Talk Plan

■ Key Drivers of Labour Market Transformation
- Focusing on Digital and Green Technologies

■ Policy Implications

Key Drivers of Labour Market Transformation (1/6)

① Technological Innovation (the most powerful)**
- Digital technologies
- Transforming existing business → Reshaping both jobs and required skills
- These technological transformations are expected to drive both job creation and job displacement
  * While ICT sector jobs (macro; output-based) and digital task jobs (micro; task-based) across broader industries are expanding, jobs in non-ICT sectors or those not utilizing digital technologies are simultaneously being replaced or redefined.

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Projected Job Changes, 2025–2030 (in millions)

Rank	Macro or Technology Trend	Created	Displaced	Net Effect
1	**Broadening Digital Access**	**9.9M**	**9.1M**	**+0.8M**
2	**AI and Information Processing**	**5.5M**	**5.2M**	**+0.3M**
3	**Robotics and Automation**	**3.8M**	**3.1M**	**+0.7M**
4	**Energy Generation, Storage & Distribution**	**2.8M**	**1.8M**	**+1.0M**
5	Climate Change Mitigation	1.3M	1.0M	+0.3M
6	Climate Change Adaptation	0.9M	0.9M	0
7	New Materials & Composites	0.8M	0.7M	+0.1M
8	Quantum & Encryption Technologies	0.6M	0.3M	+0.3M
9	Semiconductors & Computing	0.2M	0.1M	+0.1M
10	Biotech & Gene Technologies	0.1M	0.1M	0
11	Geoeconomic Fragmentation	–	1.6M	–1.6M
12	Slower Economic Growth	–	4.8M	–4.8M

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Displacement versus Augmentation, 2025−2030
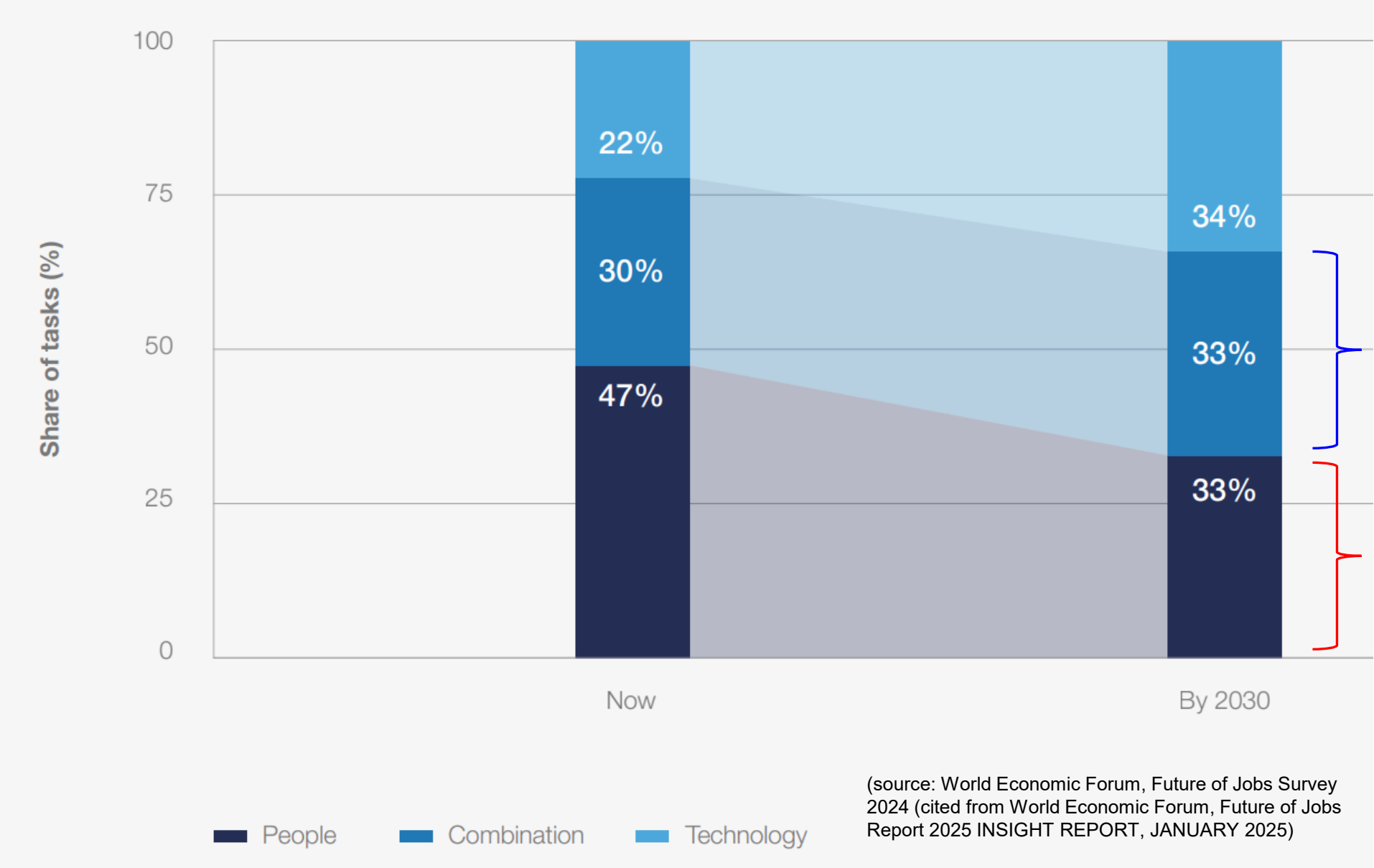
Expected to be replaced by the development of AI (recent and future) - less specialized workers can perform high-tech tasks with the assistance of AI.

