

In the Philippines, the Organic Agriculture Act of 2010 or Republic Act No. 10068 is the landmark legislation aimed at the promotion of organic agriculture. It promotes ecologically-sound, socially acceptable, economically viable and technically feasible production of food and other fibers. This Act declares that the State will promote the practice of organic agriculture in order to enrich the fertility of the soil, increase farm productivity, reduce pollution and destruction of the environment and prevent the depletion of natural resources. Furthermore, the Act aims to protect the health of farmers, consumers, and the general public, and save on imported farm inputs.

Recognising the central role of the farmers, indigenous people and other stakeholders at the grassroot level, the Act makes provisions for various support mechanisms for organic farmers. This includes, among others, tax incentives:

a) Exemption from the payment of duties on the importation of agricultural equipment, machinery and implements;
b) Identification by local government units of local taxes that may be offered as incentives to organic input production and utilisation;
c) Provision of preferential rates and special window to organic input producers and users by the Land Bank of the Philippines;
d) Subsidies for certification fees and other support services to facilitate organic certification;
e) Zero-rated value-added tax on transactions involving the sale/purchase of bio-organic products, whether organic inputs or organic produce; and
f) Income tax holiday and exemption for seven years, starting from the date of registration of organic food and organic input producers on all income taxes levied by the National Government.

In Thailand, the government launched in 2017 a programme to promote organic rice farming in view of increasing production to meet global and domestic demands for organic rice. The programme aimed to reduce the area of standard rice cultivation by 1m rai (160 000 ha) within five years. Farmers who sign up for the scheme could receive financial support to assist them in buying organic seeds, reducing their dependence on pesticides, and building barriers to prevent contamination from neighbouring farmland. Subsidies started at THB 2 000 (Thai Baht) (USD 56.30) for every rai (0.16 ha) of land cultivated the first year to THB 3 000 (USD 84.50) per rai for the second year and THB 4 000 (USD 112.70) for the third year.

Source: Republic of the Philippines (2009[85]); Oxford Business Group (2017[86]).

For the losing sectors, such as the chemical manufacturing and energy production, countries could implement policies and programmes aimed at reskilling or upskilling the affected workforce in order to facilitate labour mobility. Training programmes need to reflect the changing demands of the chemical and energy sectors. Strengthening extension services to provide continuous support and training to the affected workers would improve their employability. Such training initiatives can be jointly developed and delivered through public-private partnerships, leveraging the expertise and resources of various stakeholders. Governments could consider establishing various tools for training, including platforms for continuous learning and professional development through online courses, workshops, and mentoring programmes.

Creating enabling conditions could also make the green transition in agriculture more inclusive. Boosting market demand for sustainable food products has the potential to promote greener agriculture. Enhancing quality control systems is one way to reassure consumers about the origin and production methods used for organic food products. Countries are therefore encouraged to establish reliable certification and labelling systems to inform customers of the sustainable agricultural practices used. Another way to increase the demand for organic food products is to strengthen supply chain linkages between farmers, processors, distributors and retailers. A more efficient flow of food products could improve produce quality, avoid losses and improve farmers' access to markets like supermarkets. Collaborating with retailers and food service providers to promote and highlight sustainable food choices would help raise awareness and further stimulate demand. Furthermore, Southeast Asia could foster international trade agreements that prioritise sustainable agriculture. This could involve advocating for certification standards and simplifying trade procedures for small-scale producers, enabling them to access international markets and export sustainably produced food products. For example, the United States Department of Agriculture (USDA) provides funding opportunities to strengthen the market for organic foods and to support local farmers seeking organic certification (Box 5.3).

Box 5.3. Enabling the growth of organic markets and supporting organic farmers in the United States: The Organic Market Development Grant programme

In 2023, the USDA announced several funding opportunities for existing and transitioning organic farmers to help lower the costs and risks involved in their organic transition. This funding is part of the Organic Transition Initiative, launched in 2022, which includes various programmes ranging from conservation assistance to improved crop insurance options. Despite the remarkable growth in organic market demand, several challenges discourage farmers from transitioning to organic certification: risks associated with limited organic processing, storage, and handling capacity; insufficient markets for rotational crops; uncertainty about market access; and a shortage of certain organic ingredients. In addition, certain organic products grown in the United States (US) – particularly organic livestock and processed products – heavily depend on imported feed grains and ingredients, making their supply susceptible to external shocks in the critical organic supply regions outside the US.

The Organic Market Development Grant (OMDG) programme offers competitive grants of up to USD 75 million for businesses producing or handling organic foods, non-profit organisations, and governments financing projects designed to promote markets for domestically grown organic products. The OMDG aims to boost domestic organic product consumption by expanding existing markets and developing new markets and related facilities while encouraging their use. Potential projects may include providing funding to develop new organic products or investing in organic infrastructure to improve market access for producers. The OMDG prioritises smaller, emerging, underserved, and veteran producers as well as underserved communities.

