International Labour Organization

# Workforce 2030

## Skills for thriving in green and digital transitions

Date: Tuesday / 27 / January / 2026

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# 1. Macro picture

# Drivers of transitions

## Digital transition


AI and Robotics

Digital infrastructure

E-commerce, Remote work

Geopolitics of resources

## Green transition

Technologies and innovation

Environmental pressure


Environmental regulations

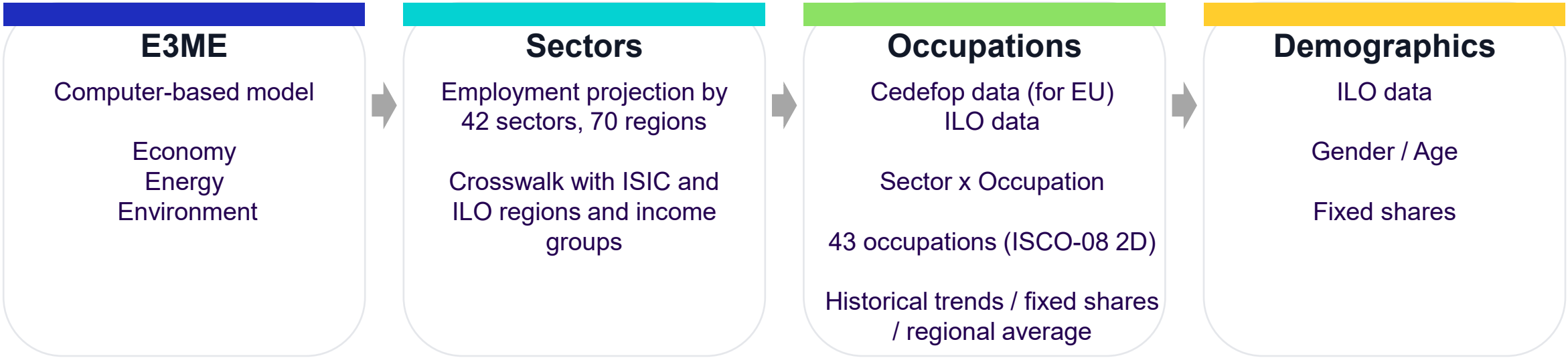
Green markets

## Why combined analysis?

- **Interaction**: digital can enable/hinder green transition ⇄ green can create demand for technology
- **Evidence gap**: little prior evidence on complementary vs. conflicting labour market impacts at the occupational level

# Methodology

- Scenario-based sectoral employment projections produced in collaboration with Cambridge Econometics
- Occupational, gender and age shares applied (post modelling)




**Interpretation**

"Net employment effect relative to baseline in 2030, under the scenario assumptions."

# Scenario assumptions

## Green transition

- Energy transition scenario
- Climate neutrality by 2050 for 124 countries) / 2060 for others (IEA)
- Levers: carbon pricing, renewables support, coal regulation, retrofits, EV infrastructure
- Limitation: excludes circular economy and adaptation measures

## Digital transition

- Near-universal broadband scenario
- 90% population coverage by 2030 (SDG 9)
- Channels: infrastructure investment + productivity + consumption shift
- Limitation: does not explicitly model AI's impact

## Green and Digital transitions

- Combined scenario
- Integrates assumptions of both scenarios (no additional assumptions nor inputs)
- Macro interactions between the two scenarios via prices, wages, productivity, and sectoral reallocation
- Limitation: does not "explicitly" model cross-technology synergies

## Baseline

- "Business-as-usual" scenario
- Reference path, reflecting policies confirmed as of 2020.
- Calibrated to published outlooks
- Limitation: Not a prediction, assume no major unforeseen shocks or new development since 2020

# Energy transition: Regions, Income groups, Sectors

***Around 2/3 of gains in construction and manufacturing, losses in extractive industries, gains highly uneven***

**37.2 million**

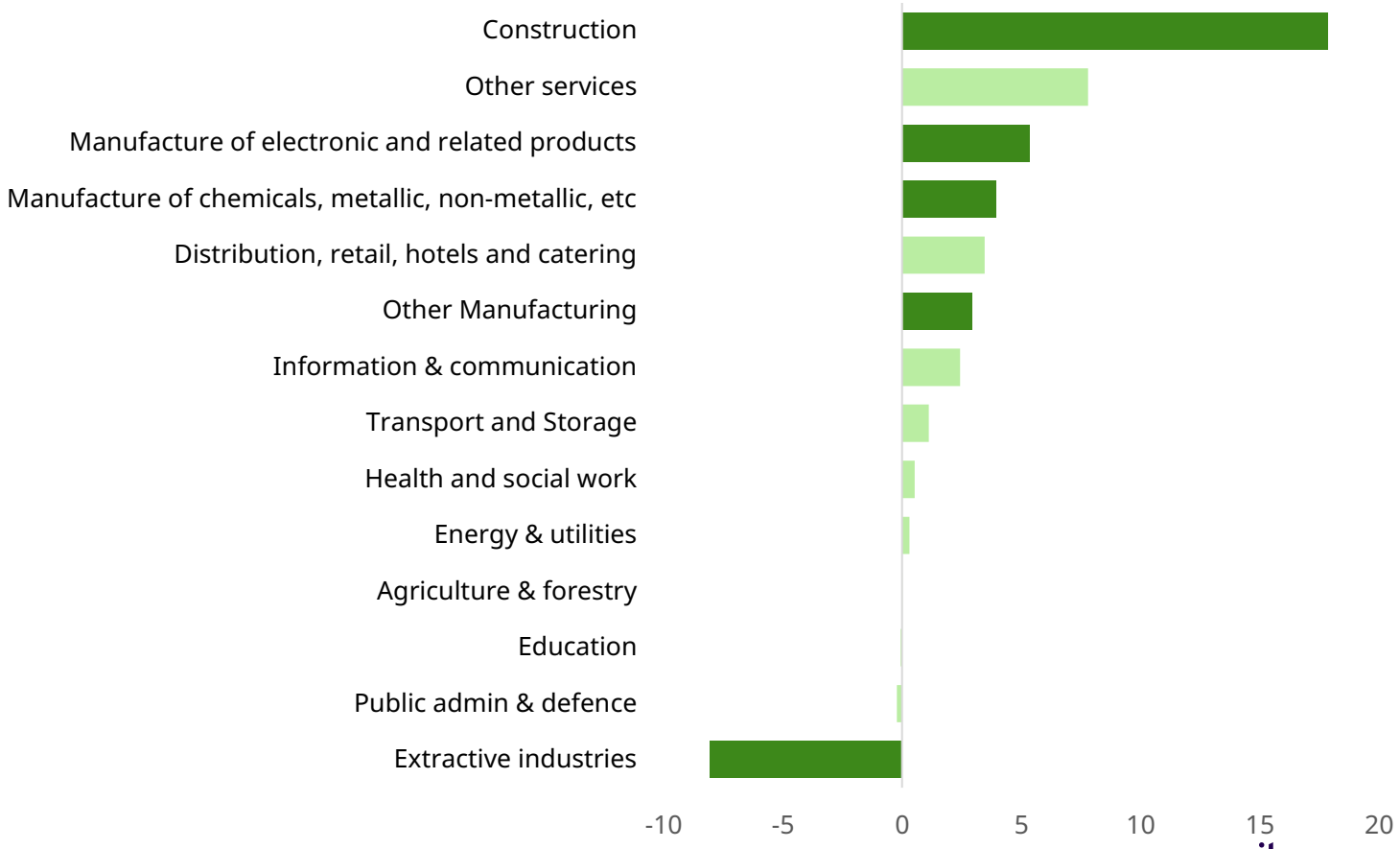
additional jobs by 2030 (+1.1% vs baseline)