By Automation (81.5%) − early stage

(source: World Economic Forum, Future of Jobs Survey 2024 (cited from World Economic Forum, Future of Jobs Report 2025 INSIGHT REPORT, JANUARY 2025)

# The Employment Effect of Digital Technologies in Literature

■ Neither uniform nor unidirectional (Hötte, 2023).

■ Early studies emphasized the *displacement effect*.

  * IT and Robots – replacing routine tasks (Lee and Shin, 2017; Autor and Dorn, 2013; Acemoglu and Restrepo, 2020; Frey and Osborne, 2017; Dauth et al., 2021), manufacturing jobs but not service sector

    jobs (Kim, 2024).

  * Technological progress tends to polarize labor markets—expanding both high- and low-skill jobs while displacing middle-skill employment (Goos & Manning, 2007; Autor, 2019).
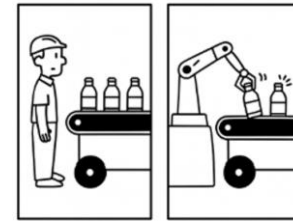
■ Recent studies reported the *complementarity effect*:

  * Digital tools and AI augment workers' capabilities, creating new occupations and demand for cognitive, creative, and social skills(**Aum et al., 2025; Marguerit, 2025**; Acemoglu & Restrepo, 2018 & 2020).

■ More Recent studies have reported the *displacement effect even for high-skills jobs.*

- **AI exposure is higher in high-skill occupations compared to the exposure to traditional technologies (Webb, 2020)** → AI may substitute high-skill workers (Eisfeldt et al., 2023).

− Firms with higher AI investment tend to have higher profits → hire more high-digital-skill workers (new not re-skilled or up-skilled) and reduce employment in non-AI positions (Babina et al., 2023; Acemoglu et al., 2022).

