EMBRACING INDUSTRY DISRUPTION FOR INCLUSIVE GROWTH: SKILLS STRATEGIES TO SUPPORT INDUSTRY TRANSFORMATION

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Executive Summary

Latin America and the Caribbean stand at the precipice of a historic industrial transformation driven by global megatrends such as artificial intelligence, nearshoring, and the green transition. This publication argues that for nations to convert these potential disruptions into competitive advantages, they must fundamentally pivot from supply-driven education models to demand-driven skills development systems. The following five sections of the report, highlight the central role of industry-led strategies in navigating this shift.

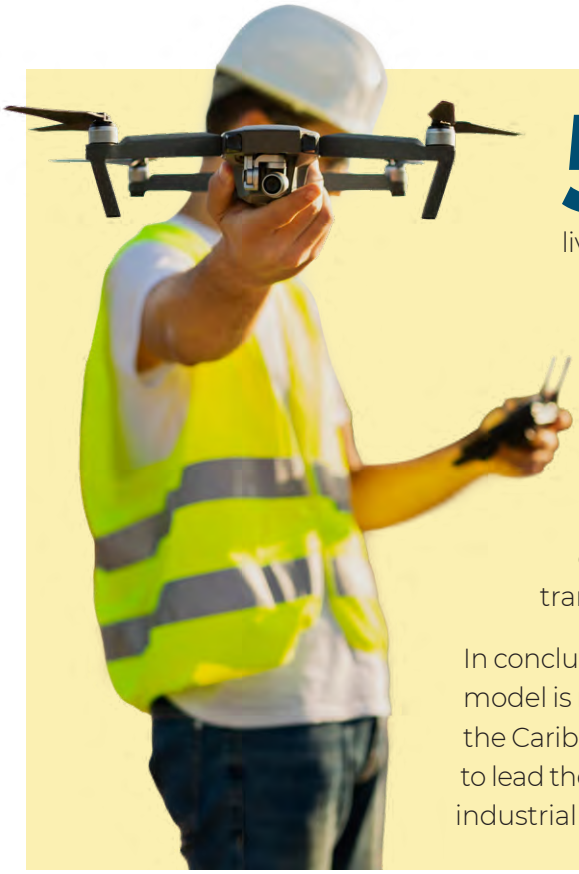
1 SKILLS GAPS IN THE ERA OF INDUSTRY TRANSFORMATIONS. The rapid pace of technological change is rewriting production rules, creating a sharp dichotomy: while new opportunities for growth emerge, severe structural risks threaten nations and firms unable to adapt. With an estimated 39% of current job skills expected to be disrupted within five years, the region faces significant skills gaps. To remain competitive, training systems must adopt a "dual architecture" that balances a robust foundation of core competencies with agile mechanisms that react to the fluctuating demands of strategic sectors.

2 THE STRATEGIC IMPERATIVE: CHARTING A CLEAR PATH FOR NATIONAL INDUSTRY GROWTH. Human capital development cannot exist in isolation; it must be strictly aligned with national economic strategies to prevent workforce bottlenecks from stifling innovation. Successful transformation requires governments to identify priority sectors and concentrate resources on them. Case studies like Portugal's Indústria 4.0 and Singapore's SkillsFuture demonstrate that synchronizing economic digitalization with national upskilling movements creates a tangible talent advantage and fosters economic resilience.

3 INDUSTRY SKILLS STRATEGIES: The Pillar of Transformation. Serving as the central pillar of this publication, Industry Skills Strategies are defined as sector-specific plans designed to align workforce competencies with evolving market demands. Because sectors evolve at different speeds and require unique technology combinations, these strategies must be industry-specific to effectively guide the training ecosystem.

- **The Leading Role of Industry:** These strategies empower industries to transition from passive consumers of graduates to active architects of talent. By conducting rigorous labor diagnoses and mapping value chains, industries can pinpoint the specific "missing links" in human capital required to achieve their transformation objectives, such as shifting to electromobility or Industry 5.0.
- **A Human-Centric Model:** The proposed model emphasizes that transformation is fundamentally a human process, not just a technical one. It advocates for a three-fold human-centric approach: **1) Preparing the future** by reskilling the current workforce to remain employable; **2) Removing barriers** to ensure vulnerable groups, such as women and youth, can access opportunities; and **3) Advancing competitiveness** through innovation-oriented upskilling. This ensures that technological change amplifies human contribution rather than displacing it.

4 INDUSTRY-DRIVEN SKILLS SYSTEMS. To sustain this alignment, the region must pivot toward demand-driven systems where industry needs explicitly shape occupational profiles and training standards. This section details governance mechanisms like Sector Skills Councils (SSCs) and Sectoral Talent Pipelines (STPs), which function as strategic command centers for industry evolution. These bodies allow employers to co-design curricula and forecast labor market intelligence, ensuring that educational capital maps strictly to productive priorities.



5 SKILLS DELIVERY: A PARADIGM SHIFT TOWARDS INCLUSIVE TRANSFORMATION. The final section focuses on the operational delivery of these strategies through Work-Based Learning (WBL). WBL mechanisms, such as apprenticeships and dual training, shift learning from the classroom to the production floor, ensuring workers develop skills on the frontier technologies actually used by firms. This co-investment model transforms training into a strategic mechanism for business resilience, allowing firms to adapt quickly to innovation while facilitating the seamless transition of students into the labor market.

In conclusion, moving toward an industry-led, demand-driven model is not optional but a prerequisite for Latin America and the Caribbean to compete globally. By empowering industries to lead the identification of skills needs, nations can ensure that industrial transformation drives inclusive, sustainable growth.

1

Skills Gaps in the Era of Industry Transformation

Latin America and the Caribbean (LAC) is facing a historic industrial transformation. Global megatrends—including AI, nearshoring, electromobility, and the green transition—are actively rewriting the rules of production and skill requirements. This shift presents a sharp dichotomy: it offers unprecedented opportunities for innovation and growth yet poses severe structural risks for nations and firms unable to adapt.

> **An industry transformation occurs when a certain threshold is effectively surpassed in relation to changes in the relevant "elements" and "relationships" in the markets, respectively, in a sequence of markets within an industrial value chain (between two distinct points in time).**[1]
>
> Gersch & Goeke (2007). Industry Transformation – Conceptual Considerations from an Evolutionary Perspective. Read more.

Technological change is advancing at an unprecedented pace, creating new occupations while rendering others obsolete. The World Economic Forum's Future of Jobs 2025 report estimates that 39% of current job skills will be disrupted within the next five years,[2] a challenge even more pronounced in developing countries, where fewer than 20% of workers have access to training that would allow them to update their skills.[3] Workers who lack opportunities for upskilling and reskilling face a growing risk of exclusion from emerging value chains.

Skills gaps are the discrepancy between the skills workers possess and those industries require. Internal gaps exist when employers believe their employees lack the skills necessary to fill the jobs; while external gaps exist when employers cannot find workers with the required skills on the market (IDB, 2019).

These transformations affect sectors unevenly. Some industries — *such as advanced manufacturing, renewable energy, electromobility, and the circular economy*— are undergoing deep structural shifts that require highly specialized competencies not yet widely available in the labor market. For example, the rapid expansion of electromobility in Europe has been constrained by shortages of qualified technicians trained in the emerging systems and technologies.[4] In LAC, a high proportion (generally 60-80%) of companies in the region still report significant difficulties accessing workers with the necessary skills, particularly in Information Technology and Data, which are consistently ranked as the most in-demand and difficult-to-find technical skills.[5]

1 McCaffrey, C., & Poitiers, N. (2024). Making industrial policy work: a case study on the European Battery Alliance Academy (No. 01/2024). Bruegel Working Paper. https://www.bruegel.org/system/files/2024-01/WP%2001%202024_0.pdf.

2 World Economic Forum. (2025). *The future of jobs report 2025.* World Economic Forum. https://www.weforum.org/publications/the-future-of-jobs-report-2025/.

3 World Bank (2019). *World development report 2019: the changing nature of work.* World Bank. https://doi.org/10.1596/978-1-4648-1328-3.

4 Marope, P. T. M., Chakroun, B., & Holmes, K. P. (2015). Unleashing the potential: transforming technical and vocational education and training. UNESCO Publishing.

5 ManpowerGroup Talent Shortage Hub (2025). https://go.manpowergroup.com/talent-shortage

Difficulty finding the **required skills**

- Brazil: **81%**
- Costa Rica: **71%**
- Mexico and Perú: **70%**
- Argentina: **68%**
- Panama: **63%**
- Colombia: **59%**

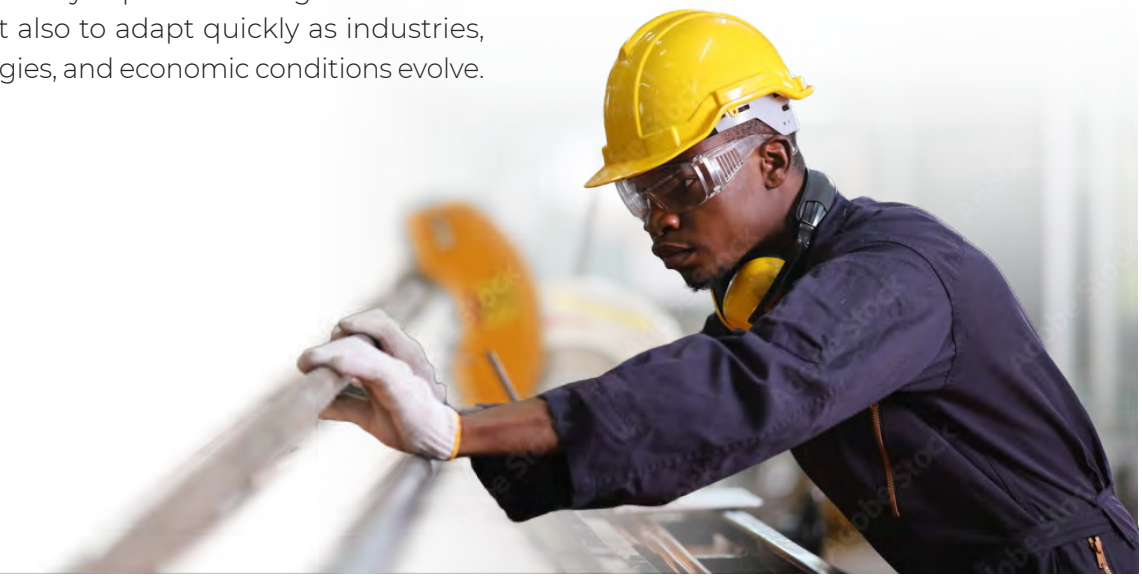
ManpowerGroup Talent Shortage Hub 2025.

In this context, technical and vocational education and training (TVET)[6], and broader skills systems emerge as fundamental pillars of industrial transformation. A human-centered approach—one that prioritizes inclusion, upskilling, and equity—is essential to ensure that workers can meaningfully participate in new economic opportunities. This requires skills systems designed not only to provide strong foundational skills, but also to adapt quickly as industries, technologies, and economic conditions evolve.

The Dual Architeture

Resilient training systems must align directly with national economic strategies. To remain effective, these systems cannot be static; they must dynamically adapt to the evolving needs of strategic industries. Effective training ecosystems must be both reactive and proactive to industry shifts. However, this adaptability requires a solid foundation. True resilience is built on a **dual architecture** that balances agility with a strong structural core.

The system requires a **robust base of core competencies** as its bedrock, providing the universal skills necessary for long-term stability. This foundation must be paired with **adaptive mechanisms** that respond to fluctuating skill demands. This combination maximizes workforce mobility: as industries evolve, workers can capitalize on their transferable core skills while using targeted modules to retrain for emerging opportunities.



6 TVET is understood as comprising education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods. It includes formal, non-formal and informal learning and takes place in a wide variety of settings. Source: UNESCO-UNEVOC TVETipedia Glossary.

FIGURE 1 FROM INDUSTRY STRATEGY TO CAREER PATHWAYS: A DEMAND-DRIVEN SKILLS SYSTEM

Demand-Driven Skills System

The country and the industry must have a clear growth and/or transformation strategy. This is the starting point, ground zero.

1

The training ecosystem must be directly linked to this industry strategy to respond assertively to the skills needs of these industries and carry out their transformations.

2

Employer participation is key to operationalizing the identification of demand in these industries. Sectoral skills/competency councils are an example of an active role for employers.

3

To this end, industry-level Skills Development Strategies allow for the identification of industry segments and the types/levels of profiles required to achieve this growth and industry transformation.

4

These strategies feed into each industry's Career Pathways Frameworks, a visual way to identify the required segments and profiles, not only informing the training ecosystem about the required packages and quantifying them but also empowering workers to take ownership of their career progression by providing the necessary input for their decision-making.