**Key channels**

Infrastructure construction, manufacturing of components, retrofits, clean transport; losses in extractives.

| Change relative to baseline | millions | % |
|---|---|---|
| **Region** | | |
| Africa | 1.4 | 0.3 |
| Americas | 2.9 | 0.6 |
| Arab States | 1.9 | 3.2 |
| Asia and the Pacific | 26.3 | 1.5 |
| Europe and Central Asia | 3.8 | 1.0 |
| **Income group** | | |
| High income | 5.9 | 1.1 |
| Upper-middle income | 12.0 | 0.9 |
| Lower-middle income | 17.4 | 1.5 |
| Low income | 0.8 | 0.4 |
| World | **37.2** | **1.1** |

**Employment change by sector in 2030 vs baseline (in millions)**

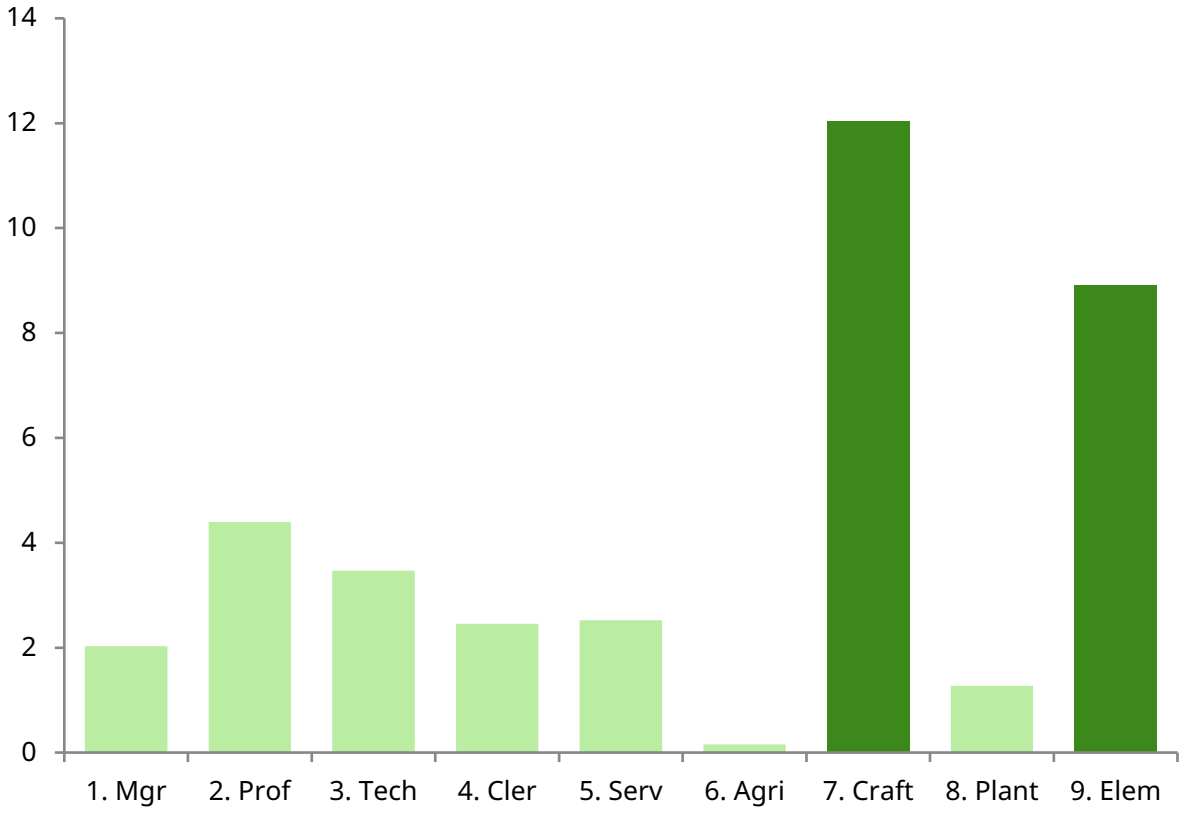



Source: ILO, based on E3ME model of Cambridge Econometrics.