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Key Drivers of Labour Market Transformation (2/6)

① Technological Innovation (the most powerful)

② Green Transition

- <u>About 50% companies (in the survey) expect that by 2030, investments and efforts to reduce carbon emissions and adapt to climate change will become a key driver</u> of business transformation
- In recent years, the employment resilience of green jobs has remained strong, with hiring rates in green sectors staying relatively stable — even during the pandemic disruptions of 2020.
    * Jobs in the Environmental Goods and Service Sectors (macro/output-based)
    * Jobs in Net-zero Transition Sectors
    * Jobs in Green and Transition Finance
    * Green jobs across various industries (mico/task-based)← In most countries — except for a few advanced economies — there is a shortage of skilled professionals in this field relative to growing demand.
  * Some green jobs are not "decent".
- In the EU, an additional 2.5 million jobs (more than +1%) will be created by the year 2030 due to the EU green transition (Siebel, Cedefop 2023).
- Jobs in the Brown sectors → Just transition policies are needed **.

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Key Drivers of Labour Market Transformation (3/6)

① Technological Innovation (the most powerful)
② Green Transition
- Automobile, energy industry, and other fossil−fuel intensive sectors ← rapid transformation
- Green and Transition Finance ← In most countries — except for a few advanced economies — there is a shortage of skilled professionals in this field relative to growing demand.

③ Industrial Policies and Changes in Global Supply Chain
- Labour market transformations driven by the decline of free trade, the consideration of climate risk and carbon emissions from the entire VC in trade policies (Scope 3 emissions under the CBAM in the EU), and reshoring/friend-shoring policies
- Evolution of strong industrial policies that prioritize domestic core manufacturing, IT, and high-growth industries.

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Key Drivers of Labour Market Transformation (4/6)

① Technological Innovation (the most powerful)
② Green Transition
③ Industrial Policies and Changes in Global Supply Chain
④ Demographic Change
- Aging and shrinking working-age populations in high-income countries ($\rightarrow$ driving growth in care-related occupations, including nursing, elderly care, and social support services, reflecting rising demand for healthcare and caregiving professionals),
- Growing working-age populations in low-income countries,
- Combined with the expansion of remote work, are reshaping the global distribution of jobs.
  - High value-added and knowledge-intensive roles are increasingly concentrated in advanced economies with strong digital infrastructure and capabilities.
  - Other types of work are shifting toward developing countries with larger and younger labour forces.

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Key Drivers of Labour Market Transformation (5&6/6)

① Technological Innovation (the most powerful)
② Green Transition
③ Industrial Policies and Changes in Global Supply Chain
④ Demographic Change

⑤ **Changing Work Preferences and Values**
- <u>Rising educational attainment</u>
- Reduced work motivation when jobs are not perceived as quality employment, resulting in higher voluntary unemployment, and
- Weaker linkage between education and occupations
  * <u>Slow adaptation of education and training systems: Curricula and vocational programs lag behind changing labor-market needs</u>
  * <u>Degree requirements have become less important in job advertisements (Fuller et al., 2022).</u>
– Labor market frictions: Limited mobility and poor information flows.
  * Workers attempted to transition toward growing sectors, but candidates coming from declining occupations were less likely to achieve successful transitions, reflecting employers' hesitation to hire occupational switchers (Carrillo-Tudela et al. 2023).
- <u>High unemployment rate of young people.</u>

⑥ **Inadequate skills forecasting and investment → Insufficient upskilling and reskilling efforts by firms and policy makers**

Post-Pandemic Observations: Labor Shortages and Skills-Mismatches

■ **Labor shortages** are unevenly distributed across sectors, largely driven by ***skills mismatches*** and changing worker preferences (ILO, 2024).

occur when workers' qualifications (SUPPLY) do not align with job requirements (DEMAND) , leading to simultaneous unemployment and job vacancies.

- The pandemic accelerated structural changes in demand and long term trends – including digitalization, the expansion of e-commerce and remote work, and decarbonization → thereby accelerating skills mismatches across labor markets (Acemoglu, 2002; Song et al., 2021).