Conversely, rigid skills architectures stifle adaptation to technological change. This static approach accelerates workforce obsolescence and widens capability gaps, directly undermining national competitiveness.

The Core Premise of This Report. This publication establishes a framework for how skills development systems must be not only viewed but utilized. Skills strategies are not peripheral social policies; they are core industrial policy instruments. Nations that proactively deploy these frameworks drive competitiveness, attract investment, and empower SMEs. Skills development must be leveraged as a strategic mechanism to **shape economic transformation**, rather than merely react to it.

Industrial transformation is not just a technical upgrade; it is a strategic shift that redefines competitive advantage, requiring companies to realign business models, invest in innovation, and build future-ready talent pipelines to sustain growth. This report displays how deliberate, industry-aligned skills strategies can bridge capability gaps and ensure inclusion. To navigate this transition, we must move beyond reactive measures and implement coherent strategies that empower the workforce to **embrace** emerging global trends, converting potential disruption into competitive advantage.

The journey begins with **The Strategic Imperative: Charting a Clear Path for National Industry Growth**, which examines how countries can define priority sectors and align productivity goals with human capital development. The following chapters progressively address industry-specific strategies, system governance, and the delivery of skills in ways that ensure transformation is both inclusive and sustainable.

2

The Strategic Imperative: Charting a Clear Path for National Industry Growth

For a country to achieve purposeful and sustainable development, a coherent **national economic growth plan** is not merely advantageous —*it is essential*. This plan must be rooted in a deep understanding of the country's economic structure and growth potential, while also aligned with long-term social and environmental goals. In the current context, these plans must also take into account the major transformations that are redefining global production and trade—such as digitalization, automation, and the transition toward a greener economy.

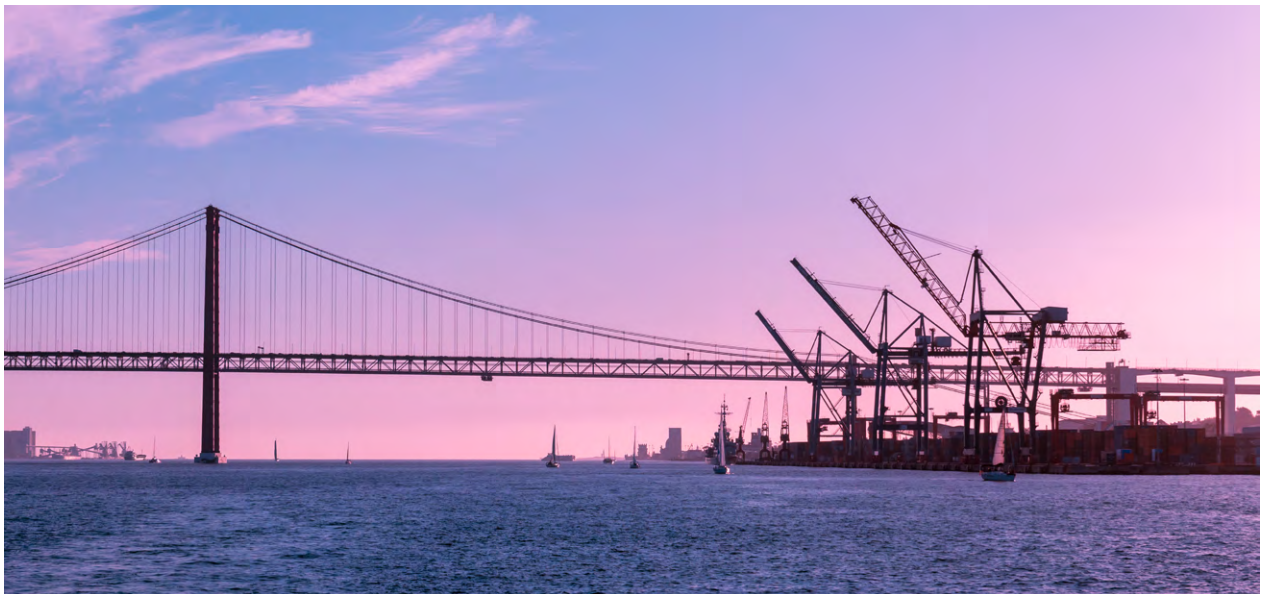
The strategic imperative lies in the deliberate identification of **priority industries**—sectors with the highest potential to drive sustainable growth, align with the SDGs, and integrate into global value chains[7]. Key fields such as advanced manufacturing, renewable energy, electromobility, and ICT act as dual engines for innovation and green job creation[8]. By concentrating resources on these high-impact sectors, governments create the necessary conditions to maximize productivity and competitiveness.

Selecting priority sectors is insufficient on its own. To maximize economic potential, human capital development must be strictly aligned with industrial policy. Education systems must equip the workforce with the specific competencies that productive sectors demand. Without this alignment, human capital becomes a bottleneck rather than a driver of transformation,[9] stifling innovation and global competitiveness.

7 OECD. (2021). *Industrial policy for the Sustainable Development Goals*: increasing the private sector's contribution. OECD Publishing. https://doi.org/10.1787/2cad899f-en.

8 International Labour Office. (2024). Global employment trends for youth: decent work, brighter futures. International Labour Organization. https://www.ilo.org/sites/default/files/2024-11/GET_2024_EN_web4.pdf.

9 Cheon, B. Y. (2014). Skills development strategies and the high road to development in the Republic of Korea. Transforming economies: Making industrial policy work for growth, jobs and development, 213-238.



2.1 Case Stude: Portugal's Integrated Indústria 4.0 and Skills Ecosystem

Portugal's *Indústria 4.0* (i4.0) strategy exemplifies a deliberate synchronization between economic digitalization and human capital development. Rather than treating training in isolation, the government tethered i4.0 to **INCoDe.2030**, a national initiative designed to equip the workforce with competencies ranging from basic digital inclusion to advanced specialization. This alignment moved beyond generic education, fostering targeted upskilling programs specifically tailored for high-value sectors like automotive components, footwear, and electronics. By identifying priority industrial needs first—via a "bottom-up" process involving over 120 companies—Portugal successfully converted its national economic vision into a tangible talent advantage. The OECD cites this demand-driven model as instrumental in strengthening the manufacturing sector's competitiveness, ensuring the workforce evolves in tandem with technological shifts.[10] [11]

Crucially, the success of this model relies on a holistic ecosystem that creates the necessary conditions for these skills to generate value. This approach is epitomized by the implementation of **"Learning Factories"**—such as the **UC Factory Lab** at the University of Coimbra and **INESC TEC's iiLab**—which function as collaborative hubs simulating real-world production environments. These facilities allow students and incumbent workers to test digital solutions (like Digital Twins and IoT integration) in a risk-free, hands-on setting before implementation on the actual factory floor. These practical hubs are articulated with broader structural mea-

10 OECD (2018). Skills Strategy Implementation Guidance for Portugal.
11 INCoDe.2030. National Digital Competences Initiative.

sures, such as the **i4.0 Platform** (managed by COTEC) and "Innovation Vouchers" which fund SME modernization. By integrating training with these technological testbeds, Portugal ensures companies possess the organizational maturity required to derive maximum benefit from their human capital investments.[12] [13] [14] [15]

Productivity Gains & Strategic Impact. The implementation of the Indústria 4.0 strategy has moved beyond theoretical training to deliver measurable operational improvements. By integrating "Learning Factories" with direct industrial application, Portuguese companies have reported significant gains in efficiency, cost reduction, and capacity.

Key Success Stories & Metrics:

- **Amorim Cork (Equipar Factory):** Through a targeted process improvement project (using the Theory of Constraints) often simulated in these academic-industrial partnerships, the company achieved a **20% increase in overall productivity** in its mechanical finishing stage. This bottleneck resolution translated into a potential annual financial gain of approximately €1.5 million, demonstrating how optimizing a single process through advanced analysis can yield high returns.[16]
- **IKEA Industry Portugal:** As part of its digital transformation, IKEA deployed AI and remote support tools that boosted efficiency in online customer processes by 200%. Internal pilots of Generative AI tools for co-workers also show a 30% productivity gain in design and planning, freeing staff for higher-value interactions.[17] [18]
- **Continental Mabor (Lousado):** The tire manufacturer established a new Solution Center in 2023, hiring over 80 specialists (data scientists and engineers) to develop digital solutions for their global operations. This investment has been pivotal in their transition to a "Mega Plant" capable of producing over 50,000 tires per day, while simultaneously reducing carbon intensity—recently achieving CO2-neutral production capability for specific lines via electric steam generation.[19] [20]
- **Bosch Car Multimedia (Braga):** A partnership with the University of Minho involving a €165 million investment in R&D has positioned the Braga plant as a global "Lighthouse Factory." The integration of "ActiveShuttle" autonomous vehicles and the Nexeed software stack has allowed for real-time logistics optimization, contributing to Bosch's global target of saving €1 billion through connected manufacturing efficiency by 2025.[21] [22]

12 INESC TEC. iiLab - Industry and Innovation Lab.
13 University of Coimbra. UC Factory Lab: Portugal's First Industrial Simulator.
14 COTEC Portugal. Indústria 4.0 Programme & Platform.
15 European Commission. Digital Economy and Society Index (DESI) - Portugal.
16 Delgado, F. et al. Improvement of a Manufacturing Process: The case study of Corticeira Amorim.
17 Loyalty Point. IKEA Digital Transformation Case Study.
18 CDO Magazine. What IKEA's Digital Chief Learned... Into the AI Era.
19 Continental. New Solution Center in Portugal Boosts Expertise.
20 Continental. Continental Tire Plant Enables CO2-neutral Production.
21 Invest in Portugal. Automotive and Mobility Industry at a Glance.
22 Bosch. Ten years of Industry 4.0: Bosch sales reach four billion euros.

Comparison: Traditional VET vs. Portugal's "Learning Factory" Approach [23]

Table 1 highlights how Portugal's "Learning Factory" model evolves beyond traditional Vocational Education and Training (VET) to meet Industry 4.0 demands.

TABLE 1 FROM TRADITIONAL VET TO LEARNING FACTORIES: A SHIFT TO MEET INDUSTRY 4.0 SKILLS NEEDS

FEATURE	TRADITIONAL VOCATIONAL TRAINING (VET)	PORTUGAL'S "LEARNING FACTORY" APPROACH
Primary Focus	**Task Mastery:** Focuses on mastering specific, isolated trade skills (e.g., welding, CNC operation) within a single discipline.	**System Competence:** Focuses on understanding the entire value chain, integrating engineering, management, and data science to solve complex systemic problems.
Learning Environment	**Static Workshops:** Uses standard, standalone equipment often separated from the complexities of a real production line.	**Dynamic Simulation:** Uses "Digital Twins" and connected cyber-physical systems (like at iiLab) to simulate real-time factory data, breakdowns, and process flows.
Industry Role	**Receiver:** Industry receives graduates and provides occasional internships but often has limited input on daily curriculum.	**Co-Creator:** Industry partners (e.g., via COTEC) co-design the facility and curriculum, using the factory as a testbed to solve their own actual production issues.
Innovation Cycle	**Linear Transfer:** Innovative techniques are taught only after they become standard industry practice.	**Concurrent Innovation:** Students and workers test new technologies (AR/VR, AI) in the Learning Factory before they are fully adopted by the market, acting as a sandbox for R&D.
Target Audience	**Students:** Primarily designed for entry-level students entering the workforce.	**Multi-Generational:** Serves as a hub for both students and incumbent workers (upskilling/reskilling) to learn side-by-side on the same advanced platforms.

23 Created using Google Gemini.

2.2 Case Study: SkillsFuture Singapore - A National Movement

Investment in human capital has long been central to Singapore's national agenda. The advanced economy has sustained its competitive edge by aligning economic development strategies with skills development policies, ensuring that its workforce acquires the competencies required at each stage of national growth.[24] But Singapore's leaders have also acknowledged the importance of ongoing adaptation to sustain a vibrant economy. In the early 2010s, Singapore faced significant demographic shifts, including a rapidly aging workforce and lower fertility rates, coupled with rapid technological progress, shorter lifespan of skills, increasing international competition, and the nation's push toward a digital and green economy. Without a renewed strategic response, a critical skills gap would emerge, leading to reduced economic competitiveness, structural unemployment, and social inequality.

SkillsFuture was launched in 2015 as a deliberate, comprehensive intervention to reskilling and lifelong learning to ensure productivity and extend careers. It was not merely a skills development initiative but a national movement that redefined education and training from a front-loaded, early-life activity to a continuous journey of lifelong learning.[25] Furthermore, it was embedded within a national economic strategy, and its components function like a well-integrated business ecosystem:

24 WEF (2025). A nation of lifelong learners: Singapore's skills-based approach to workforce development. World Economic Forum.

25 SkillsFuture Singapore. (n.d.). Our SkillsFuture story: empowering every Singaporean to build future-ready skills for fulfilling careers. SkillsFuture Singapore. https://www.skillsfuture.gov.sg/.