The Organic Certification Cost Share Program (OCCSP) covers producers' and handlers' costs of obtaining or renewing organic certification. The OCCSP provides up to 75% of certification costs and up to USD 750 for crops, wild crops, livestock, processing/handling and state organic programme fees (California only) during the programme year (1 January 2022 to 30 September 2023).

Source: USDA (2023[87]).

When developing sustainable or organic food value chains, Southeast Asian countries should prioritise investments in agricultural infrastructure in order to strengthen the inclusiveness of value chains. Improving irrigation systems, enhancing storage and processing facilities, and upgrading transportation networks in rural areas can increase the overall efficiency of agri-food value chains, benefitting all actors engaged in the agri-food system. For individual farmers, enhanced infrastructure is fundamental to increasing productivity, reducing post-harvest losses and accessing larger markets. Moreover, such an infrastructure upgrade can enable and sustain rapid growth in sustainable agriculture and its local markets. To ensure inclusive infrastructure investment, governments should involve farmers' organisations and rural communities in order to give voice to smallholders, particularly resource-poor and women farmers (Guarín et al., 2022[84]). Governments should ensure efficient and sustainable infrastructure development in agriculture through collaboration with development partners, private sector stakeholders and local communities (World Bank, 2022[82]). Adequate funding and technical assistance should be allocated to address the specific needs and challenges of different regions and farming systems within each country.

Lastly, improving social protection and labour standards is important for creating decent work in emerging sectors and addressing livelihood challenges in declining sectors. Southeast Asia could perform a review and update of existing labour laws and regulations in order to ensure alignment with international labour standards. This includes providing fair wages, safe working conditions and access to social protection for agricultural workers. Countries could encourage the establishment of agricultural workers' associations or unions to empower (mostly informal) workers and protect their rights. Providing training and support to enhance their capacity for negotiation and collective bargaining could further strengthen agricultural workers' position in the agri-food value chain. In the meantime, the development of targeted social protection programmes (such as crop insurance, health insurance, and pension schemes) is essential in order to safeguard the livelihoods and well-being of smallholder farmers and agricultural workers. Unemployment benefits and temporary income assistance are necessary to provide social support for workers in the chemical manufacturing and energy production sectors who may undergo a job seeking and re-employment process. Engaging with the private sector to promote responsible and inclusive business practices is also crucial. This includes encouraging fair treatment of workers, respect for human rights and adherence to environmental sustainability principles.

Develop mainstreaming mechanisms and policy measures to implement strategies for sustainable agriculture

Southeast Asian countries need to put more political effort into creating enabling conditions to expand sustainable farming. The region's current policy frameworks for sustainable agriculture are highly concentrated on high-level legislation or development plans. In contrast, concrete policy actions to implement the laws are less visible, except in a few countries. As part of the implementation strategies, the region has set quality standards for agricultural products at the regional and national levels. However, these are guidelines, which, in the absence of other actions, may have minimal impacts on the adoption of sustainable agriculture. Tools such as certification schemes also need to be carefully measured in terms of their impact on smallholders' participation. Certification may promote non-random selection, favouring specific locations, organisations, farmers and workers who already participate in the existing marketplace rather than improving or changing their circumstances on average (Meemken et al., 2021[26]). Compliance with the guidelines and standards is currently entirely up to value chain actors, thus raising more questions than answers.

Governments are encouraged to establish mainstreaming mechanisms that involve integrating sustainable practices and principles into agricultural policies, programmes and practices. Countries that specify the organisations responsible for the implementation of national strategies for sustainable agriculture need to be more transparent about how those organisations will facilitate the transition to sustainable agriculture and with what policy tools, and how they will measure, monitor and evaluate the policy outcomes. Regular expenditure review or strategic assessment of sustainability indicators could help to measure the effectiveness of relevant policies and programmes. Meanwhile, countries without designated institutional mechanisms should consider leveraging an existing institution or creating a new one to facilitate cross-sectoral co-ordination, information sharing and joint planning for sustainable agriculture. For some countries, developing a stand-alone regulatory framework for sustainable agriculture should be prioritised in order to accelerate the green transition process. This would ensure that sustainable agriculture becomes a shared priority across relevant institutions and fosters the coherent implementation of sustainable practices.

To ensure successful implementation, Southeast Asian countries should tailor these recommendations to their specific contexts and regularly monitor, evaluate and provide feedback on their implementation. Adjustments should be made as needed in order to address the unique challenges and opportunities of each country. By implementing these policies, Southeast Asian countries can promote and enhance access to sustainable agriculture, and provide their workforces with the skills necessary to foster inclusive and resilient agriculture systems in the region.