# Energy transition: Occupations and Skill levels

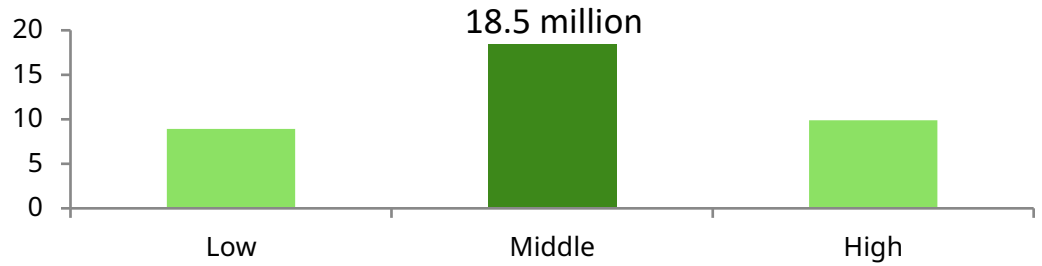
## *"Crafts & Related Trades" and "Elementary Occupations" would see much gains*

**Employment change by ISCO-08 1 digit in 2030 vs baseline (World, in millions)**




Source: ILO, based on E3ME model of Cambridge Econometrics.

**Employment change by skill-level in 2030 vs baseline (World, in millions)**




**Top 10 occupations accounting for 60 per cent of total employment gain, 2030**

| # | ISCO | Occupation | millions | % |
|---|---|---|---|---|
| 1 | 93 | Labourers in Mining, Construction, Manufacturing & Transport | 6.0 | 4.3 |
| 2 | 71 | Building & Related Trades Workers (excluding Electricians) | 5.5 | 4.0 |
| 3 | 72 | Metal, Machinery & Related Trades Workers | 2.3 | 2.0 |
| 4 | 74 | Electrical & Electronic Trades Workers | 1.6 | 1.9 |
| 5 | 75 | Food Processing, Woodworking, Garment & Other Craft & Related Trades Workers | 1.4 | 1.3 |
| 6 | 73 | Handicraft & Printing Workers | 1.2 | 1.7 |
| 7 | 24 | Business & Administration Professionals | 1.1 | 1.1 |
| 8 | 33 | Business & Administration Associate Professionals | 1.1 | 1.0 |
| 9 | 21 | Science & Engineering Professionals | 1.1 | 1.3 |
| 10 | 12 | Administrative & Commercial Managers | 1.0 | 1.0 |

# Near-universal broadband: Regions, Income groups, Sectors

***Highest relative gains in low-income countries, connectivity enables expansion of services, creating jobs***

**23.5 million**

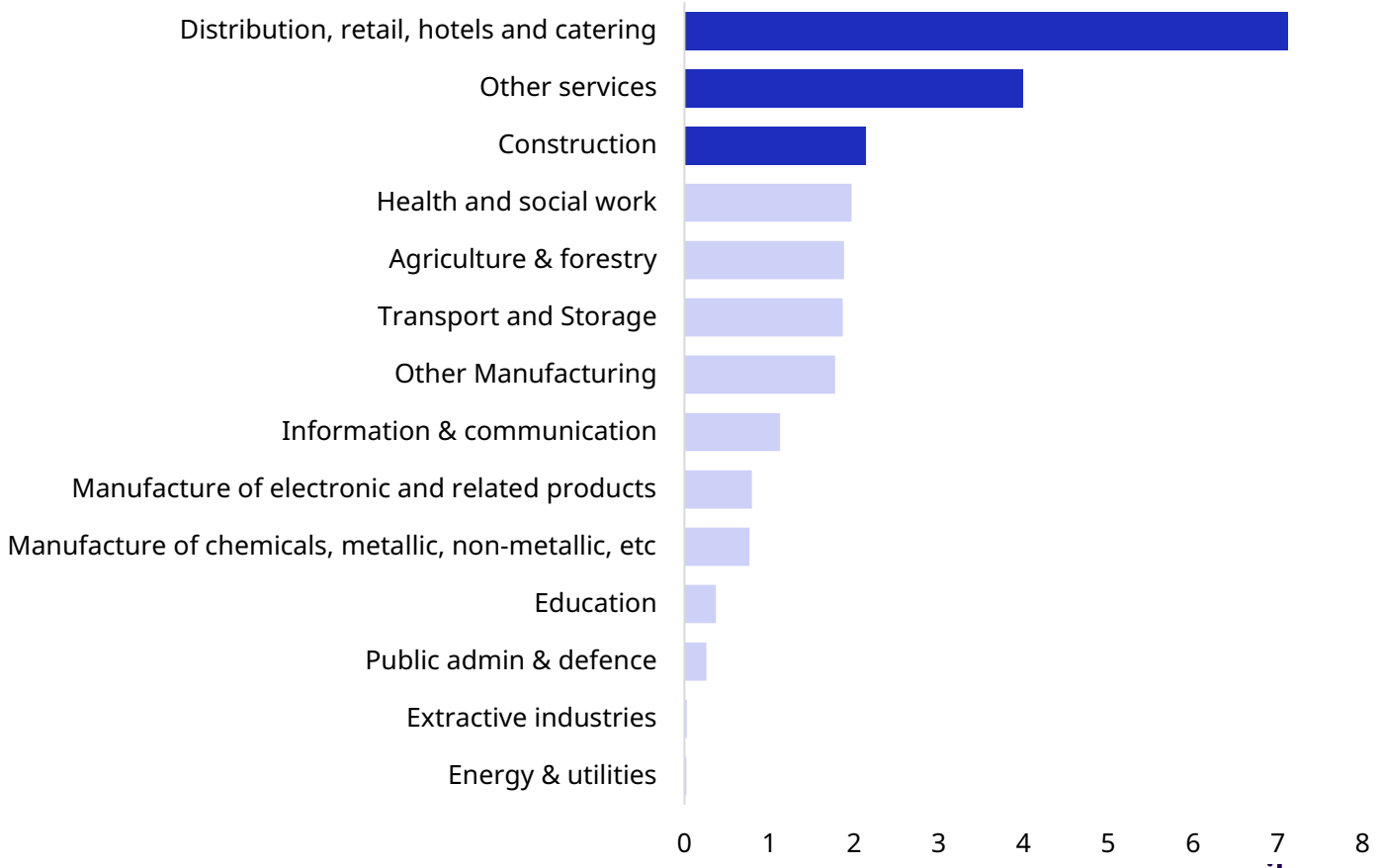
additional jobs by 2030 (+0.7% vs baseline)