1. **Industry-Driven Roadmaps (The "Market Alignment"):** The Future Economy Council developed 23 Industry Transformation Maps (ITMs), mapping out how each sector should transform and the necessary actions to support national growth (e.g., move up the value chain, adopt new technologies, redesign business models, raise productivity, reskill workforce).[26] These are not static documents but dynamic roadmaps that identify future growth areas and respond to emerging challenges, such as the Covid-19 pandemic.

2. **Multi-Stakeholder Alliances:** SkillsFuture Singapore Agency (SSG) works in concert with industry associations, unions, employers and training providers to develop Skills Frameworks and ensure that training aligns with the ITMs.[27] These frameworks provide detailed information on sector-specific career pathways, job roles, and the required technical and critical core skills. This ensures that the training individuals pursue is directly relevant to the economy's future needs.[28]

3. **Integrated Education & Training System (The "Supply Chain"):** SSG articulates the policy levers and the infrastructure to enable employers and workers to act on the Skills Frameworks. This involves aligning the entire education system—from the Institute of Technical Education (ITE) and Polytechnics to Universities—with the ITMs. Stemming from the lifelong learning imperative, SSG promotes skills development schemes for students, graduates, and working adults. These include a broad array of initiatives, such as young-talent development programs, work-study programs, apprenticeships, modular courses, and leadership development programs.[29]

4. **Individual Empowerment (The "Customer Pull"):** The **SkillsFuture Credit** is a personal learning account provided by the government to every Singaporean aged 25 and over to improve their skill set.[30] It is a cornerstone of the strategy, since it integrates with the Skills Frameworks, linking learning opportunities to specific jobs and valued competencies within each sector.[31] Moreover, it differs from previous training initiatives because it targets individuals directly and eliminates financial barriers to training. This innovative approach grants autonomy to citizens, empowers them to take ownership of their skills development, and fosters sustainable lifelong learning.

The impact of *SkillsFuture* is tangible and multi-layered:

26 Co-creation with Industry: A factsheet from the Ministry of Trade and Industry (MTI) further details the integrated approach of the ITMs, emphasizing that each roadmap consists of a growth and competitiveness plan supported by four pillars: Productivity, Jobs & Skills, Innovation, and Internationalization.

27 MTI provides a high-level overview of the ITM program, highlighting that under the S$4.5 billion Industry Transformation Programme, these roadmaps are designed to address issues within each industry and deepen partnerships.

28 These frameworks are publicly available at The SkillsFuture Jobs-Skills Portal.

29 Woo (2018). Educating the developmental state: policy integration and mechanism redesign in Singapore's SkillsFuture scheme, Journal of Asian Public Policy, 11:3, 267-284. https://doi.org/10.1080/17516234.2017.1368616.

30 SupportGoWhere. (n.d.) SkillsFuture credit.

31 SkillsFuture Credit – Social Service Institute.

- **For Individuals:** It enhances employability and wage prospects.[32] A 2023 SSG survey found that 98% of trainees reported improved job performance after training, with 93% feeling the courses helped advance their careers.[33]

- **For Businesses:** Companies that leverage *SkillsFuture* benefit from a more adaptable and productive workforce. In 2023, approximately 23,000 enterprises participated in SSG-supported programs, enabling them to innovate and scale up.

- **For the Nation:** It fosters economic resilience. By creating a future-ready workforce, Singapore can confidently attract high-value investments and navigate economic downturns more effectively. The initiative achieved significant national scale in 2023, with 520,000 participants representing approximately 12.5% of Singapore's resident population (citizens and permanent residents) and nearly 9% of the total population.[34] [35]

SkillsFuture Singapore is a textbook example of successful long-term strategic planning. It addresses the core economic challenge of the 21st century by treating skills development as a critical national infrastructure. The business case is compelling: by investing in its people, Singapore secures its economic future, ensures inclusive growth, and reinforces its position as a global hub for talent and innovation. It is a model for any nation seeking to thrive in a perpetually changing world.[36] The *SkillsFuture Singapore* has enabled Singapore to develop a highly skilled and adaptable workforce, which has been key to the country's economic growth in sectors such as *electronics*, *logistics*, and *finance*.[37]

Achieving an effective alignment between industrial policy and the skills development ecosystem is not a passive exercise; it requires forging robust coordination mechanisms. These frameworks are only successful when **the private sector (industry) assumes a fundamental role** as a strategic partner. This collaboration must permeate the entire educational and training landscape, bridging agile **TVET systems with advanced university programs** to ensure the nation's talent pipeline is precisely calibrated to power its prioritized economic sectors.

32 Ministry of Education, Singapore. (2020, October 5). Measuring SkillsFuture and employment outcomes. https://www.moe.gov.sg/news/parliamentary-replies/20201005-measuring-skillsfuture-and-employment-outcomes.

33 Ministry of Finance, Singapore. (2024, November 24). Singapore public sector outcomes review 2024. https://www.mof.gov.sg/news-publications/press-releases/singapore-public-sector-outcomes-review-2024.

34 SkillsFuture Singapore. (2024). More employers and mid-career workers taking up SSG-supported training. Retrieved from https://www.ssg.gov.sg/newsroom/more-employers-and-mid-career-workers-taking-up-ssg-supported-training/.

35 Population in Brief 2023 (Official publication by the Prime Minister's Office Strategy Group and Singapore Department of Statistics).

36 World Economic Forum (n.d.). Global skills taxonomy adoption toolkit, Case Studies. Retrieved from https://initiatives.weforum.org/reskilling-revolution/gst-case-studies.

37 SkillsFuture Singapore. (2021). Skills demand for the future economy. Spotlight on Singapore's key growth areas. Retrieved from https://www.skillsfuture.gov.sg/docs/default-source/initiatives/ssg-skills_demand_for_the_future_economy_2021.pdf.

3

Industry Skills Strategies

3.1 What are Industry Skills Development Strategies?

Skills development strategies are structured, forward-looking frameworks designed to equip individuals with the competencies, knowledge, and attitudes required to thrive in evolving labor markets. Their purpose is to align education and training systems with emerging economic and technological demands, ensuring that workers remain employable, adaptable, and resilient.

At their core, these strategies integrate labor market intelligence, pedagogical design, and multi-stakeholder collaboration. They prepare individuals not only for today's jobs but also for roles that do not yet exist, fostering adaptability, lifelong learning, and inclusive participation in economic growth.[38]

3.2 Why Skills Strategies Matter in Industrial Transformation

Skills development strategies are increasingly recognized as critical instruments for economic resilience, social inclusion, and technological adaptation. In a rapidly changing industrial landscape, these strategies serve as the backbone for preparing individuals and societies to navigate disruption and seize emerging opportunities.

In a rapidly changing industrial landscape —driven by advances such as electromobility, automation, digitalization, and the green transition—skills strategies become critical. They serve as a **bridge between innovation and inclusion** by ensuring that technological change does not displace workers but rather repositions them within new value chains. For example, the shift toward electromobility requires automotive technicians to learn battery systems, electric drivetrains, and digital diagnostics. Energy transitions may require fossil fuel workers to be reskilled for roles in renewable energy industries. Effective skills strategies anticipate these transformations, identify new competencies, and design training pathways in partnership with employers and industry associations.

3.3 Why are Skills Strategies Industry-Specific?

An **Industry Skills Strategy** is a sector-specific plan designed to ensure the workforce possesses the competencies required for long-term competitiveness and sustainable growth. Industry skills strategies act as the central pillar of industrial transformation. By strictly aligning workforce competencies with evolving market demands, they provide the essential blueprint for sustainable growth and long-term competitiveness.

38 Cleary, J., & Van Noy, M. (2014). *A framework for higher education labor market alignment: lessons and future directions in the development of jobs-driven strategies.* Working Paper. John J. Heldrich Center for Workforce Development.

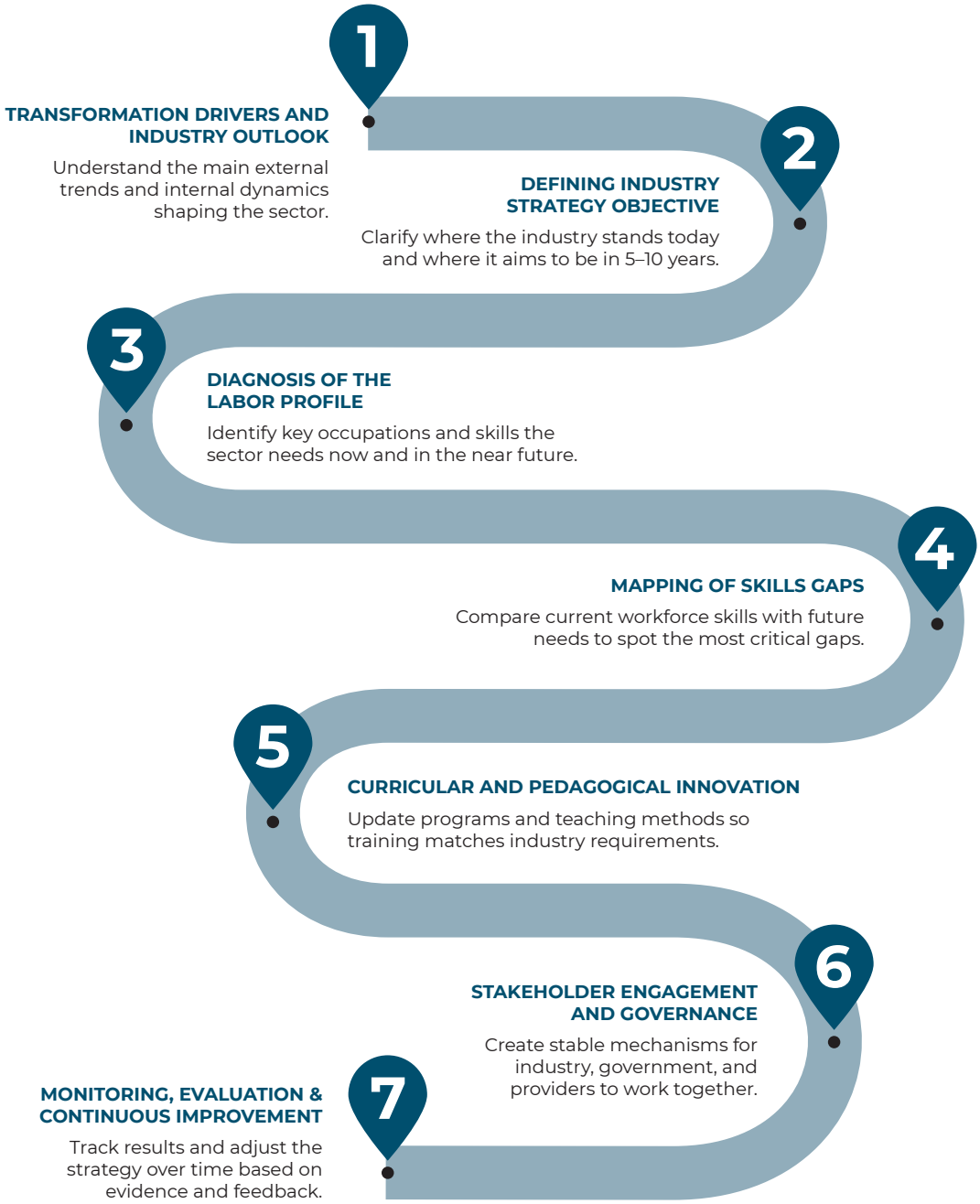
This strategy is directly linked to industry transformation objectives –whether expanding production (*industry growth*), attracting investment, adopting new technologies (such as *automation and AI*), pivoting to a more sustainable production matrix (*green transition*), or shifting business models. By clearly articulating the skills needs of a sector, an industry skills strategy provides direction to the education and training systems and ensures that human capital development supports the sector's transformation trajectory. By translating high-level objectives into an actionable deployment roadmap, industries not only align the training ecosystem with real-world needs but also empower the workforce to stand as the defining pillar of a **human-centric transformation**.

Skills strategies must be industry-specific because sectors evolve at different speeds, adopt distinct technologies, and require unique combinations of competencies to remain competitive. Industrial transformation is not uniform: the drivers, technologies, and value-chain configurations impacting the automotive sector, for instance, differ substantially from those shaping logistics, energy, construction, or digital services. As a result, each industry generates its own set of emerging occupations, skill demands, and training needs.

3.4 Key Stages of an Industry Skills Strategy

Industry skills strategies follow a sequenced process that links sector transformation goals with talent needs. **Figure 2** summarizes the core analytical stages that underpin later actions on training and governance.