Conclusion

Promoting sustainable agriculture has become a central agenda for Southeast Asia to achieve long-term environmental, economic and social well-being. By adopting sustainable farming practices, such as organic farming, Southeast Asian countries could mitigate the negative impacts of agriculture on the environment, conserve natural resources and improve food security. While the existing regional policy frameworks have room for improvement, some countries have been pioneers in encouraging sustainable farming practices through their own legislation and policy mechanisms. Sustainable agriculture is known to enhance the livelihoods of rural communities by bringing direct and indirect positive socio-economic benefits. However, during the transition period, the risks engendered by structural change could spill over to other sectors linked to agriculture.

In Southeast Asia, the green transition in agriculture, measured by an expansion of organic rice farmland area, is estimated to generate gains in rice outputs without negatively affecting employment and income in the agricultural sector and related sectors downstream. In contrast, output losses will likely be concentrated in the chemical manufacturing and energy production sectors linked to the rice value chain. The estimated effects, while generally minor, are much more pronounced than with the conventional farming scenario and vary from country to country. The socio-demographic and job profiles of the farmers and workers affected most by the conversion to organic farming practice also differ by industry. Southeast Asian countries should establish a broad, comprehensive skills strategy to support workforce recruitment in the emerging sectors as well as smooth labour reallocation in the declining sectors. Governments should also invest in creating enabling macro conditions for the inclusive expansion of sustainable farming and its value chains. Establishing implementation mechanisms using various potential policy instruments overseen by a responsible governing body should be the priority for policy makers. By doing so, Southeast Asia could pave the way for a sustainable and prosperous future for rural development and the entire economy.

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Annex 5.A. Methodology of the organic rice farmland expansion simulation

An input-output analysis was used to evaluate the labour and macroeconomic effects of a shift towards organic agricultural practice in Southeast Asia. Input-output tables (IOTs) describe the relationships between sectors of an economy by depicting sales and purchases from industry to industry (Miller and Blair, 2009[88]). IOTs take the form of a matrix whose values constitute the intermediate demand of each sector, with the rows representing the destination of the outputs from that sector and the columns representing the inputs to that sector (Annex Figure 5.A.1, Panel A). IOTs also include a final demand portion which quantifies the final use of the output based on whether the output was purchased by consumers or government bodies, stored in inventories, etc. IOTs are often complemented by a “value added” portion that consists of additional outputs of sectors, such as employment or wages. By “shocking” a final demand column or expanding a sector, the cascading effects of a change in the economy can be evaluated in terms of changes in output, employment and wages for each sector present in the table.

IOTs are frequently applied in contexts related to food systems and agriculture because of their flexible framework and ability to provide granular insights into changes across sectors (Jablonski et al., 2022[89]). IOTs can provide a granular perspective on which industries will be most affected by changes or a shock in an economy. This is because IOTs are less demanding from a data and computational perspective compared with common alternatives such as computable general equilibrium (CGE) models, and therefore it is much easier to estimate the effects on many sectors. IOTs do have limitations in that neither prices nor technology adjust to reflect changes in demand as would typically occur in a CGE model. This requires smaller shocks to be applied during IOT analysis in order to avoid infringement of assumptions of fixed relationships between sectors. This also circumvents concerns over the lack of supply constraints that also apply to IOTs, as the simulation does not foresee a large increase in production.

An organic rice sector is estimated in the OECD IOTs borrowing from the rice sectors in three Southeast Asian national IOTs. The OECD produces IOTs every three years for 66 countries (including most ASEAN countries and 45 industries). The OECD IOTs were selected due to their standardisation in accounting methodology and sectoral classification, which makes the results directly comparable across the region (Annex Figure 5.A.1, Panel A). The sectors in the national IOTs, which are 80-sector models, are mapped to the OECD IOT sectors, leaving 40 industries in the final augmented OECD IOTs. The latest version, covering the 2018 calendar year, is used as a framework to develop an IOT augmented with an estimated organic rice sector (Annex Figure 5.A.1, Panel B). The analysis covers three countries with full tables (Indonesia, the Philippines and Thailand), where the technical coefficients for the rice sector were taken directly from each country’s own national IOT. Three additional countries (Cambodia, Lao PDR and Viet Nam) were estimated as “hybrid” tables, borrowing technical coefficients from Thailand to create the rice sector.