**Key channels**

Infrastructure investment, productivity gains, shift toward digital services; gains are small where coverage is already high.

| Change relative to baseline | millions | % |
|---|---|---|
| **Region** | | |
| Africa | 6.3 | 1.2 |
| Americas | 6.2 | 1.2 |
| Arab States | 0.9 | 1.5 |
| Asia and the Pacific | 8.2 | 0.5 |
| Europe and Central Asia | 0.7 | 0.2 |
| **Income group** | | |
| High income | 2.0 | 0.4 |
| Upper-middle income | 8.7 | 0.7 |
| Lower-middle income | 8.9 | 0.8 |
| Low income | 2.7 | 1.4 |
| World | **23.5** | **0.7** |

**Employment change by sector in 2030 vs baseline (in millions)**

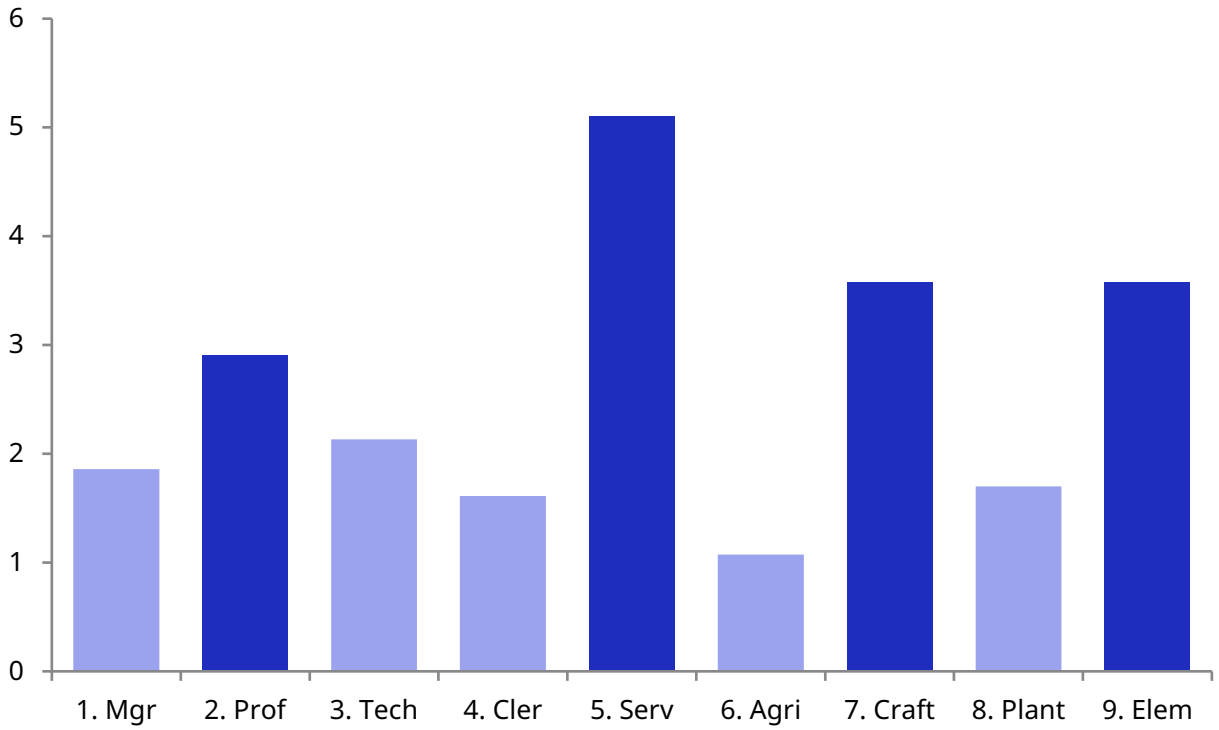



Source: ILO, based on E3ME model of Cambridge Econometrics.

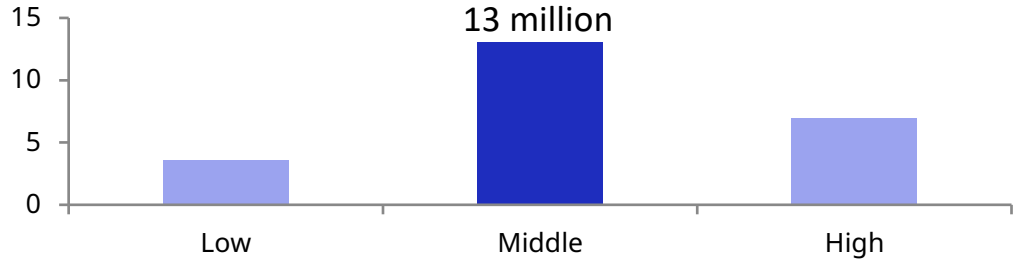
# Near-universal broadband: Occupations and Skill levels

## *Broader occupational spreads: "Services and Sales workers" and "Professionals" would also see gains*

**Employment change by ISCO-08 1 digit in 2030 vs baseline (World, in millions)**




**Employment change by skill-level in 2030 vs baseline (World, in millions)**




**Top 10 occupations accounting for 46.3 per cent of total employment gain, 2030**

| # | ISCO | Occupation | millions | % |
|---|---|---|---|---|
| 1 | 52 | Sales Workers | 2.0 | 0.9 |
| 2 | 51 | Personal Service Workers | 1.4 | 1.0 |
| 3 | 83 | Drivers & Mobile Plant Operators | 1.1 | 0.9 |
| 4 | 71 | Building & Related Trades Workers (excluding Electricians) | 1.1 | 0.8 |
| 5 | 93 | Labourers in Mining, Construction, Manufacturing & Transport | 1.0 | 0.7 |
| 6 | 54 | Protective Services Workers | 1.0 | 1.1 |
| 7 | 91 | Cleaners & Helpers | 0.9 | 0.9 |
| 8 | 72 | Metal, Machinery & Related Trades Workers | 0.8 | 0.7 |
| 9 | 12 | Administrative & Commercial Managers | 0.8 | 0.8 |
| 10 | 61 | Market-oriented Skilled Agricultural Workers | 0.8 | 0.4 |

Source: ILO, based on E3ME model of Cambridge Econometrics.