FIGURE 2 KEY STAGES OF AN INDUSTRY SKILLS STRATEGY



The previous figure illustrates the interdependence of these stages, representing a unified workflow that does more than produce a document—it builds capacity. The process itself compels stakeholders to bridge the traditional silo between high-level business goals (the domain of Chief Strategy Officers), production plant managers/supervisors (those who can identify actual needs) and workforce execution (the realm of HR), ensuring true ownership of the outcome. The cycle begins with **Stages 1 and 2**, utilizing **Transformation Drivers** and the **Industry Transformation Objective** to set the strategic foundation. This vision is then translated into actionable human capital data during **Stages 3 and 4**—the **Diagnosis of the Labor Profile** and **Mapping of Skills Gaps**. These insights directly fuel **Stage 5**, **Curricular and Pedagogical Innovation**, which defines exactly *what* needs to be taught and *how*. Finally, running parallel to this technical work are **Stages 6 and 7**—**Stakeholder Engagement and Monitoring, Evaluation & Continuous Improvement**—which establish the governance fabric necessary to ensure the strategy is not just implemented, but continuously adapted to future industry shifts.

1. Transformation Drivers and Industry Outlook. A key initial step in any Industry Skills Strategy is understanding the external and internal environments shaping a sector. Externally, this means assessing technological, economic, social, and regulatory trends and their implications. Internally, it involves value-chain mapping to identify competitive advantage and where new capabilities are needed. Together, these analyses clarify growth potential and justify investment in talent development.

2. Defining Industry Strategy Objective. Understanding an industry requires more than global trends; it demands a clear view of where the local sector stands today. By identifying the value chain segments currently in operation, the industry anchors its transformation strategy. This clarity enables leaders to set a bold 5-to-10-year vision and pinpoint the "missing links"—the segments that must be built or expanded to move from today's footprint to the future objective.

3. Diagnosis of the Labor Profile. Based on the industry outlook, the next step is a comprehensive analysis of current and future job roles and **the skill sets they require**, conducted with companies, unions, and industry associations. Key outputs include priority occupational profiles, competency standards and skill clusters, and career pathways for mobility and progression. These profiles underpin relevant, future-ready training design.

4. Mapping of Skills Gaps. This stage examines the workforce's skills and demographic characteristics to identify workforce shortages, obsolete or declining skills, and priority skills that must be built. The goal of this process is to pinpoint the gaps between the current workforce and future industry needs. Industry Skills Strategies draw on several analytical tools, each offering a different lens on how a sector is evolving and supporting the initial stages of a strategy, as explained in **Figure 3** and **Table 2**.

FIGURE 3 TOOLS TO DIAGNOSE A SECTOR'S SKILLS NEEDS

TABLE 2 PURPOSE OF THE TOOLS USED TO DIAGNOSE A SECTOR'S SKILLS NEEDS

TOOL	WHAT IT IDENTIFIES	PURPOSE
Sector Trends Analysis	• Major transformation drivers (e.g., automation, electromobility, renewable energy) • Global competitiveness pressures • Policy and regulatory shifts • Consumer and market demand changes • Demographic or workforce dynamics	To understand how and why the industry is changing, and the macro-level factors influencing its trajectory.
Value-Chain Mapping	• Where value is created (design, manufacturing, logistics, after-sales) • Vulnerable or low-productivity segments • Segments with potential for upgrading or specialization • Opportunities for new technologies (automation, digitalization) • Industry transformation objective.	To understand what segments of the value chain the industry operates in, which allows for the identification of areas of additionality and the definition of the strategic objective to achieve such industry competitiveness or growth, and to pinpoint where in the value chain skills gaps are most critical and which segments should be prioritized for transformation.
Market Research	• Current labor shortages or surpluses • Hiring patterns and employer demand • Wage dynamics • Competitive landscape • Investment patterns and firm expectations	To ground the strategy in current industry needs and ensure that training responds to what employers require today.
Prospective Skills Analysis	• Skills likely to be required in 5–10 years • Roles that will disappear, transform, or emerge • Technologies likely to influence job content • Scenarios for future workforce needs	To anticipate future talent demands, ensuring the workforce is prepared for long-term industrial transformation.

5. **Curricular and Pedagogical Innovation.** The skills gaps analysis guides a systematic process of curricular review to align both the educational content and teaching methods of existing TVET and higher education programs to the labor market and industry needs. It also informs of new training schemes and their integration within the TVET and Higher Ed systems and offerings. The initiatives to support the strategy can include **upskilling** programs to update existing skills, **reskilling** programs for transitions into new roles. Modular training pathways or micro-credentials for flexibility; and high-quality learning models such as dual training, project-based training, and virtual simulations.

6. **Stakeholder Engagement and Governance.** Meaningful stakeholder involvement requires an institutional framework that clearly defines roles, responsibilities, and coordination mechanisms across industry, government, and training providers. This includes establishing formal structures—such as Sector Skills Councils (SSCs)[39], cluster-based governance bodies, or talent pipeline committees—that give industry/employers a decision-making role in setting priorities, validating occupational standards, and shaping training delivery. This framework must ensure predictable financing, streamlined regulatory processes, and dedicated liaison functions so that companies can participate consistently rather than on an ad hoc basis. In practice, this means creating stable platforms where employers can collaborate with education institutions, co-design curricula, host apprentices, and jointly monitor training outcomes as part of a shared accountability system.

7. **Monitoring, Evaluation & Continuous Improvement.** A final step involves developing robust Monitoring and Evaluation (M&E) plan to ensure that the strategy remains effective, relevant, and responsive to changing industry needs. By establishing clear performance metrics and continuous feedback mechanisms, policymakers and industry leaders can track not only the quality and effectiveness of training, but also its broader impact on workers. This means measuring outcomes beyond productivity—such as economic mobility, job stability, and psychosocial well-being—to capture whether the strategy is truly supporting an inclusive and sustainable transformation. An integrated M&E component enables evidence-based adjustments, strengthens accountability, and ensures that the skills ecosystem evolves in line with technological and labor-market demands. Singapore's data-driven approach[40], serves as an example of a M&E plan designed to ensure training strategies remain effective and responsive:

The "Future-Ready Workforce" Initiative
Objective: To align workforce training programs with real-time industry needs using a data-driven skills ecosystem.

Strategic Rationale A robust Monitoring and Evaluation framework moves beyond simple compliance checking; it acts as a strategic engine for workforce development. By shifting

39 See section 4.1.1 for further details on SSCs.

40 WEF 2025. How Singapore's data-driven approach is building a skills-first economy.

the focus from volume (hours trained) to value (career mobility), this plan creates a dynamic feedback loop that keeps the ecosystem agile. The following breakdown illustrates the mechanics behind this strategic alignment:

- **Relevance:** By anchoring the plan in a *common skills language* (taxonomy), policymakers ensure that the "product" (training) matches the "market" (employer needs).
- **Responsiveness:** Continuous feedback from the private sector allows the strategy to pivot quickly. If data shows a spike in demand for "Green Economy" skills, the *Response Time* metric forces a rapid curriculum update.
- **Effectiveness:** Instead of just counting how many people attended training, the *Impact* metrics force leaders to look at the actual benefit to the worker (jobs and promotions).

TABLE 3 KPI FRAMEWORK FOR A DEMAND-DRIVEN SKILLS SYSTEM

COMPONENT	ACTION / STRATEGY	KEY PERFORMANCE INDICATOR (KPI)
Relevance (Input)	Adopt a Common Skills Language: Implement a "Skills Taxonomy" that standardizes terms across employers, training providers, and unions.	Alignment Score: % of training courses explicitly mapped to high-demand skills identified in the national Jobs-Skills dataset.
Effectiveness (Output)	Track Skills Progression: Use digital tools like a Career-Skills Passport to record individual skill acquisition and certification.	Utilization Rate: % of workers who successfully log new certifications and receive course recommendations via the platform.
Impact (Outcome)	Measure Labor Market Success: Correlate training completion with actual employment outcomes.	Mobility Metric: % of trainees who secure a job or promotion in a growth sector within 6 months of upskilling.
Responsiveness (Feedback)	Establish Public-Private Loops: Conduct quarterly "Skills Articulation" sessions with private sector partners to validate data.	Response Time: Average time taken to update training curricula after a new industry skill is identified (Target: < 3 months).

Aerial view of VW's Puebla plant in Mexico. Photo by Volkswagen AG.

3.5 Case Study: Driving Transformation – Automotive Skills Strategies in Mexico

The Mexican automotive industry is advancing through the electromobility transition by embracing a focused skills strategy that ensures its workforce is prepared for rapid technological change. This section presents two cases of how a human-centric approach to skills development can facilitate industrial transformation, strengthen competitiveness, and support inclusive growth. Mexico's ongoing shift toward electric vehicle (EV) production demonstrates that strategic investments in training and reskilling can accelerate adaptation, reduce transition risks, and position workers to participate in emerging value chains.

Context. Electromobility has become a key driver of global efforts to build low-carbon and sustainable economy.[41] The transition requires not only the adoption of innovative technologies—such as EVs, batteries, and charging infrastructure—but also major adjustments to production processes, supplier networks, and workforce capabilities. For Mexico, this shift represents both an opportunity for industrial upgrading and a pressing need to build the skills base required to compete in new and quickly evolving markets.

41 Holzwarth, S., Lah, O., Martin, E., et al. (2022). *Integration is key: the role of electric mobility for low-carbon and sustainable cities.* United Nations Human Settlements Programme (UN-Habitat) and the Urban Electric Mobility Initiative (UEMI).

Mexico's automotive industry already plays a central role in the national economy. It accounts for 4.7% of GDP, 21.7% of manufacturing GDP,[42] while attracting a significant portion of foreign direct investment (FDI). As the fifth-largest vehicle producer worldwide[43] and the undisputed leader in Latin America, Mexico manufactures nearly 4 million vehicles annually.[44] The sector generates over one million direct jobs[45], and its export-oriented focus is robust, sending more than 87% of its production abroad, with approximately 80% destined for the United States.[46] Regional Industry Skills Strategies—from the **Central Zone** (Puebla and *Tlaxcala*) and the **Metropolitan Zone** (*State of Mexico*, *Hidalgo*, and *Mexico City*)— highlight that this performance is strongly driven by USMCA (T-MEC) tariff exemptions, which underpin Mexico's export competitiveness. At the same time, this high concentration in a single export market underscores the importance of diversifying production and preparing for global shifts toward EVs and greener technologies. Recognizing this, the Mexican government through its Plan Mexico has designated electromobility as a strategic priority for industrial development. A comprehensive skills strategy is therefore essential to align the country's talent with these demands, support firms through the transition, and ensure workers benefit from the opportunities created by new technologies.

3.5.1 Central Zone Automotive Industry: Skills Alignment - Navigating the Productive Matrix Change

To support Mexico's transition toward EV production, the **Inter-American Development Bank (IDB)**, **SOFOFA Futuro del Trabajo**, and the **Central Automotive Cluster (CLAUZ)** jointly developed one of the country's most comprehensive skills strategies.[47] Designed for the Puebla-Tlaxcala cluster—home to approximately 55,000 direct automotive workers—this initiative offers a blueprint for how targeted workforce development can help the sector navigate technological transformation, nearshoring pressures, and evolving trade dynamics.

Purpose and Strategic Framing

The strategy begins with a "business case" that outlines why a coordinated human-capital plan is necessary for Mexico's automotive competitiveness. It identifies major global drivers—electrification, automation, and sustainability—and the specific implications for Mexico's produc-

42 The sale of vehicles and auto parts represents more than 3% of the national GDP. Including trade and services activities, according to the Mexican Association of the Automotive Industry (AMIA), this figure rises to 4.7% of the national GDP and 21.7% of the manufacturing GDP. Source: Industria Nacional de Autopartes (INA) & AMIA. Automotive Industry in Mexico - Overview.

43 Mexico Business News with International Organisation of Motor Vehicle Manufacturers (OICA) data, "Mexico Ranks 5th in 2024 Auto Output".

44 Mexico Business News with INEGI data, "Mexico Sets Auto Production Record in 2024"

45 Co-Production International, "Mexico Auto Parts: Leading the Automotive Industry" and INEGI - Encuesta Mensual de la Industria Manufacturera (EMIM).

46 ProMexico Industry, "How Many Vehicles Did Mexico Export in 2024?"

47 Clúster Automotriz Zona Centro (CLAUZ), Inter-American Development Bank (IADB), & SOFOFA Capital Humano. (2025). *Estrategia de Habilidades para la Industria Automotriz en la Zona Centro de México*. This strategy for the Automotive Industry in the Central Zone was an integral initiative requested by the region's automotive cluster (CLAUZ) and financed by the IADB.

tive matrix, which depends heavily on USMCA (T-MEC) market access and deep integration with U.S. value chains. Puebla, the country's leading vehicle-exporting state, and Tlaxcala, a critical supplier for the region, both face the challenge of adapting their workforce to new EV technologies while maintaining high-export performance.