The organic rice sector is estimated in several steps using data from a number of national and international sources. The technical coefficients of the rice sectors borrowed from national IOTs are weighted by sectors based on intensity of use in organic rice production. Weights were constructed using agricultural surveys comparing input costs for conventional and organic rice farming in Asian and Southeast Asian countries. Each cost component was mapped to sectors present in the OECD IOTs and the organic cost was divided by the conventional cost for each sector to create the weight. The average weight for each sector was calculated across 15 surveys (Annex Table 5.A.3) and was then applied to the corresponding technical coefficient in the OECD IOTs. The weighted technical coefficients for the organic rice sector were then converted to intermediate demand values using an estimate for organic rice production.

Annex Figure 5.A.1. IOT with organic rice sector

Panel A

	Intermediate demand			*Final demand*	
	Agriculture	*Industry*	*Services*	*Consumer demand*	*Government demand*
Agriculture					
Industry					
Services					
Employment					

Panel B

	Intermediate demand				*Final demand*	
	All other agriculture	*Organic rice*	*Industry*	*Services*	*Consumer demand*	*Government demand*
All other agriculture						
Organic rice						
Industry						
Services						
Employment						

Note: Sectors have been truncated for brevity. Organic rice, shaded in blue, is the new sector estimated.
Source: Authors' own elaboration.

Construction of output, employment and income matrices

Employment. We use the labour force surveys (LFS) and country reports on agricultural employment to construct employment data in selected Southeast Asian countries Annex Table 5.A.1. The number of employees by sector (ISIC rev. 4, 2-digits) and the average wage by sector (ISIC rev. 4, 2-digits) for 2018 is extracted from raw LFS or from ILOTSAT for each of the treated countries (ILOSTAT, 2023[90]). The sectors are aggregated to match the grouping of the final 40-sectors in the OECD IOTs. While the Philippines, Cambodia and Indonesia include ISIC rev. 4, 4-digit designations in their LFS that provide estimates for some of the agricultural product employment, additional figures for employment by agricultural crop are pulled from agricultural censuses or other similar literature.

Income. A measure for income is constructed similarly to employment. Income data for the 40-sectors is only available for Indonesia and Thailand, whereas a more aggregated version of the OECD IOTs with 15-sectors is created to estimate broad sectoral impacts for the other countries. The Indonesia income data comes from estimates constructed using the LFS from 2016. Thailand's income data is sourced from the country's national IOTs. However, due to limited sectoral data availability the OECD IOTs must be even further aggregated to have estimates for each country. This relates to a total of 21 sectors.

Output. We gather output data from both the national IOTs and production data from national sources or the FAO. When the value for output is borrowed from the national IOTs we use the exchange rate to USD for that country and for the year the IOTs were published. This converts it to a currency consistent with the OECD IOTs values. Where there are no national IOTs to draw upon, data is gathered with preference to agricultural census reports published by the country's statistical authority. That failing, the data is sourced from the FAOSTAT database on agricultural production.

Organic rice output is estimated using rice output values for 2018 taken from either national sources or the FAO database. The rice output value is discounted according to an output coefficient developed from the agricultural surveys and the land estimates of organic rice production taken from Research Institute of Organic Agriculture (FiBL). The same methodology is applied to estimate the number of employees for organic rice across countries, but using ILO and national estimates for number of employees in rice. The organic rice sector is then inserted into the IOTs and subtracting the total amount from the agriculture, hunting and forestry sector, assuming its entire production was already captured in that sector.

Organic land area. To evaluate expansion of organic agriculture and come up with organic output and employment estimates as the sector expands, organic land area data is needed. This data comes from Research Institute of Organic Agricultural (FiBL) and is the result of a global survey on organic farming (FiBL/IFOAM, 2021[71]). The organic indicators begin in 2000 and are broken down by crops, covering organic area (hectares) and the share of organic land area compared to the total farmland. Due to the volatility in agricultural production unrelated to organic production (e.g. rainfall, crop cycling, etc.) as well as gaps in data collection, we estimate organic land area as the average of the last ten years, as available. This evens out production and provides a more stable estimate of organic production, particularly given some notable variations in FiBL estimates and what has been published in national reports. This data is collected for each of the countries we are treating and for each of the agricultural products, which are also selected based on their availability in this dataset.

Agricultural surveys. Finally, organic coefficients, which are used for weighting the technical coefficients pulled from national IOTs to more accurately represent organic production of that product, are developed from a number of agricultural surveys and academic papers. These coefficients are constructed using data on the difference in cost structure between organic and conventional agriculture production provided by this literature. These agriculture surveys are collected with preference to Southeast Asian and Asian countries and focus on a single agricultural product at a time. However, due to data limitations, supplementation from surveys conducted outside of the region is also considered for some of the agricultural products. Rice in particular includes estimates from Bangladesh and India. At least ten surveys must be collected for a set of coefficients to be considered viable, although a higher number is preferred.