Observations in Korea

■ Digital
- AI, big data, and IoT reduces high-skill jobs in manufacturing sector but this displacement effects are offset by new jobs in IT services. (Aum and Shin, 2025; Han, 2023).
- The occupations most affected differ across industries: Craft jobs in manufacturing, professionals in IT services, and elementary occupations in other services have all experienced significant declines (Aum and Shin, 2025).
- AI adoption reduces new hiring. At least in the short term, the impact of AI adoption on employment and wages is limited, but as the increased demand for AI specialists tends to offset job reductions elsewhere (Han, 2023).
- The employment effect of digital techs shows a polarized pattern – increasing in groups with above-average exposure to AI, while decreasing in groups with below-average exposure (Lee and Hwang, 2023).
- Unlike previous technologies (such as industrial robots and software), AI tends to expose higher-income and higher-educated workers more intensively. A 10% increase in the AI exposure index is projected to reduce the employment share of affected jobs by 7 percentage points and lower wage growth by 2 percentage points over the next 20 years (Han and Oh, 2023; Song et al., 2024; Kim et al., 2024; Jang and Kim, 2025).

■ Green
- Labor-intensive, stable-demand sectors are expected to experience moderate growth
- Integrated with the digital transformation → Green ICT

Summary and Implications

• Technological agenda requires **shifting from job protection to transition facilitation** — ensuring workers can actively join and drive the transition toward expanding sectors.

1) **Green Technologies**

• **The Employment Effects**
–   The employment effects are positive (weakly),
–   The process of decarbonizing the economy could open up new areas and opportunities for the development of digital technologies, thus stimulating digital innovation.
-   Moreover, green technologies tend to be more digital than the technologies they replace → the green transition could stimulate the digital transition.

• Skill Policies
–   In some sectors, "non-decent" jobs can be transformed to decent jobs by combining digital technologies. Just transition (reskilling, upskilling policies, and social welfare approaches) is needed for brown sectors.

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Summary and Implications

2) Digital Technologies

- **The Employment Effects**
- continue to evolve and reshape the nature of work, with **displacement effects expected to increase**, increasingly **replacing even high-skill jobs**.

- **Skill Policies**
  - Reforming the education system — including curriculum design and lifelong learning frameworks — to better align with labor market skill demands and soft skills
  - Integrating in-company training (upskilling and vocational training for current and potential employees) with school education and industrial support policies to enhance workforce relevance and skill alignment.
  - Identifying occupations with a high risk and establish reskilling and upskilling programs and job-linked welfare policies to strengthen the social safety net.
  - Introducing youth employment policies that support smoother entry into the labor market.
  - Strengthening and educating workers in areas that rely on uniquely human abilities (i.e., creativity, empathy, ethical judgment, social skills, and complex problem-solving)
    * Required skills

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Thanks!

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Evolving Technological Themes in the Twin Transitions – Green Transition

MS/HS
- Manufacturing
  * Emerging green sectors; existing industries in transition including green cement and low-carbon steel
  * Industrial Process (electrification, heat recovery, process control with IoT/AI optimization, cloud workload carbon-scaling)
- Energy-efficient appliances and tech.
- Sustainable product design;
- Building/Retrofit (high-efficiency insulation, smart HVAC, heat pumps);
- Transport electrification (EV, battery cells/modules/packs, materials, charging infra., E-power trains);
- Carbon dioxide utilization (CCUS);
- Green social entrepreneurship