The strategy's core objective is to de-risk Mexico's EV transition by ensuring the region has the talent required for advanced manufacturing (e.g., high-voltage systems, battery assembly, software-integrated automotive design). By articulating its skills needs, the industry provides clear direction to education and training providers, enabling them to align programs with real labor-market demand and support the attraction of future investments.

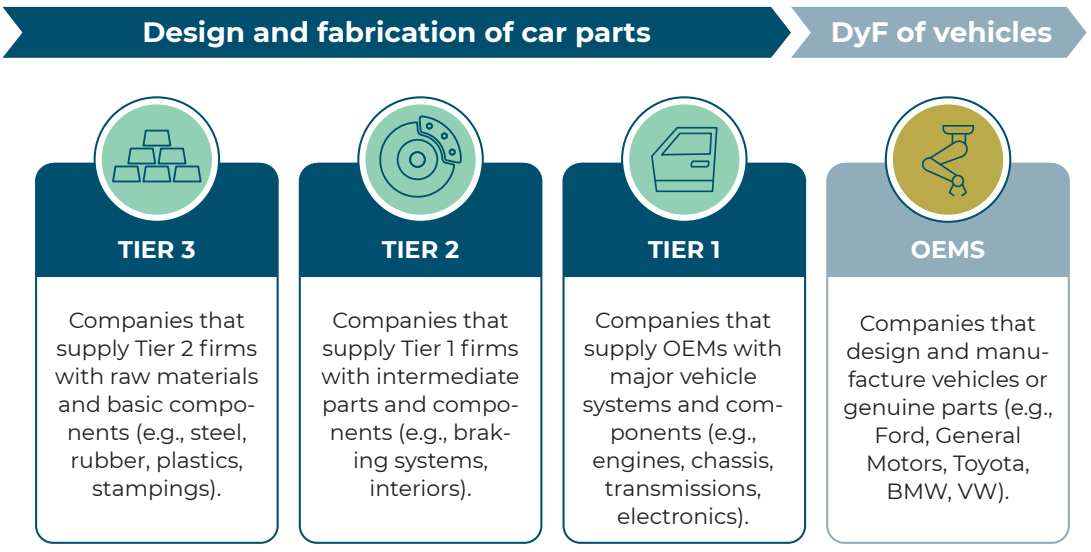
Analytical Foundation

The strategy uses a rigorous analytical approach that integrates:

- Sector trend analysis (global technological, economic, and environmental shifts)
- Value-chain mapping
- Original Equipment Manufacturers (OEMs) – A company that designs and manufactures vehicles, or the genuine parts that go into them, i.e. Ford, General Motors, Toyota, BMW, and VW.
  - **Tier 1** – Companies that supply OEMs with major vehicle components, such as engines, chassis, transmission systems, electronics, among others.
  - **Tier 2** – Companies that supply Tier 1 suppliers with intermediate parts and components, such as braking systems, vehicle interiors, etc.
  - **Tier 3** – Companies that supply Tier 2 suppliers with raw materials and basic components, such as steel, rubber, plastics, laminates, stampings, among others.
- Surveys, interviews, and technical visits
- Benchmarking using 187 OEM technical documents

This evidence base allows a precise understanding of how electromobility will reshape technologies, job roles, career pathways, and competency requirements across the cluster.

FIGURE 4 EXAMPLE OF VALUE-CHAIN MAPPING IN THE AUTOMOTIVE SECTOR



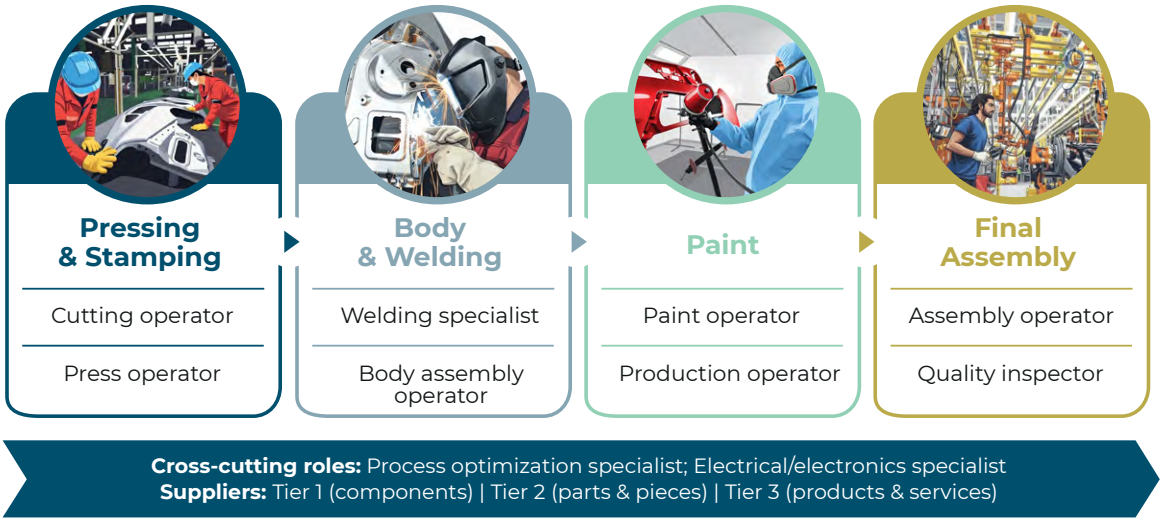
Key Findings and Outputs

1. Mapping of Occupational Profiles Across the Value Chain

A total of **788 occupational profiles** and **654 relevant skills** were identified (see **Figure 5**):

- 55 OEM profiles
- 249 Tier 1 profiles
- 376 Tier 2 profiles
- 108 Tier 3 profiles

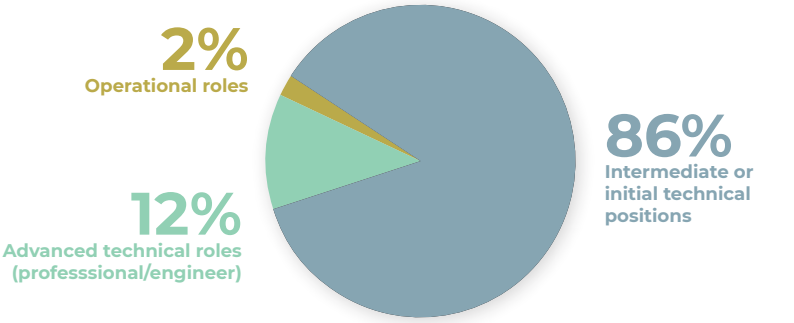
FIGURE 5 OEM MANUFACTURING VALUE CHAIN: CORE STAGES AND REPRESENTATIVE OCCUPATIONS



This mapping revealed that 86% of roles correspond to **intermediate or initial technical positions**, corresponding to high school or secondary-educated technicians. In contrast, advanced technical roles (professional/engineer) represent only 12%, and operational roles account for a mere 2% (see **Figure 6**). This structure highlights the need for strong **technical-program expansion** and makes the strategy highly **inclusive and scalable**.

Crucially, the strategy also identified cross-cutting profiles (e.g., process specialists, parts purchasing, electronics) that are shared with other industries. This finding is essential for inter-industry talent reconciliation, enabling efficient retraining and recruitment into the automotive sector.

FIGURE 6 DISTRIBUTION OF ROLES BY SKILL LEVEL (OCCUPATIONAL MAPPING)



2. Prioritizing Critical and Emerging Skills

From the 788 profiles, the strategy prioritized **85 critical current profiles and 31 emerging profiles**, ranging from operators to specialists in electromobility and cybersecurity (see **Annex 1**).

Training was then segmented into short-term (3–5 years) and medium-term (5–15 years) objectives, according to thematic classification, to ensure sequenced skill development and efficient inter-industry talent reconciliation.

Skills were grouped according to major technological trends redefining the industry:

- **Manufacturing 4.0** (e.g., *industrial robotics and cyber-physical systems integration*).
- **Software and Automation** (e.g., *programming and system configuration*).
- **Technology and Development**, with a focus on **electromobility** (e.g., *electric propulsion systems and battery management*).

3. Modular Training Model: Skill Packs

A **skill pack** is a training grouping required to develop certain skills, such as mechatronics, digital skills, operational safety, among others. The identification of skills allows this package to be used to train different profiles, and it can even be used transversally across different technical areas. Furthermore, a skill pack can be defined within the same thematic area at different levels of complexity, thus being aligned and ready to be applied, for example, to professionals, technicians, and operators.

A skill pack does not fully address the training required for a profile, much less for a set of them. For this reason, several skill packs are defined, which, in turn, can be used in a modular manner (possibly) for other profiles or thematic areas.

To translate these needs into action, the strategy developed **107 modular skill packs—a flexible training architecture that groups shared competencies across roles**:

- **47** for **professionals/engineering profiles**
- **60** for **technical and operator profiles**

Each skill pack details the necessary courses and training hours required to develop all competencies. This design allows for:

- Clear pathways for upskilling and reskilling,
- Lateral mobility across occupations,
- Efficient retraining of workers from other industries,
- Tailored support for dual training and on-the-job training (OJT) programs.

This modularity makes the strategy adaptable to diverse training institutions and company needs. Skillpacks are highly valuable for **upskilling** and **reskilling**, as companies realize they *reduce staff integration and development costs*. The model also provides alternative paths for current and future workers, based on where they are and where they wish to go. Such people-centered approach allows workers to remain current and employed, generating income and contributing to a more productive and sustainable society.

4. Projecting Talent Demand and Workforce Growth

- **7,000+ new workers** will be needed over three years in the Puebla-Tlaxcala region. These new jobs will create a demand for:
  - 2,512 new professional roles, +39% compared to current levels
  - 4,787 new technician/trade roles, +10% growth
- This represents nearly **30% expansion** of the regional workforce.
- The strategy aims to **upskill and reskill 40,000 current workers** through a modular, scalable training model.

Implementation Roadmap

The strategy proposes mechanisms to integrate skill packs into the regional education and training ecosystem through stronger partnerships between industry and education providers to capitalize on existing technical and vocational education programs, dual training, and company-based leaning (see **Annex 2**). As Víctor Cota, President of the Board of Directors of the Central Zone Automotive Cluster (CLAUZ) explains, *"German companies like Audi and Volkswagen, leveraging their Dual Training expertise, have integrated into the local educational ecosystem. This involvement fosters collaborations with companies to facilitate student apprenticeships. By allowing students to participate in production processes and gradually develop knowledge, the goal is to make the transition from training to employment seamless since the trainees are already adapted to the workplace"*.

Governance and Future-Proofing

Employer ownership is essential not only in designing industry skills strategies but also in ensuring their effective implementation. The Puebla-Tlaxcala EV strategy calls for the active involvement of CLAUZ members in delivering training—through continuous alignment of curricula with real production needs, on-the-job learning, and mentorship—the strategy becomes grounded in practical realities rather than abstract projections. The strategy also recommends governance models—such as a *Sector Skills Council* or a *Talent Pipeline* framework—to ensure sustained coordination among industry, government, and VET institutions.

To **future-proof the approach, the strategy provides guidance** on adapting the roadmap to emerging technologies, evolving OEM requirements, and shifting global norms in EV production.

Why This Strategy Matters

The CLAUZ-IDB-SOFOFA initiative demonstrates how a **human-capital strategy can anchor industrial transformation**. By aligning workforce development with technological and market shifts, the Puebla–Tlaxcala cluster is strengthening its competitiveness, supporting investment attraction, and ensuring that workers—especially technicians—can participate in the opportunities created by electromobility. It offers a replicable model for other Mexican clusters and for countries seeking to link skills development directly to industrial policy.

3.5.2 Metropolitan Zone Automotive Industry: Workforce Strategy for Industry 5.0

In the Metropolitan Zone, the skills strategy focuses on preparing the workforce for **Industry 5.0**,[48] a model that integrates advanced technologies with human-centered innovation. This transition requires both **technical upskilling**—to adopt digital and automation tools—and **behavioral reskilling**—to strengthen soft skills that support adaptability and complex problem-solving. The strategy was designed to ensure the Metropolitan Automotive Zone can successfully navigate its **productive transformation**, embrace electromobility, and sustain long-term competitiveness.

Technical & Digital Skills. These competencies are essential for adopting new technologies, automating production processes, and moving toward the "smart factory" of the future:

- **Intelligent Business Analytics:** Leveraging **big data** and advanced analytics across the value chain—from predictive maintenance in the production line to real-time supply chain optimization—to drive efficiency and strategic decision-making.
- **Practical AI Applications:** Applying **Artificial Intelligence (AI)** and **Machine Learning (ML)** to automate quality control, optimize processes, and integrate advanced features into connected vehicles.
- **Cybersecurity 360° (OT, IT, and Vehicle):** Protecting the digital ecosystem across Operational Technology (OT) in plants, Information Technology (IT) systems, and the complex software-driven of connected vehicles.
- **Digital Twins Modeling and Simulation:** Creating virtual replicas of products, processes, and entire production lines to test scenarios, optimize performance, and anticipate failures before physical deployment.