# Combined scenario: Regions, Income groups, Sectors

***Combined investment "levels up" outcomes, employment growth is never below +1.1% across the board***

**57.6 million**

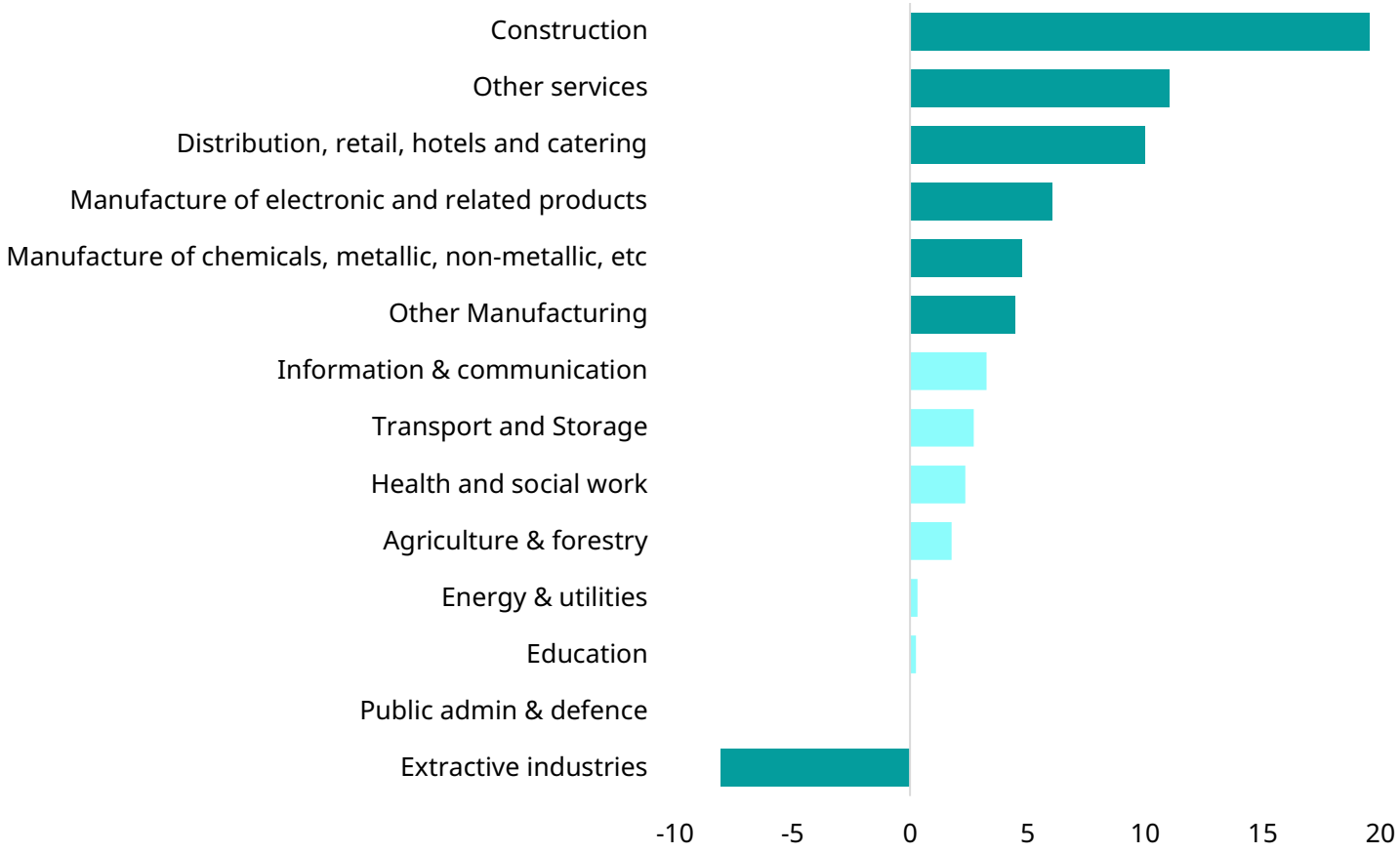
additional jobs by 2030 (+1.6% vs baseline)

**Key channels**

Green + digital investments with interactions, productivity gains and wage pressures.

| Change relative to baseline | millions | % |
|---|---|---|
| **Region** | | |
| Africa | 7.8 | 1.5 |
| Americas | 7.7 | 1.5 |
| Arab States | 2.9 | 4.9 |
| Asia and the Pacific | 32.8 | 1.9 |
| Europe and Central Asia | 4.3 | 1.1 |
| **Income group** | | |
| High income | 7.8 | 1.4 |
| Upper-middle income | 19.4 | 1.5 |
| Lower-middle income | 24.4 | 2.1 |
| Low income | 3.8 | 1.9 |
| World | **57.6** | **1.6** |