LS/MS/HS
- Circular economy and resource management

HS/MS
- Sustainable finance (green & transition finance)
- AI/Machine-learning for carbon data (tracking/ monitoring/assessing),
- ESG management,
- Climate risk modeling,
- Satellite and sensing for disaster and monitoring
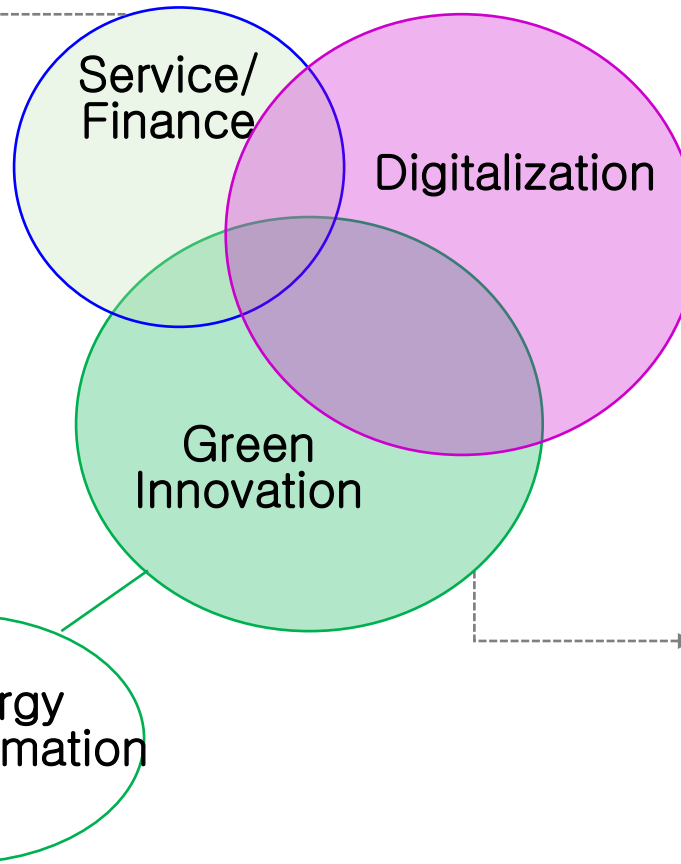
MS/LS
- Renewable energy: Labor-intensive
- CCS, Green hydrogen;
- Smart grids and energy digitalization (grid expansion, demand-side management, advanced metering infra, grid cybersecurity)

Service/Finance

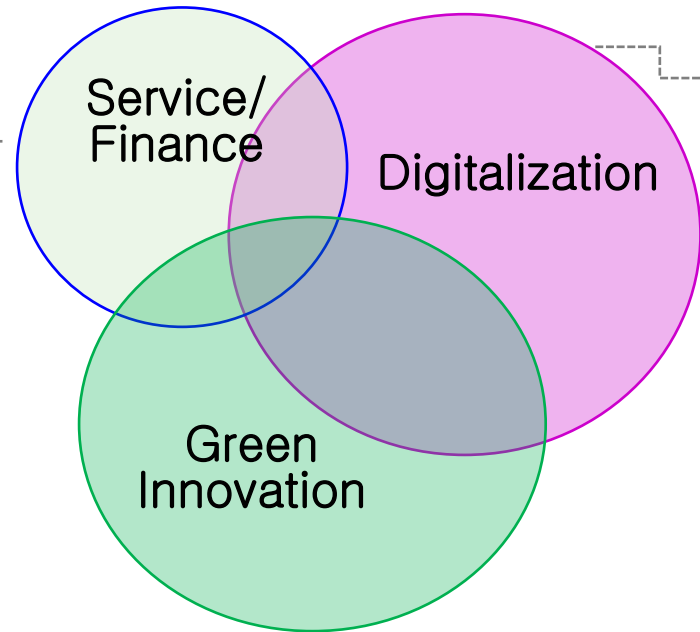Digitalization

Green Innovation

Energy transformation

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Evolving Technological Themes in the Twin Transitions – Digital Transition