Annex Table 5.A.1 summarises the baseline data used for the simulation.

Annex Table 5.A.1. Baseline of rice and organic rice output, employment and income, 2018

	Organic rice output estimate (current USD)	Total rice output (current USD)	Employment in organic rice sector, estimates (FTE jobs)	Employment in rice sector (FTE jobs)	Monthly income of organic rice workers, estimates (USD)	Monthly income of rice workers (USD)
Cambodia	13 998 680	2 666 947 000	8 569	847 711	214.85	139.37
Indonesia	41 516 880	21 600 614 000	64 223	17 350 000	173.24	112.38
Lao PDR	3 947 948	1 204 473 000	4 834	520 894	408.51	265.00
Philippines	2 719 283	7 262 732 000	1 582	2 194 208	479.07	310.77
Thailand	72 194 980	9 907 604 000	51 924	3 700 000	20.38	13.22
Viet Nam	10 189 140	12 674 355 000	13 625	8 800 000	156.81	101.72

Note: Data on organic rice are estimations made using various surveys and literature and are not official data. They serve as starting points for the simulations. Data for employment are from 2018 unless otherwise stated.
Source: EMPLOYMENT**:** Philippines and Cambodia: ILOSTAT (2023[90]); Indonesia: Sujianto et al. (2022[91]), Toharisman and Triantarti (2014[92]); Thailand: Kusanthia (2010[93]), ILO (2021[94]); Viet Nam: Vietnam Trade Promotion Agency (2008[95]); Lao PDR: Lao PDR Ministry of Agriculture and Forestry (2020[96]). INCOME**:** Indonesia: ILOSTAT (2023[90]); Viet Nam: ERI (2023[97]). OUTPUT**:** Philippines: Philippine Statistics Authority (2023[90]); Indonesia: Statistics Indonesia (2021[98]); Thailand: Thailand Office of the National Economic and Social Development Council (2023[99]); Cambodia, Viet Nam and Lao PDR: FAOSTAT (2022[20]).

Simulation methodology

1. Extraction of agricultural product sectors

As a first step, we break organic agriculture down into the production of several organic agricultural products. We do this because of the lack of data on the cost structure of organic agriculture as a whole in the region. Instead, agricultural surveys at the crop and livestock level are much more readily available, allowing us to construct coefficients without the need for supplementary surveys. We can then apply relevant coefficients to the production functions of each crop, which we built up to estimate organic agriculture as a whole. However, it does not capture all of organic production, given that we select only crops that are particularly relevant to each country's production and that agricultural surveys do not exist for all crops that are produced organically in the country. Breaking down organic agriculture into specific agricultural products also opens up the possibility for pursuing complementary frameworks such as life cycle analysis should we want a more micro-perspective.

The OECD IOTs have a single sector that captures all of agricultural production in their national industry-by-industry tables: Agriculture, hunting and forestry. We assume that all of agricultural production, both conventional and organic, is captured in this sector. To parse out our targeted agricultural product from this sector, we borrow from either the country's national IOT or from a similar neighbouring country. When available, we use the national IOT from the same year as the OECD, 2018, or the latest year available. As an example, we focus on the rice sector in the Philippine Statistics Authority's (PSA) IOT.

Each sector in the PSA IOT is mapped to the 40 sectors available in the OECD IOTs using ISIC rev. 4 2-digit designations. We next calculate a vector of technical coefficients for both inputs into and outputs of the rice sector. This is done with the following equation,

$$a_{ij} = \frac{z_{ij}}{x_j} = \frac{value\ of\ sector_i\ purchases\ from\ rice\ industry_j}{total\ value\ of\ rice\ production} \quad \textbf{Equation 1}$$

where j represents the rice sector, i represents one of the 40 other sectors in the OECD IOTs, a_{ij} represents the technical coefficient at the conjunction of $sector_i$ and rice, z_{ij} is the intermediate or final demand value for $sector_i$ from rice, and x_j is the total output of rice. This is repeated for the 40 sectors, creating two vectors: one for origin of rice production, what are the necessary inputs for production, and the other for destination of rice production, which industries use rice production as an input.

2. Addition of organic agricultural product sectors

Our next step requires that there is already a non-zero amount of organic agricultural production in the country. National reports and FiBL data make it clear that each of the six countries have some organic production already underway for each of the agricultural products we are treating. We also assume that there is a notable difference in the cost structures between organic and conventional agricultural production. These differences are related to the (non-)use of chemical pesticides and fertilisers, farming techniques, tillage practices, types of seeds used and a focus on biodiversity (IFOAM, 2021[63]). Furthermore, we require that these differences are strictly controlled through national and international certification standards. Given these assumptions, there should be a notably large impact on factors that can be captured by looking at variations in cost structures between conventional and organic farms such as inputs, labour and yield. We thus undertake a process similar to how IOTs are originally constructed and map purchases of organic farmers to sectors using financial statements and agricultural surveys. However, since we already have robust technical coefficients borrowed from national IOTs, this process can be far less data-intensive while still providing credible estimates.