**Employment change by sector in 2030 vs baseline (in millions)**

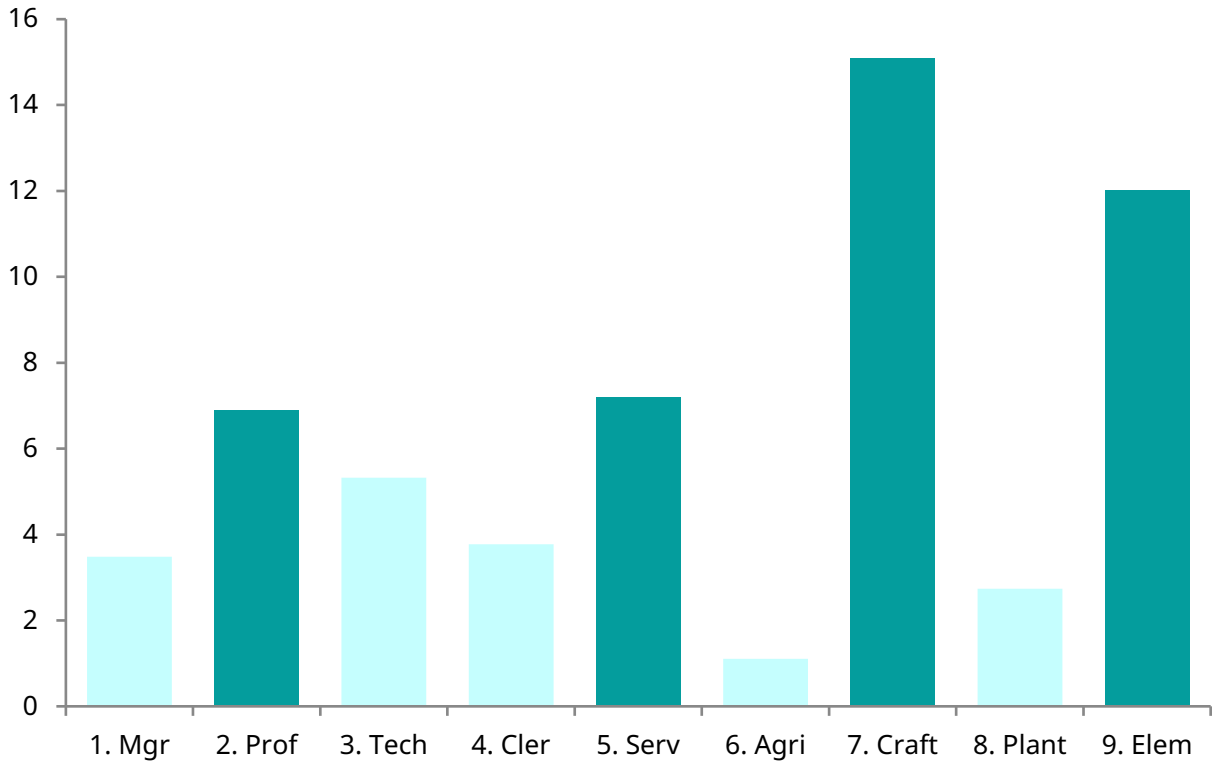



Source: ILO, based on E3ME model of Cambridge Econometrics.

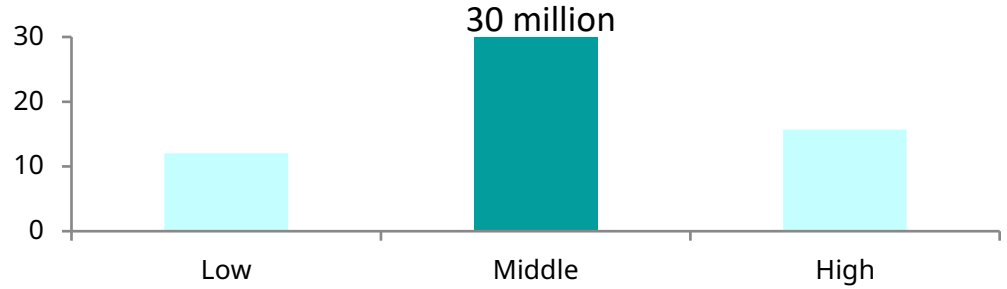
# Combined scenario: Occupations and Skill levels