HS
- Digital finance: digital lending, mobile payments, digital wallets, the expansion of cashless economies, digital currency, blockchain;
- AI/Machine-learning for financial data analysis
- Fintech,
- Cybersecurity
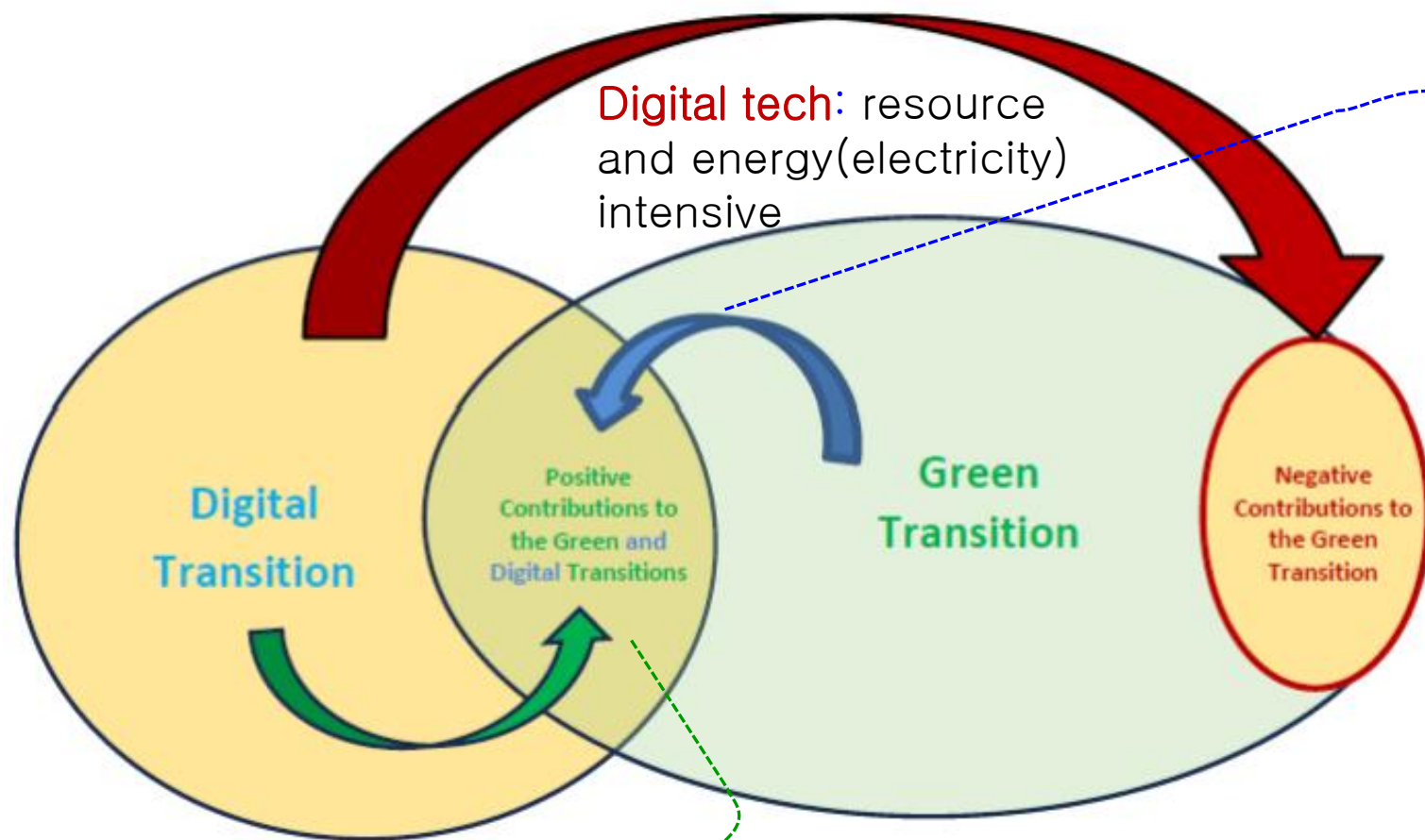
MS/LS
- E-business including e-commerce and e-tourism

HS/MS
- AI & robots
- Digital operation (machine learning, cloud computing, IoT, big data, edge computing)
- Remote−work
- Digital infra (telecommunication, satellite, and etc.)
- Digital products
- Data governance (industry 4.0)

LS
- Programing/coding

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Interactions between Digital and Green technologies

Digital tech: resource and energy(electricity) intensive

Digital Transition

Positive Contributions to the Green and Digital Transitions

Green Transition

Negative Contributions to the Green Transition

Digital tools
- enhance environmental monitoring, energy efficiency, & green supply-chain management (OECD, 2023)
→ The digital transition could facilitate the Green Transition.