To account for cost variations between conventional and organic for each of the agricultural products, we construct coefficients that will essentially function as weights for the technical coefficients. We create these coefficients using the literature available on cost structure variations between conventional and organic agriculture. This literature consists of agricultural surveys, farmers financial statements, and other cost structure data. We extract the total cost for a number of inputs for the agricultural products, which include expenses such as seeds, fertiliser and labour, but also cover yield, output and destination categories occasionally. Each of these expenses are mapped to the inputs of the corresponding sector in the OECD IOTs (Annex Table 5.A.2). When aggregated, the sum across the OECD sectors is calculated and the total cost for that sector for both conventional and organic farming.

Annex Table 5.A.2. Sectoral mapping of farmers expenses from agricultural surveys

Industry	Expense
Agriculture, hunting, forestry	Seeds
	Organic fertiliser
	Biofertiliser
	Green manure
Coke and refined petroleum products	Fuel
Chemical and chemical products	Pesticides
	Fertiliser
	Inorganic fertiliser
	Urea
	Super phosphate
Transport	Land transport and transport via pipelines
Machinery and equipment, nec	Depreciation of tools
	Hulling
	Irrigation
	Tractor power
Manufacturing nec; repair and installation of machinery and equipment	Manufacturing
Mining and quarrying, non-energy producing products, mining support services	Potash
Financial and insurance activities	Interest on working capital
Real estate activities	Land rent
Public administration and defense; compulsory social security	Government assistance
Taxes less subsidies on intermediate and final products (paid in domestic territory)	Land tax
Textiles, textile products, leather and footwear	Rice bags/Bags
Labour	Human labour
	Weeding
	Hoeing harrowing and ploughing
Output	Output
Income	Income

Source: Authors' own elaboration.

Certain challenges arise from the lack of standardization in the literature as many of the surveys do not include exact definitions for their expenses. For example, the definition of inorganic and organic fertiliser can vary in its specification, with definitions ranging from animal manure to organic fertiliser processed in plants similar to those of non-organic fertiliser. When available, we verify that definitions match as much as possible across surveys through reviewing the questions posed during the survey. Otherwise, we rely on a large number of surveys to smooth any misalignments in designations. Other issues arise from categorization of broad costs, such as potash, which passes through several sectors to reach its final destination, starting with the chemical sector and ending with retailers. Additional research is conducted here to evaluate which sector would be considered the largest contributor to the expense's production.

3. Calculating ratio between organic and conventional rice costs

We next calculate the ratio between organic and conventional total cost to create a coefficient. Drawing inspiration from Garett-Pelitter (2017[100]), we assume this coefficient represents the relative difference in input or output between the two farming practices and will use it as a weight for each of the agricultural product's technical coefficients. Given that we aggregate from a number of different sources, we account for differences in currencies by calculating the ratio from each source individually. The final coefficients are the mean of each source's ratios by sector. The coefficients for rice are the average of 15 cost surveys for rice in the Southeast Asia and neighbouring countries (Annex Table 5.A.3).

Annex Table 5.A.3. Rice coefficients, comparing organic and conventional agriculture

Sector	Rice coefficient
Origin coefficients	
Agriculture, hunting, forestry	0.961
Coke and refined petroleum products	0.820
Chemical and chemical products	0.361
Food products, beverages and tobacco	0.847
Machinery and equipment, including motor vehicles	0.733
Real estate activities	0.922
Taxes less subsidies on intermediate and final products (paid in domestic territory)	1.020
Textiles, textile products, leather and footwear	0.536
Destination coefficients	
Land transport and transport via pipelines	0.896
Productivity coefficients	
Output	0.858
Labour	1.580
Income	1.540

Note: These coefficients are a summary of 15 cost surveys for the production of rice.
Source: Authors' own calculations.

The coefficients for rice align with what would be expected when estimating the difference in conventional and organic farming practices. They also follow along generalised organic coefficients that have been calculated for similar methodologies (ILO, 2018[64]). The labour coefficient of 1.58 indicates that organic farming is more labour-intensive than its conventional counterpart. This aligns with the consensus in organic farming data and literature that more labour is required when employing organic farming practices (Orsini, Padel and Lampkin, 2018[55]). This is attributed to the need for additional land to maintain yields and infrequent use of large machinery in tillage and weeding. The income coefficient's value of 1.54 also reflects expectations, given the price premium afforded to organic products has led to higher profitability from organic farms (Crowder and Reganold, 2015[101]). Finally, the much lower incidence of Chemical and chemical products in organic farming, here a ratio of 0.36, reflects the fact that industrial pesticides, herbicides and fertiliser are prohibited on organic farms, which are captured in this sector.