New Strategic & Sustainability Skills. These advanced skills support the **green transition** and the emergence of new business models associated with connected and sustainable mobility:

48 The strategy for the Automotive Industry in the Metropolitan Zone was an integral initiative requested by the region's automotive cluster (CLAUT) and financed by the IADB.

- **Tech-Sustainability:** Integrating technology and environmental goals through energy optimization, smart energy grids, and **circular economy** practices.

- **Ethical Digital Experience Design:** Building digital interfaces and customer interactions grounded in **privacy**, transparency, and inclusion—critical for connected vehicles and mobility services.

Core Soft Skills. These behavioral competencies enable the workforce to engage in **complex problem-solving** and thrive amid rapid technological change:

- **Adaptability and Learning Agility:** Learning new technologies quickly, adapting to evolving job roles, and remaining effective in a dynamic production environment.

- **Global Mindset:** Navigating international supply chains and collaborating across diverse cultures—essential competencies in a globally integrated sector.

- **Complex Problem Solving:** Analyzing multi-faceted and interconnected technical challenges, such as *integrating high-voltage systems with software architectures*, and developing innovative, practical solutions.

3.6 Human-Centric Transformation: A Three-Fold Approach

Industrial transformation is not only a technological and economic process—it is fundamentally a human-centered one. A human-centric approach to transformation recognizes that technological change succeeds only when workers can adapt, participate, and thrive. Effective skills strategies therefore require a three-fold perspective that prepares the future workforce, includes those historically left behind, and accelerates innovation through continuous upskilling.

While much focus is placed on technical restructuring due to outdated knowledge, as production systems become more digital and inter-connected, skills such as adaptability, collaboration, and complex problem-solving become as essential as technical mastery. A human-centric approach recognizes that workers need to be equipped with the calibrated mix of technical, digital, and behavioral competencies.[49] The exponential rise of Artificial Intelligence intensifies this imperative, fundamentally altering the human-machine interface. As AI evolves from a static tool into an autonomous agent, the workforce must pivot from mere operation to high-level orchestration and ethical oversight. In this context, 'AI fluency' demands critical thinking to direct algorithmic outputs and the emotional intelligence to manage nuances machines cannot replicate. Consequently, **upskilling** and **reskilling** are no longer ancillary supports; they are the strategic pillars of transformation, ensuring that technology amplifies, rather than diminishes, human contribution.

49 Schwab, K. (2020). The Fourth Industrial Revolution. Futuro Hoy. 1:1, 6-10. Publishing Fund of the Secular Humanist Society of Peru. doi: 10.5281/zenodo.4299164.

FIGURE 7 THREE PILLARS OF HUMAN-CENTRIC TRANSFORMATION

Preparing for the Future

Reskilling keeps workers employable as industries transform. It requires segmented approaches, flexible learning formats, and clear pathways for lateral mobility within and across sectors.

Removing Barriers

Human-centric transformation must remove structural barriers that limit access to training and jobs for vulnerable groups. Inclusive initiatives expand participation through targeted programs and support, and track social outcomes to ensure benefits are shared.

Advancing Competitiveness

Innovation-oriented upskilling helps firms adopt new technologies, optimize processes, and improve productivity. It should be guided by skills intelligence and market alignment, monitored with performance metrics, and sustained by demonstrating ROI.

1. **Preparing for the Future:** Training New Generations and Reskilling Today's Workforce. Reskilling is essential to ensure that workers remain employable as industries transform. This requires personalized & segmented approaches that respond to different learning needs and labor market realities. Flexible programs must address barriers such as the digital divide and provide clear pathways for lateral job mobility within and across sectors. By integrating hybrid training formats (online/in-person), financial support, and non-financial incentives (e.g., flexible schedules, internal recognition, and psychosocial assistance), workers can more easily retrain for evolving roles.

2. **Removing Barriers:** Inclusion Through Accessible Initiatives. A human-centric transformation must also eliminate structural barriers that prevent vulnerable groups from accessing opportunities. Women, youth, people with disabilities, migrants, and indigenous communities face additional hurdles in training and employment—constraints that reinforce inequality and limit productive potential.[50] Inclusive skills strategies must actively expand opportunities for these groups by offering targeted programs, tailored learning pathways, and support systems that make participation possible. Measuring social metrics, such as economic mobility and well-being, ensures that transformation benefits are equitably distributed.

50 International Labour Office (2021). Skills development in the time of COVID-19: taking stock of the initial responses in technical and vocational education and training. International Labour Organization. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40ed_emp/%40ifp_skills/documents/publication/wcms_766557.pdf.

3. **Advancing Competitiveness:** Innovation-Oriented Upskilling. Finally, a human-centric strategy enables firms to reach the next level of productivity and competitiveness. Companies that invest in data-driven upskilling strengthen their capacity to adopt new technologies, optimize processes, and innovate. For upskilling to deliver real impact, it must be grounded in robust workforce skills analysis and market alignment such as Singapore's data-driven approach described in section 3.4. This includes:

   - **Skills mapping and data intelligence** to anticipate talent needs,
   - Monitoring **performance metrics** (e.g., productivity, retention), and
   - **Demonstrating a positive Return on Investment (ROI)** to justify sustainable training programs.

By combining inclusive practices with innovation-focused talent development, industries build a workforce that is resilient, adaptable, and capable of driving long-term competitiveness. This three-fold approach ensures that industrial transformation is not only technologically successful but also socially inclusive and economically sustainable.

TABLE 4 SKILLS STRATEGY: KEY ELEMENTS

ELEMENT	DEFINITION	INTERRELATION
Understanding Transformation Drivers and Industry Outlook	Understand the main external trends and internal dynamics shaping the sector to clarify where the industry stands today and where it aims to be in 5–10 years (Strategy Objective).	Driven by industry trends and identified opportunities, the strategic objective is defined to guide the industry toward increased competitiveness and growth. It clearly sets forth the priority areas for skills forecasting and development needed to achieve this industry transformation.
Skills Forecasting and Gap Analysis	The process of using data intelligence (e.g., labor market and industry trend analysis) to project future skill demands, identify current workforce skill gaps, and define required competencies for new productive matrices (e.g., EV production, Industry 5.0).	Directly informs Curriculum Reform, providing the data for what needs to be taught. Success metrics are defined here for Monitoring and Evaluation.
Curriculum Reform and Pedagogical Innovation	The systematic process of updating educational content (curricula) and teaching methods (pedagogy) to match the skills identified in the forecast. This includes developing modular training and incorporating hybrid learning formats.	Driven by Skills Forecasting, it provides the how and what of training delivery. Its effectiveness is assessed via Monitoring and Evaluation.
Stakeholder Engagement and Governance	Establishing formal structures and mechanisms (e.g., Sector Skills Councils, Talent Pipelines) that ensure continuous collaboration and shared decision-making among industry, educational institutions, government, and workers' representatives.	This element provides the strategic oversight and resources needed for effective Curriculum Reform and is crucial for enforcing Inclusive Access policies. (Schwab, 2020)
Inclusive Access and Equity Measures	Designing and implementing policies to reduce barriers to training and employment for all, especially vulnerable or traditionally excluded groups (e.g., women, migrants, at-risk youth). This includes providing financial, psychosocial, and digital support.	Ensures that the output of Curriculum Reform is accessible to all segments of the population identified in the Gap Analysis. (OIT, 2021)
Monitoring, Evaluation, and Continuous Improvement	Establishing performance metrics and a feedback loop to track the efficiency, quality, and impact of the strategy. Metrics must measure not only productivity, but also economic mobility and psychosocial well-being.	Uses data from all elements to validate the accuracy of Skills Forecasting, assess the impact of Curriculum Reform, and gauge the efficacy of Inclusive Access policies, driving iterative improvement.

4

Industry-driven Skills Systems

Industrial transformation requires not only well-designed skills strategies but also **institutional mechanisms** capable of sustaining collaboration between firms, government, and training providers. While Section 3 described what an industry skills strategy is and *why* it matters, this Section explains *how industries organize themselves* to continuously drive workforce development as technologies, markets, and value chains evolve.

4.1 Sectoral Skills Councils and Sectoral Talent Pipelines

Effective industry skills strategies require a governance scheme capable of bringing all key stakeholders—employers, government, training institutions, and worker representatives—together to coordinate decisions and align actions. While such governance arrangements can take multiple forms depending on institutional context and industry maturity, two models have proven particularly effective in sustaining collaboration and ensuring responsiveness to evolving skills needs: Sector Skills Councils (SSCs) and Sectorial Talent Pipelines. These mechanisms provide structured platforms for shared decision-making, continuous labor market-intelligence, and joint implementation of workforce development initiatives.[51]

4.1.1 Sectoral Skills Councils

Sector Skills Councils (SSCs) are independent, employer-led organizations that define the skills and training needs for specific economic sectors. They act as a bridge between the industry and the education system, ensuring that training standards, qualifications, and curricula are directly aligned with the current and future labor market demands. Their core mandate is to reduce skills gaps, increase workforce employability, and improve productivity by giving the industry a direct voice in the skills development ecosystem.

SSCs perform three core functions:

1. **Labor-Market Intelligence and Forecasting.** SCCs identify current skills gaps and **anticipate future demands** through employer surveys, market analysis, and technology-trend forecasting. This forward-looking role is essential for keeping curricula aligned with evolving industry needs. In the context of rapid economic change where skills can become obsolete in ever-shorter periods, this anticipatory function is what allows a country to build a competent, adaptable, and future-proof workforce.[52]

51 UNESCO-UNEVOC TVETipedia Glossary.

52 Redecker, C., Leis, M., Leendertse, M., Punie, Y., Gijsbers, G., Kirschner, P., Stoyanov, S., & Hoogveld, B. (2012). *The future of learning: Preparing for change*. Publications Office of the European Union.

2. **Catalyzing Work-Integrated Learning.** SSCs broker partnerships between companies and TVET institutions to co-design and implement practical training solutions, such as **dual training**, **apprenticeships**, **and structured internships**. These initiatives (to be described in **Section 5: Skills Delivery**) allow students to gain essential hands-on experience but also dramatically facilitate the transition from education to employment, directly reducing the costly mismatch between training supply and industry demand.[53]

3. **Setting Skills Standards. SSCs define competency frameworks** that ensure quality and establish a common "skills currency", supporting **labor mobility** within and across sectors, nationally and internationally. Competency frameworks also allow SSCs to drive targeted **upskilling and reskilling initiatives**.

As discussed, SSCs play a central role in identifying skills needs and linking productive sectors with the TVET and higher education system. Their impact, however, goes beyond diagnostic functions. SSCs act as catalysts for collaborative action, creating economies of scale and improving the efficiency of skills development by mobilizing employers, VET institutions, and government actors around shared priorities. This demand-driven coordination stands in contrast to traditional supply-driven models and helps build a more dynamic training ecosystem aligned with real labor-market needs. By articulating a unified industry voice, SSCs can also influence public policy and guide funding toward programs that address the competencies employers genuinely require.[54] **Ultimately, SSCs transform employers from passive consumers of graduates into the architects of talent, ensuring that the industry does not merely signal demand but takes full ownership of defining it**.

4.1.2 Sectoral Talent Pipelines

Sectoral Talent Pipelines (STPs) are demand-driven, collaborative strategies designed to ensure a steady and predictable flow of qualified professionals for high-growth sectors. Built through partnerships between employers, education providers, and public agencies, they focus on improving productivity and strengthening employability by directly linking training supply to industry needs.[55] Unlike generalized workforce programs, which often target broad skill areas, STPs concentrate on generating specialized talent for priority roles where demand consistently outstrips supply.[56]

While SSCs focus on governance, labor market intelligence and standard-setting, STPs emphasize implementation and delivery. They function as "smart pipelines" that translate employer

53 International Labour Office. (2019). *Quality apprenticeships: addressing skills mismatch and youth unemployment*. International Labour Organization.

54 This video explains why skills councils are crucial for industry growth by connecting education with industry needs to shape the workforce of tomorrow. *Why Skills Councils Are Crucial for Industry Growth*, World of TVET.