## *Overall higher gains, concentrating in middle-skilled occupations*

**Employment change by ISCO-08 1 digit in 2030 vs baseline (World, in millions)**




**Employment change by skill-level in 2030 vs baseline (World, in millions)**



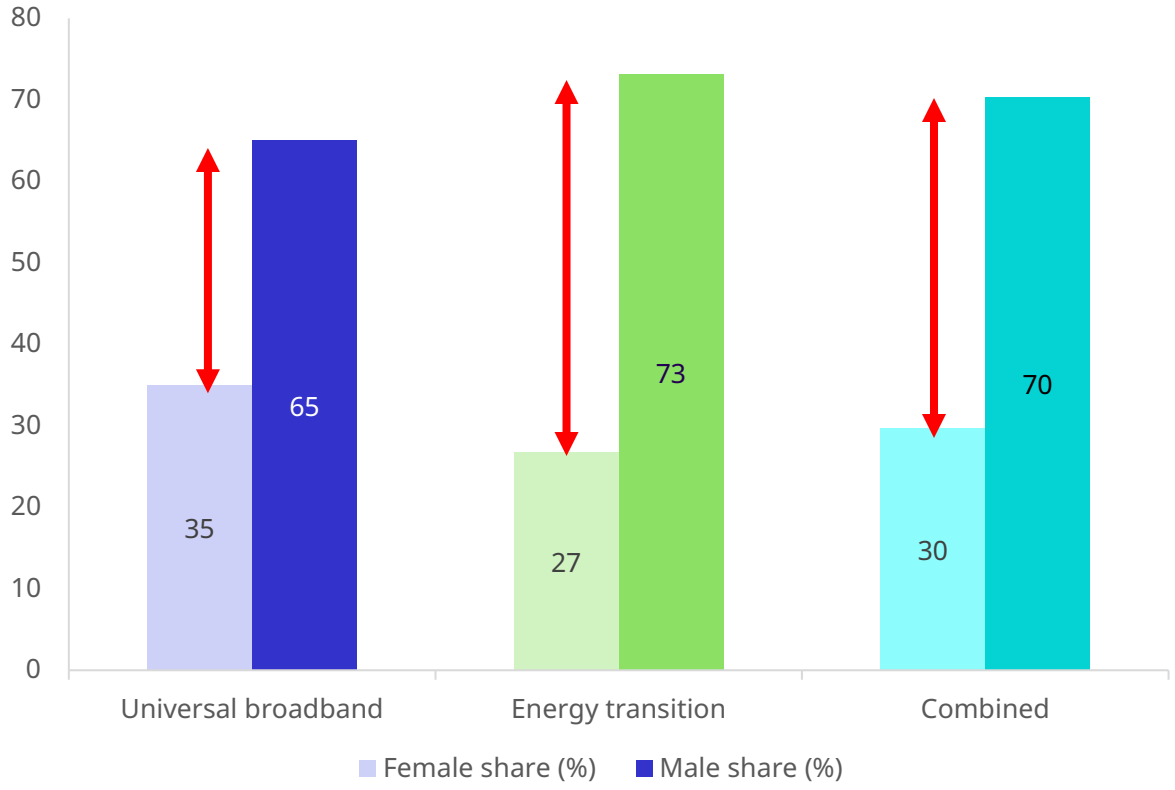

**Top 10 occupations accounting for 52 per cent of total employment gain, 2030**

| # | ISCO | Occupation | millions | % |
|---|---|---|---|---|
| 1 | 93 | Labourers in mining, construction, manufacturing & transport | 6.8 | 4.8 |
| 2 | 71 | Building and related trades workers (excluding electricians) | 6.4 | 4.7 |
| 3 | 72 | Metal, machinery and related trades Workers | 3.0 | 2.6 |
| 4 | 52 | Sales workers | 2.8 | 1.2 |
| 5 | 74 | Electrical and electronics trades workers | 2.0 | 2.4 |
| 6 | 51 | Personal service workers | 2.0 | 1.5 |
| 7 | 75 | Food processing, woodworking, garment and other craft and related trades workers | 2.0 | 1.8 |
| 8 | 83 | Drivers and mobile plant operators | 1.7 | 1.4 |
| 9 | 24 | Business and administration professionals | 1.6 | 1.7 |
| 10 | 33 | Business and administration associate professionals | 1.6 | 1.5 |

Source: ILO, based on E3ME model of Cambridge Econometrics.

# Demographics: Gender

***Gender distribution of additional job creation is alarmingly unequal***




**Universal broadband scenario**: Female share - **30 pct points smaller / 7 million LESS jobs** than men.

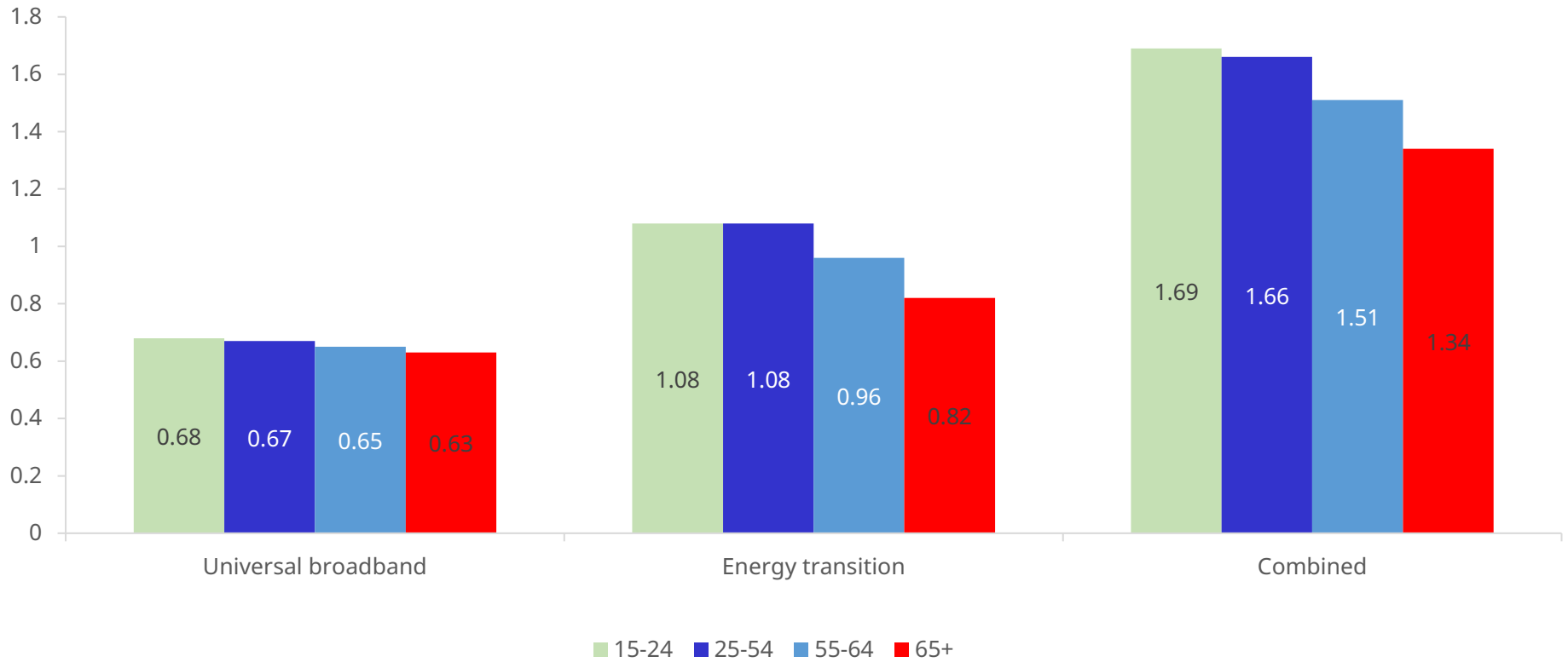
**Energy transition scenario**: Female share - **46 pct points smaller / 17 million LESS jobs** than men.

**Combined Scenario**: Female share - **41 pct points smaller / 23 million LESS jobs** than men.

Source: ILO, based on E3ME model of Cambridge Econometrics.

# Demographics: Age group

***Older workers would see lower percentage changes in additional job creation***




Source: ILO, based on E3ME model of Cambridge Econometrics.