Contrary to Garrett-Peltier (2017[100]), we do not need to normalise our coefficients to fit between 0 and 1 to keep output estimate constant in the IOTs. This is because our methodology focuses on a single sector with our new organic sector being calculated relative to the Agriculture, hunting and forestry sector. This means that we assume that the growth of one is at the expense of the other, so that as organic rice expands, Agriculture, hunting and forestry will shrink. This follows the assumption that most farms convert from conventional to organic farming, so they would take away from the conventional farming values included in Agriculture, hunting and forestry rather than expand the sector through formation of new farms. This allows us to subtract the new organic values from the conventional sector, keeping total sectoral output values fixed and only changing production relationships through weighting.

For each of the sectors that have an organic agriculture coefficient, we multiply the technical coefficient for that sector by the corresponding coefficient. This creates a new vector with technical coefficients for both origin and destinations representative of organic production of that product. Next, to create intermediate demand vectors that can be inserted into the OECD IOTs, we must estimate the organic agricultural product's current level of production. Since actual output data does not exist for most organic crops, we estimate a proxy using land area, output, and relative yield of organic and conventional agriculture.

The land area values represent the possible productivity of the land for a given agriculture product based on its current output. This relative productivity value is weighted by a yield coefficient to account further for the variance in yield between organic and conventional production for the crop, borrowed from agriculture surveys. The equation resembles the following,

$$Output_{organic} = \alpha\left(\frac{Output_{total} * \ Land\ area_{organic}}{Land\ area_{total}}\right) \quad \text{Equation 2}$$

where α is the organic output intensity coefficient, $Output_{total}$ is the total output for that agricultural product, $Land\ area_{organic}$ is the organic land area in hectares and $Land\ area_{total}$ is the total land area in hectares for the crop. The output values are similar to what is provided by limited literature (Annex Table 5.A.1).

With organic output estimated, we are able to calculate the sectoral intermediate demand. These values are inserted into the OECD IOTs as a new organic sector for the agricultural product through subtracting from the original Agriculture, hunting and forestry sector. This is done for both origin and destination values in the OECD IOTs, creating a 41x41 matrix.

4. Estimation of organic agricultural employment

In order to provide an estimate on how a shift towards organic can impact employment, we must construct an employment requirements (ER) matrix. To build the ER matrix, it is necessary to have data on the number of people employed for each of the 41 sectors represented in the organic augmented IOT. For the majority of the sectors, we can use data provided by national estimates or LFS. However, there is no reliable employment data available for organic rice farming in the region. As a result, we must estimate organic employment similarly to how it was done for organic output.

We assume that the number of employments for organic employment is a function of the land area and the labour needed at its current capacity, thus given the organic land area we can estimate organic employment for that crop. The number of employees needed to cultivate the organic land area is then weighted by the labour coefficient for the organic agricultural product. The weighting should account somewhat for the differences in labour needs between conventional and organic agriculture. The equation resembles the following,

$$Employment_{Organic} = \beta\left(\frac{Employment_{Total} * \ Land\ area_{Organic}}{Land\ area_{Total}}\right) \quad \text{Equation 3}$$

where β is the organic labour requirement coefficient, $Employment_{Total}$ is the total number of individuals employed in that agricultural product, $Land\ area_{Organic}$ is the organic land area in hectares and $Land\ area_{Total}$ is the total land area in hectares for the crop. The organic employment estimates track estimates from unsubstantiated sources such as press releases, news articles and unpublished papers in the country.

Using these estimate we calculate the ER table. This requires calculating the employment-to-output ratio by dividing the vector of number of employees for the 41 sectors by the output of the 41 sectors. The result is transformed into a diagonal matrix, which is post-multiplied by the Leontief inverse matrix. The equation resembles the following,

$$\mathrm{ER} = e(I - A)^{-1}$$

Equation 4

where e represents the employment-to-output ratio and $e(I - A)^{-1}$ represents the Leontief inverse matrix.