55 The Aspen Institute, Economic Opportunities Program. (2017). *Sectoral Employment Development: A Guide to Resources.*

56 Fuller, J. & Sigelman, M. (2017). *Room to Grow: Identifying New Frontiers for Apprenticeships.* Harvard Business School Project on Managing the Future of Work & Burning Glass Technologies. https://www.hbs.edu/managing-the-future-of-work/Documents/room-to-grow.pdf.

demand into concrete education and training pathways.[57] In contrast to training programs that operate in isolation, STPs apply a systemic, end-to-end approach that includes:

1. **Forecasting Demand:** Working with industry leaders to identify critical job roles and emerging skills needs.
2. **Co-designing Curricula:** Creating agile learning pathways and industry-relevant credentials with educational institutions.
3. **Facilitating Hands-On Experience:** Integrating apprenticeships, internships, and structured on-the-job training to ensure practical experience.
4. **Facilitating Job Placement:** Building direct pathways from training to employment through coordinated recruitment and hiring processes.[58]

The core value of STPs lies in this continuous collaboration among companies, government, and TVET institutions, ensuring the skills developed align precisely with labor market requirements.[59]

Why These Mechanisms Matter for Industry Transformation

Sector Skills Councils and Sectorial Talent Pipelines are not merely administrative bridges; they are the strategic command centers for industry evolution. They are critical because they:

- **Elevate Industry to Architect Status:** Shift the private sector from a passive consumer of graduates to the primary architect of talent, establishing full ownership of the skills agenda.
- **Accelerate System Agility:** Drastically compress the lag time between market disruption and curricular update, replacing static learning cycles with real-time adaptation.
- **Guarantee Investment Precision:** Ensure that educational capital maps strictly to productive priorities, eliminating the friction between academic output and economic necessity.
- **Fuel the Innovation Engine:** Unlock the specialized human capital required for firms and clusters to not just adopt new technologies, but to drive innovation itself.

57 Jobs for the Future. (2021). *Building Educational Pathways for In-Demand, Well-Paying Jobs.*
58 Lerman, R. I. (2019). *Expanding Apprenticeship to Rebuild the Skilled Trades and Middle-Class Jobs.* American Enterprise Institute (AEI).
59 OECD. (2020). *Strengthening the Adult-Learning System in a Changing World of Work.* OECD Skills Studies.

Sector Skills Councils vs Sectoral Talent Pipelines: The Key Differences

While both address skills gaps, Sectoral Talent *Pipelines (STPs)* and *Sector Skills Councils (SSCs)* have fundamentally different roles. Think of it as the difference between an architect and a construction crew.

Sector Skills Councils (SSCs) are typically employer-led advisory bodies. Their primary function is strategic: they conduct research, forecast future labor market needs, and develop **National Occupational Standards** that define what a person in a certain job should know and be able to do. They create the blueprint for skills development but don't typically build the training programs or manage the flow of talent themselves.

Source: International Labour Organization (ILO). (2019). Sector Skills Councils: A Guidance Note.

In contrast, **Sectoral Talent Pipelines (STPs)** are the operational execution of that blueprint. They are action-oriented partnerships focused on building and managing the *end-to-end infrastructure* for moving people from training into employment. STPs actively recruit candidates, oversee training delivery in partnership with educators, facilitate apprenticeships, and ensure graduates are hired. In short, SSCs define the **what** (what skills are needed), **while** STPs build the how (how we get a steady stream of people with those skills into jobs).

FIGURE 8 SSC VS STPS: A SIDE-BY-SIDE COMPARISON

SECTOR SKILLS COUNCILS (SSC)	SECTORAL TALENT PIPELINES (STPS)
Definition Organizations that bring together representatives from industry, government, education, and training to address job skills.	**Definition** Strategy that connects employers with the right talent in a specific sector.
Main objective Develop skills and competency standards to improve employability.	**Main objective** Ensure a constant flow of qualified talent to specific sectors.
Focus Skills training and certification.	**Focus** Identifying and developing talent in key sectors.
Participation Employers, educational and training institutions, and governments.	**Participation** Mainly companies and industry organizations.
Deployment process Development of training programs, certifications, and policies.	**Deployment process** Collaboration between companies and educational centers to facilitate talent recruitment.
Duration Long-term, adapting to changing market needs.	**Duration** More dynamic and adaptive to labor market trends.
Expected results Improve workforce quality and reduce the sector's skills gap.	**Expected results** Increase graduate employability and meet sector human capital needs.
Examples of activities Occupational profiles, certifications, training programs.	**Examples of activities** Targeted training and employment initiatives based on needs and urgency.

4.2 Adapting for Growth: Demand-Driven, Industry-Led Transformation

For decades, skills development in Latin America and the Caribbean have been dominated by a **supply-driven model**, in which educational institutions design training programs based on their internal capabilities rather than labor-market realities. While well-intentioned, this approach is fragmented and inefficient.[60] Moreover, it has generated persistent **skills gaps**: graduates often lack the competencies employers need, companies struggle to find qualified workers, and productivity and competitiveness suffer across the region.[61]

Transitioning to Demand-Driven Systems. A more effective alternative is the demand-driven model, where industry needs shape the design of occupational profiles, competency standards, and training programs. In this approach, Sector Skills Councils (SSCs) and employer coalitions lead the process, which results in more relevant and higher-quality training programs. This shift creates a **reinforcing cycle of benefits**:

- **For Workers:** Training aligned with market reality not only improves employability but unlocks clear pathways for **career progression**, allowing individuals to continuously advance into higher-value roles and secure better livelihoods.
- **For Companies:** Reliable access to a calibrated talent pool minimizes skills gaps and hiring friction, **maximizing operational productivity** and sharpening global competitiveness.
- **For Economies:** A highly skilled, adaptive workforce accelerates industrial transformation and drives innovation, positioning the region as a **magnet for high-value investment** and ensuring resilient, sustainable economic growth.

Industry Insights: The Case for Employer Leadership

Industry leaders consistently highlight the importance of employer engagement in defining skills. During the IDB's 2024 Regional Policy Dialogue (see **next page**), **Bettina Schaller**—President of the World Employment Confederation and head of Public Affairs at Adecco Group—underscored that companies are uniquely positioned to identify the skills required for technological change. In countries where the productive sector collaborates closely with education and training systems, the results are clear: **increased productivity, stronger innovation, and lower unemployment** across economic segments.

60 World Bank. (2020). Demand-driven skills training and results-based contracting: lessons for youth employment programs. https://documents1.worldbank.org/curated/en/245201585887181276/pdf/Demand-Driven-Skills-Training-and-Results-Based-Contracting-Lessons-for-Youth-Employment-Programs.pdf.

61 Ashwani, A., Comyn, P. J.,; Hoftijzer, M., Iqbal, S. A., Katayama, H., Levin, V., Santos, I. V., & Weber, M. (2023). Building better formal TVET systems: principles and practice in low- and middle-income countries. World Bank Publications. http://documents.worldbank.org/curated/en/099071123130516870

The testimony of Bettina Schaller Bossert

President of the World Employment Confederation (WEC).

Strategic Value of Collaboration: Economies of Scale and System Efficiency. One of the main advantages of a demand-driven model is the ability to define occupational profiles collaboratively, creating **economies of scale** that benefit the entire sector. Moving toward a demand-driven system transforms fragmented training efforts into a coherent, efficient, and innovation-oriented system. When companies, educational and training institutions, and governments work together, the benefits extend across firms and regions:

- **Development Costs Fall.** Instead of each company designing its own curricula or assessments, shared standards reduce duplication and improve quality.
- **Education Providers Gain Efficiency.** Institutions can offer standardized, high-impact programs aligned with industry needs, rather than fragmented, one-off courses. This allows for resource optimization, more effective instructor training, and ultimately lower costs per student.
- **Recruitment Becomes more Transparent and Predictable.** A common skills language and competency framework streamline hiring for employers and job seekers.
- **Shared Identification of Challenges and Opportunities.** A collaborative framework facilitates the joint recognition of emerging challenges and opportunities and promotes a coordinated response.
- **Dissemination of Best Practices.** Shared insights and proven training models raise industry-wide performance.
- **Support for SMEs.** Smaller firms, which rarely have the capacity to develop in-house training, gain access to high-quality programs and a stable talent pipeline.
- **Higher Returns on Investment.** Shared infrastructure and employer-validated curricula make training more cost-effective and impactful.

Ultimately, **pivoting towards a demand-driven** system creates a unified platform for continuous improvement and long-term workforce readiness.

Sussex and Surrey Institute of Technology (SSIoT).

4.3 Industry Collaborative Action: UK's Model for Higher Technical Education

The United Kingdom's (UK) Institutes of Technology (IoTs) offer a compelling example of a national, industry-led model for strengthening higher technical education. Created to address the country's long-standing shortage of skilled technicians, and the "missing middle" in intermediate-level STEM skills, IoTs operate as a **formal network** of employer-led partnerships that deliver "world-class technical education and training",[62] aligned with labor-market needs. The network is a key component of the government's *"Skills for Jobs White Paper,"* positioning the IoTs as central to the UK's strategy for economic recovery and long-term productivity.

Purpose and Governance: IoTs seek to become *"leaders in the provision of high-quality, higher-level technical education and training"* by emulating successful, labor-market-oriented systems in other industrialized nations (e.g., Germany and France). Each IoT is built through a **structured partnership** between **leading industry employers** and education providers (including Further Education Colleges and Universities).[63] The collaboration is formalized through a **license issued by the Department for Education (DfE)**, which is signed by all partners, ensuring shared accountability and sustained employer participation. The structure is best understood as a **partnership board** or steering committee focused on collective decision-making. The intentional lack of a rigid, centrally prescribed legal structure allows each of the 21 IoTs the flexibility to adapt governance to its

62 Institutes of Technology. (n.d.). Home. Retrieved October 15, 2025 from https://www.institutesoftechnology.org.uk/.

63 The Education Hub. (2021, October 12). What are Institutes of Technology? https://educationhub.blog.gov.uk/2021/10/what-are-institutes-of-technology/.

unique regional partners and industry specialists, fostering agility and market responsiveness. The system's design deliberately shifts the UK from a supply-led educational model to *demand-driven, employer-anchored system*.

Strategic Objectives. IoTs pursue two central objectives:

1. **Closing the National Technical Skills Gap.** IoTs are mandated to increase the number of learners earning Level 4 and 5 qualifications, such as Higher Technical Qualifications (HTQs) and higher/degree apprenticeships–critical for sectors such as advanced manufacturing, digital technologies, construction, engineering, and healthcare.
2. **Establishing a Flexible, Inclusive, and Market-Responsive System.** By placing *employer needs at the core* of curriculum design and delivery, IoTs ensure training remains relevant, accessible, and responsive to the labor market. Flexible and affordable pathways support both new entrants and adult learners seeking to upskill or retrain, helping widen participation in higher education and fostering greater social mobility.

Operational Model. IoTs differentiate themselves from traditional education providers through three pillars:

1. Employer-Led Ecosystem. Companies play a decisive role not only in shaping curriculum but also in training delivery. This reduces risk for both learners and employers:

- **Students** have access to qualifications that reflect real market demand.
- **Employers** have access to predictable talent pipelines, lowering recruitment costs, accelerating onboarding, lower turnover and increasing productivity.

2. Sector-Focused Curriculum. IoTs concentrate on STEM fields aligned with the government's industrial strategy. By bridging the gap between school-leaver qualifications (Level 3) and bachelor's degrees (Level 6), they produce job-ready technicians essential for future growth. This specialization also supports lifelong learning for adults seeking career advancement or transition. For instance, IoTs proved their capability for rapid retraining by supporting the successful transition of displaced Honda automotive workers into the aerospace sector (e.g., the West of England IoT partnering with GKN).[64]

3. World-Class Infrastructure. With £300 million in government's investment, IoTs offer *"state-of-the-art facilities and industry-standard equipment"*. These serve both education and industry by providing hands-on training on modern technologies; supporting R&D collaboration, prototyping, and technology diffusion; and functioning as innovation hubs for SMEs.[65] [66]

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64 The National Network of Institutes of Technology. (n.d.). Boosting opportunity, skills & growth through collaboration. Retrieved from https://www.institutesoftechnology.org.uk/assets/_/2025/07/02/6de79c26-7e57-44f6-80e7-42ec2b5b503e/iot-impact-report.pdf?v=1.

65 Department for Science, Innovation & Technology, United Kingdom (2023, March). The UK science and technology framework. Retrieved on October 15, 2025 from https://www.gov.uk/government/publications/uk-science-and-technology-framework/the-uk-science-and-technology-framework.

66 The Royal Society. (2020). The role of public and non-profit research organisations in the UK research and innovation landscape. Retrieved on October 15, 2025 from https://royalsociety.org/-/media/policy/Publications/2020/2020-09-the-role-of-public-and-non-profit-research-organisations-explainer.pdf.