# Key takeaways

1. **Broadband gains concentrate** where coverage gaps are biggest (notably Africa and low-income countries): Infrastructure build-up and services expansion

2. **Energy-transition gains concentrate** where necessary decarbonization investment is largest and industry-base for manufacturing is well-established (notably Asia and the Pacific): Infrastructure build-up and manufacturing of components

3. **Combining broadband and energy transitions "levels up" the distribution**: All regions and income groups see positive employment growth greater than 1.1% by 2030

4. **Middle-skilled workforce is much needed**: Across all scenarios, skills development system would face greatest demand/pressure for training trade-level occupations

5. **Distribution is not going to be automatically neutral**: without targeted action, gains are skewed by gender and age, risking widening inequalities

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# 2. Deep dive

# Occupations and skills for the green transition

**Individual occupations cannot simply be classified as “green” or “not green”**

All occupations require some type of ”green skill”:

- foundational skills: numeracy, literacy, digital literacy and climate/environmental literacy
- core (soft) skills: communication, problem solving, teamwork, collaboration, creativity
- semi-technical skills: customer handling, project management, research, sales and marketing
- technical skills: skills needed to build biogas digesters, solar and wind systems, and others

**Significant spatial and sectoral differences**

- An area’s ability to benefit from the green transition depends on, e.g.:
  - business base
  - skills base
  - government policy
  - reliance on carbon-intensive industries
  - renewable energy endowments
- Important worker transition challenges – ”green jobs” tend to need higher skills than ”brown’ jobs. But workers often have key transferable skills.

# Occupations and skills for digitalisation

**There have been several waves of digitalisation**, which is different to the green transition

Current wave, driven by generative AI, promises much disruption in skill needs

Substantial investment in retraining needed to mitigate potential negative impacts

Workers need:

- Basic digital skills
- Technical skills
- Human-centric skills, e.g. customer handling, project management
- Hybrid skills for computer-human interaction

**Digitalisation works out differently per locale and sector**

- E.g. agriculture affected by robotics, clerical work by AI
- Jobs centred around manual labour may by most insulated from AI, e.g. carpentry, plumbing, adult care
- Spatial variations flow from differences in digital infrastructures and prevalence of informal employment

# Green and digital combined

**Digital and green transitions do not always move in the same direction**

Some digital technologies support the green transition, e.g. by reducing the need to travel

But others, e.g. blockchain mining or Generative AI, increase energy consumption and environmental footprint.

There are areas of overlap in **basic skills**, e.g. understanding energy efficiency of computers

**Core skills**, e.g. systems thinking and communication, are needed to deal with complex green challenges and in human-computer interactions

Both transitions require different **technical skills.** But at the intersection, we are seeing the application of high-level technical digital skills to the development of green products and services.

New types of occupations combine green and digital technical skills – e.g. green technology specialists such as energy experts and digital specialists working in precision agriculture

# Inclusion risks

## Green transition

Disadvantaged youths are less likely to master environmental sustainability, to be aware of and care about the environment, and to engage in pro-environmental activities.

Women: under-represented in green jobs; less likely to study STEM and to transition from education or training into green jobs

Men: most affected by the loss of polluting “brown jobs”

But some new jobs represent women better than old jobs, e.g. PV solar

## Digital transition

Disparities in access to digital technology and skills development

The advantaged benefit most; the disadvantaged fall further behind (Matthew principle)

Younger, higher-skilled, permanent employees most likely to get employer-funded training

Women are significantly underrepresented in high-demand digital fields across the globe, but especially in developing countries

## Green and digital combined

The green and digital transitions have revealed weaknesses in adult learning systems around:

- quality of provision
- lack of schemes to deliver training to those most in need of it, especially the low-skilled, older workers, the self-employed and part-time and temporary workers

# Skills anticipation and planning

**Skills anticipation mechanisms are a foundation stone for understanding skill needs**

Approaches include:

- integrating skills systematically into existing mechanisms
- taking one-off initiatives through specific studies or expert groups, often focused on specific sectors or as part of activities of sectoral skills bodies
- creating specific structures and processes (most common in the green transition?)

**Key issues**

- Higher- and upper-middle-income countries tend to have well-developed skills anticipation systems
- lower-income countries have tended to rely on more ad hoc mechanisms and targeted stakeholder collaboration
- need for more fine-grained data at the level of skills, occupations, regions and local labour markets
- involvement of the business community is an important ingredient for success

# TVET, lifelong learning, upskilling and reskilling

**Greening of skills development programmes is now widespread**

Involves inserting foundational, core and technical skills into training and qualifications

Ranges from full course reviews to creating new modules and micro-credentials

Some countries have embedded generic and foundational green skills across all TVET programmes

**Governments have responded in various ways to waves of digitalisation**

Over-arching digital education policies are common, plus wider skills development systems

Robust investment in human capability, including AI education and lifelong learning, is essential for long-term employability

But we need to know more about effects of educational technologies on learning

**Green and digital tend to be in separate camps at strategy level**

But a growing confluence

Tend to be brought together at school and teacher levels

Ubiquity of digital tools in environmental sustainability means digital skills often taught as a matter of course

Centres of Vocational Excellence (CoVEs) have the potential to bring green and digital together, linking skills, research, innovation and business development

# Key investments

## Teachers, trainers and TVET providers

New skills in green and digital need the updating of teachers' and trainers' skills

This may require new approaches, e.g. active learning to develop problem-solving skills

Investments are needed in both initial and continuing training

TVET providers can become beacons of good practice in green and digital

## Enterprise development schemes

Especially for the development of green products and services at the overlap with digitalisation

Such schemes can incorporate skills development as integral element

## Investing in inclusion

A focus on inclusion is an important part of many interventions

Some countries have embedded the just transition into their strategies

Gender-based initiatives are increasingly a feature with a focus on opening up opportunities for women

# Recommendations

Put skills development centre stage in all relevant strategies, plans and funding commitments

Ensure strong relationships across government ministries

Ensure social partners and all other relevant stakeholders are engaged

Improve education and training provision so that they are more responsive to new skill needs

Pay attention to foundational skills and core competencies, not just technical skills

Consider gender equality at every stage and level of skills development

Include questions of spatial variability in the distribution of the benefits and costs in all interventions

Support R&D into a range of areas, e.g. data granularity; a better understanding of how green and digital can be handled together in curricula and pedagogies

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