5. Construction of scenarios

Scenarios were created to evaluate different policies for encouraging sustainable agriculture in Southeast Asia using our new organic sector. IOTs provide several pathways to evaluate policy scenarios, primarily through estimating how a change in demand in one sector has cascading effects on its inter-related sectors. One possibility is through simulating a policy aimed at boosting in consumer spending in the sector, which can take the form of price subsidies or vouchers. This would increase final demand for households equivalent to the size of policy support, which when estimated in the IOT will produce a multiplier for the policy's impact across output, employment and income. It will also highlight which sectors would see the most gains from the policy and those which may exhibit losses because of it. It is also possible to model a policy that takes on the form of direct purchases of organic rice in the public sector. This would create an increase in the government final demand column, producing the same results as the private sector.

Beyond these commonly used levers in IOTs, we are also able to evaluate how an expansion of the organic sector itself affects output, employment and income. Given that estimates for output and employment are based on the size of the organic land area, we can easily re-estimate new values for these indicators based on growth in the organic industry. This is particularly interesting as it makes it possible to evaluate the targets set out in the agriculture strategies in some of the Southeast Asian countries. For example, the Philippines goal was to reach 5% of organic agriculture land area by 2020, a goal which it has almost achieved by 2018 (Philippines Bureau of Agriculture and Fisheries Standards, 2018[66]). Thailand also provides a target in their National Plan for Organic Farming to increase organic rice farming in particular to 400 000 ha of land area by 2021, which represents 2.5% of total arable land area in Thailand (FAOSTAT, 2022[20]; Thailand Government Public Relations Department, 2017[67]). We extrapolate these goals to the other countries being estimated, evaluating how an expansion of similar size would look within their economy.

The scenarios are applied in stages according to their magnitude, which we assign as low, medium and high relating to the relative expansion of organic agriculture as well as the size of government intervention (Annex Table 5.A.4).

Annex Table 5.A.4. Scenarios for increased organic land area and increased final demand

Scenario	Percentage of organic agriculture area	Increase in demand for organic agriculture (USD)	
		Government final demand	*Household final demand*
Low	3%	1 000 000	100 000
Medium	5%	1 500 000	250 000
High	7%	2 000 000	500 000

Given that overall land area dedicated to organic agriculture is smaller in the other four countries treated, with about 0.2% on average, we take 5% expansion of organic agriculture area as the medium scenario, with plus or minus 2% for the low (3%) and high (7%) growth scenarios. We then add in various increases in government final demand. Given that direct government spending is relatively low in Agriculture, hunting and forestry, we must employ a larger nominal increase in government final demand than that of household final demand for there to be any effect.

To evaluate the scenarios, we compare the total value added (employment) for the baseline scenario, with organic rice at its estimated level of current production and employment, to the total value added (employment) with the scenarios applied. This resembles the following for the output,

$$\Delta \mathrm{Y} = f^1(I-A)^{-1} - f^0(I-A)^{-1}$$

Equation 5

where f represents the final demand or organic area at the baseline (0) and with the scenario (1), $\Delta \mathrm{Y}$ represents the change in output and $e(I-A)^{-1}$ represents the Leontief inverse matrix. This quantifies how a change in organic rice impacts the other sectors in the IOT.

Caveats

IOTs have two main drawbacks. The first is that IOTs are static in the year they are estimated. When there is a change in demand for a good, such that is assumed in our scenarios, prices will adjust relative to the supply. Unlike CGE models, IOTs include no dynamic process to capture price changes. This can be a problem because this price change would likely have some impact on the choices industries make, such as substituting relatively cheaper goods from another industry, which would alter the intersectoral relationships in the tables. To combat this, we impose relatively small changes in demand that would only have a minimal impact on the production choices of firms. This assumption works doubly to mitigate any issues related to the lack of supply constraints that come from IOTs. Similarly, the second drawback of IOTs is the fact that the tables assume a linear and constant relationship across all sectors of the table. As a result, they do not account for any changes in technology that could occur given an increase in demand. This underscores the fact that IOTs are not an appropriate tool for forecasting changes, but instead highlight how an increase in demand or expansion of a sector work to influence an economy in the observation year. As such, we assume that the output and employment impacts we observe have occurred in short-term, within one to two years from the year the IOT was developed, before the sectors have time to adapt.

Development Centre Studies

Towards Greener and More Inclusive Societies in Southeast Asia

Over 100 million workers in Southeast Asia have jobs that are directly or closely linked to the environment, making them vulnerable to climate change impacts. These same workers likely earn at least 20% lower than the national average and are largely in informal employment. The region's necessary transition towards greener growth could affect them in several ways: some sectors will create jobs and others will lose jobs or disappear altogether. Understanding the effects of both climate change and green growth policies on jobs and people is thus essential for making the transition in Southeast Asia an inclusive one. The study explores these issues, with emphasis on the potential effects on labour of an energy transition in Indonesia, and of a transition in the region's agricultural sector, illustrated by a simulated conversion from conventional to organic rice farming.

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