The process of decarbonizing the economy
- could open up new areas and opportunities for the development of digital technologies, thus stimulating digital innovation.
- Moreover, green technologies tend to be more digital than the technologies they replace → the green transition could stimulate the digital transition.

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Skills Expected to Grow in Importance (2025–2030)
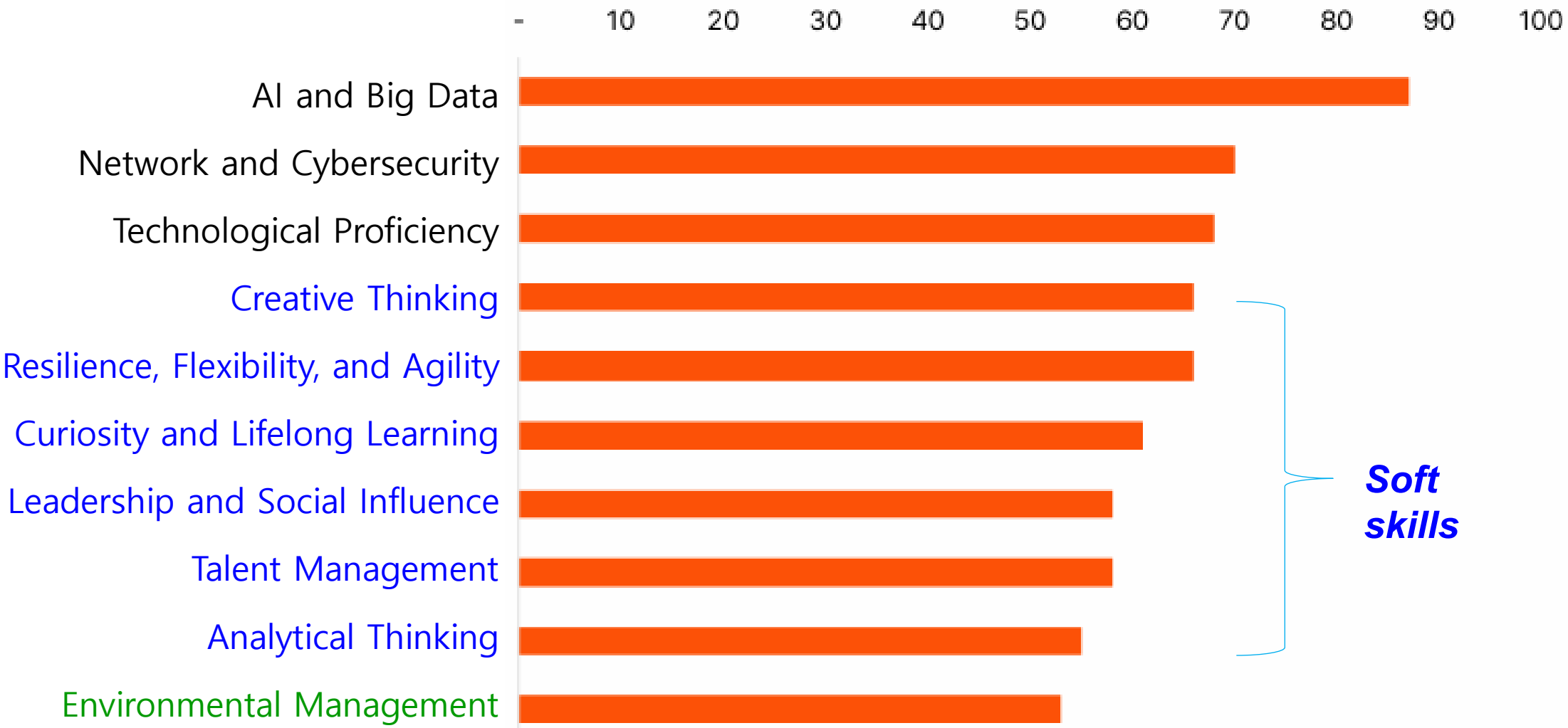
Source: WEF, Future of Jobs Report 2025; Samil PWC Institute.