TABLE 5 MECHANISMS FOR EMPLOYER ENGAGEMENT AND INFLUENCE

Mechanism of Influence	Specific Activities (Supporting Evidence)
Curriculum Co-Design	Co-shaping course content, competency standards, and learning outcomes to ensure full alignment with industry standards. (44)
Work-Based Learning	Providing industry placements; setting live student projects; hosting student visits—activities that contextualize education and embed real-world practices into training. (42)
Expert Instruction	Delivering talks, masterclasses, and applied workshops by current industry practitioners who bring up-to-date technological knowledge and insights. (42)
Strategic Direction	Participating as core members of IoT governing bodies, influencing long-term strategy and program development. (42)
Talent Acquisition	Recruiting apprentices and graduates from IoTs, strengthening employment pathways and validating the relevance of training. (42)

TABLE 6 CORE CHARACTERISTICS OF THE UK INSTITUTE OF TECHNOLOGY MODEL

FEATURE	DESCRIPTION
Core Mission	To deliver high-quality, employer-led higher technical education (Levels 4 & 5) in priority STEM sectors.
Key Partners	Tripartite partnership of Further Education (FE) Colleges, Universities, and Employers.
Primary Qualification Focus	Higher Technical Qualifications (HTQs), Higher & Degree Apprenticeships.
Target Learner	School leavers and adult learners seeking to upskill or reskill.
Governance Philosophy	Employer-led, with industry as core members of governing bodies.
Funding Model	Backed by up to £300m in government capital investment, with ongoing public and private funding streams.

Strategic Value for the Industry, the Workforce, and the Skills Ecosystem. The IoT model delivers strong benefits for employers, learners, and the broader skills ecosystem, as illustrated in **Figure 9**:

FIGURE 9 THREE PILLARS OF STRATEGIC VALUE

Benefits for companies, the workforce, and the skills ecosystem

Companies

- Reliable local talent pipeline with in-demand technical skills.
- Lower recruitment costs and reduced labor-market uncertainty.
- Access to cutting-edge technology and applied research.

Workforce

- Hands-on training in strategic, technology-intensive sectors.
- Recognized qualifications that open high-skill, high-wage careers.
- Flexible routes for upskilling, reskilling, and career change.

Skills Ecosystem

- Employers engaged as high-impact partners in skills development.
- Strong collaboration between colleges, universities, and firms.
- Innovation hubs that support SMEs and strengthen sector resilience.

IoTs Return on Investment for Government and Private Stakeholders. While long-term ROI data for IoTs is still emerging, analogous UK investments in related areas generate very high returns, suggesting IoTs will follow similar patterns. As summarized in Table XX, every **£1** of public money invested in higher education, R&D, and educational technology, yields a return of **£14**, **£10**, and **£7.90** respectively. Since IoTs uniquely **combine the high-return elements of all three areas** and add the efficiency of **direct labor-market alignment**, their ROI is projected to be positive and substantial.

TABLE 7 SYNTHESIZED RETURN ON INVESTMENT (ROI) ANALYSIS

INVESTMENT AREA	REPORTED RETURN ON INVESTMENT (ROI)	RELEVANCE TO INSTITUTES OF TECHNOLOGY (IOTS)
UK Higher Education Sector	£14 return for every £1 invested[67]	IoTs are a key part of the HE sector and partner with universities.
University Research & Development	£10 return for every £1 invested	IoTs partner with research-intensive universities and leverage applied knowledge to drive innovation.
Educational Technology (EdTech)	£7.90 return for every £1 invested [68]	IoTs are technology-focused institutions using state-of-the-art equipment to deliver training.
Institutes of Technology (IoTs)	The evidence suggests the ROI for IoTs will be in the range of £8-£14 for every £1 of public investment, given the integration of education, research, and technology within a demand-driven model.	This projection provides a defensible, evidence-based estimate of the initiative's financial viability.

Macroeconomic and Fiscal Impact of IoTs. IoTs represent a strategic investment in the UK's "human infrastructure," generating **macroeconomic benefits** that far exceed their upfront fiscal cost. Positioned as a central mechanism for national workforce development, the IoTs network is essential for unlocking the UK's long-term growth potential in technology-intensive sectors.[69]

Unlocking Future GDP Growth. IoTs are pivotal to realizing the substantial economic gains expected from emerging technologies:

- **GDP Catalyst:** Technology areas aligned with IoT specializations are projected to contribute **£223.4 billion—an 8.4% increase—to the UK's real GDP by 2035**.
- **Essential Human Capital:** Without the skilled technicians and engineers produced by IoTs, this immense economic growth will not be realized.

Fiscal and Compounding Returns. Investment in the IoTs should be viewed as patient capital—an investment that compounds through higher productivity, stronger labor markets, and increased fiscal returns.

67 Universities UK. (n.d.). What impact do start-ups have? Retrieved on October 15 from https://www.universitiesuk.ac.uk/what-we-do/creating-voice-our-members/campaigns/unis-start-uk/what-impact-do-start-ups-have.

68 Pearson (2025, January 9). Pearson and Cebr research: £8.7 billion benefit for UK economy from investment in technology in schools. Retrieved on October 15, 2025 from https://plc.pearson.com/en-GB/news-and-insights/news/pearson-and-cebr-research-ps87-billion-benefit-uk-economy-investment.

69 Universities UK. (October 29, 2025). The economic impact of higher education, teaching, research and innovation. Retrieved October 15, 2025 from https://www.universitiesuk.ac.uk/what-we-do/policy-and-research/publications/economic-impact-higher-education.

- **Net Fiscal Benefit:** Individuals earning higher technical qualifications generate substantial lifetime tax contributions, with net fiscal returns comparable to those of first-degree graduates (estimated around **£75,000** per graduate).
- **Virtuous Cycle of Growth:** As IoTs anchor regional skills ecosystems, they attract additional private investment, stimulate new business creation, and strengthen local innovation capacity. Over time, this produces a reinforcing **cycle of growth, higher employment, and continued industrial innovation**.

The Institutes of Technology (IoTs) represent a **strategic shift** in the UK's approach to technical education and are central to overcoming the country's long-standing productivity challenge. By building a deeply collaborative ecosystem that integrates employers, Further Education colleges, and universities, the IoT model creates a sustained pipeline of advanced technical talent for high-growth, innovation-intensive sectors. The UK's ambition to become a "Science and Technology Superpower" depends heavily on the success of this network: The IoTs are the primary mechanism for developing the skilled workforce required to implement national priorities in critical technologies such as *AI, advanced manufacturing, and engineering.* Continued investment in the IoT network is therefore not simply an education initiative—it is a foundational economic strategy and a prerequisite for securing the UK's long-term competitiveness, innovation, and shared prosperity.

5

Skills Delivery: A Paradigm Shift towards an Inclusive Transformation

Work-based learning (WBL) is a critical delivery mechanism within any demand-driven, industry-led system. While Section 4 established the importance of aligning TVET with industry needs through industry skills strategies, WBL provides the operational foundation that allows those strategies to translate into concrete, job-relevant competencies and skills. Its distinctive value lies in shifting the focus of learning from the classroom to the production floor, reframing training not as a peripheral activity but as a core business investment that strengthens competitiveness and innovation.

5.1 Why Work-Based Learning Matters for Industry Skills Strategies

In-company learning embeds training directly within real production environments, ensuring that workers develop the specific skills, behaviors, and professional norms required by firms. Unlike institution-based training—which often operates at a distance from technological and organizational change—WBL evolves in tandem with business needs. This allows companies to:

- **Train on frontier technologies,** ensuring learning aligns with actual equipment, software, and processes used in industry.[70]
- **Transfer tacit knowledge** through mentorship from experienced technicians and engineers—knowledge that cannot be fully codified in curricula.[71]
- **Adapt quickly to innovation**, updating training content in real time as new production methods, standards, or tools emerge.

In this sense, WBL operationalizes the forward-looking priorities defined in industry skills strategies, enabling firms to turn strategic competency frameworks into practical, scalable learning pathways.

70 Autor, D. H. (2014). Skills, education, and the rise of earnings inequality among the "other 99 percent." Science, 344(6186), 843–851.

71 Lerman, R. I. (2018). *Expanding apprenticeship opportunities in the United States.* Brookings, The Hamilton Project. https://www.hamiltonproject.org/assets/legacy/files/downloads_and_links/expand_apprenticeship_opportunities_united_states_lerman.pdf.

5.2 Co-Investment and the Economic Case for Employer Leadership

Demand-driven systems depend on meaningful employer participation—and WBL is where such participation yields the greatest return.[72] When employers co-invest in structured, in-company learning:

- **Skills investments become more precise**, as firms help define exactly which competencies are needed ("assertive edge").[73] [74]
- **The risk of skills mismatch decreases**, because workers are trained for real jobs, not hypothetical occupations that may become obsolete.
- **Adaptation accelerates**, allowing firms to redeploy new skills quickly as technologies and business models evolve.[75]

This co-investment model transforms training from a social obligation into a **strategic mechanism for business resilience**, protecting human capital and ensuring sustained productivity.

TABLE 8 CO-INVESTMENT VS. CLASSROOM TRAINING: A MORE DIRECT PATH TO PRODUCTIVITY AND RESILIENCE

INVESTMENT APPROACH	BENEFIT/RETURN	WHY IT'S MORE ASSERTIVE
Traditional Classroom	Foundational knowledge, academic credentials.	Indirect: Skills are theoretical; high risk of mismatch with actual job requirements; delayed time-to-productivity.
In-Company (Co-Investment)	Immediate productivity gain, innovation capacity, higher retention rates.	Direct: Skills are practical and applied immediately; reduces training time post-hire; learning is validated by the production environment.

72 World Bank. (2023). *Building better formal TVET systems: unlocking the promise of skills development.* World Bank Group. http://documents.worldbank.org/curated/en/099071123130516870.

73 Acemoglu, D., & Pischke, J. S. (1999). The structure of wages and investment in general training. *Journal of Political Economy, 107*(3), 539–572.

74 (OIT, Toolkit Forqualityapprenticeshipsvolume I: Guide For Policy Makers, 2017)

75 OECD. (2021). *Skills outlook 2021: learning for life.* OECD Publishing. https://doi.org/10.1787/0ae365b4-en.

5.3 Setting the Stage for Work-Based Learning Modalities

In practice, WBL takes diverse forms—apprenticeships, internships, project-based training, continuous training, professional certifications, micro-credentials—each requiring a different degree of employer involvement and offering distinct benefits for learners and firms. What unites them is their capacity to expose learners to authentic production contexts; strengthen the alignment between training and labor market needs; and support the long-term success of industry skills strategies.

The following subsections examine these mechanisms in detail, clarifying how each contributes to building a responsive, employer-led skills ecosystem and what is required from firms to make them effective.

5.3.1 Apprenticeships

Apprenticeships are the most structured and employer-intensive form of work-based learning. This approach mandates that apprentices spend a significant portion (often 60% or more) of their training time gaining hands-on, paid experience directly in a company workplace, with the remainder spent in a vocational school acquiring theoretical knowledge.[76] This direct workplace learning effectively eases the school-to-work transition and provides skills highly aligned with employer needs. International evidence—particularly from dual systems in Switzerland, Germany, and Austria—shows that apprenticeships are defined by four compulsory features:[77]

1. **A paid job with a structured training plan.** The apprentice holds a formal job and receives a wage. Employers provide a defined training route and invest in workplace learning guided by experienced supervisors ("masters of trade").

2. **Combined on-the-job and off-the-job training.** Apprentices split their time between productive work and related technical instruction—usually one or two days per week—delivered by vocational schools or training centers.

3. **A written contract of employment.** The contract formalizes rights, responsibilities, compensation, and (usually) social-protection benefits, underscoring the mutual value for employer and learner.

4. **Industry-recognized assessment and certification.** Upon completion, apprentices undergo a formal evaluation and obtain a credential recognized across the sector, enabling job mobility and signaling competence to employers.

76 IZA. (2013). *A roadmap to vocational education and training systems around the world.* (IZA Discussion Paper No. 7110). Institute of Labor Economics.

77 Fazio, M. V., Fernández-Coto, R., & Ripani, L. (2016). *Apprenticeships for the XXI century: a model for Latin America and the Caribbean?* (IDB Monograph No. 475). Inter-American Development Bank, Labor Markets Division. http://dx.doi.org/10.18235/0012817.

When discussing apprenticeships, a distinction is made between "programs" and "systems". *Programs* implement the four compulsory elements plus good-practice design principles (e.g., quality standards, governance, financing). Systems are part of a country's broader skills-development structure and consider the wider enabling architecture—funding, regulation, industry bodies, curricula, and quality assurance—that allows apprenticeship programs to function at scale.

Employer Expectations: Apprenticeships require the *highest level of employer commitment:* firms must co-design curricula, assign trained mentors, supervise learning, provide regular feedback, guarantee protected learning time, and participate in assessment processes. In return, employers develop talent aligned with their production systems and reduce skill shortages.

Value for the Industry: No other WBL model combines employment, structured workplace learning, formal instruction, and standardized certification. This makes apprenticeships particularly suited for youth labor-market insertion, occupational identity formation, and long-term talent pipelines.

Illustrative Example: The Swiss Vocational and Professional Education and Training (VPET) system remains the global benchmark. With apprentices spending up to four days per week in firms and one in school, Switzerland maintains exceptionally low youth unemployment and strong employer satisfaction. Employers shape curriculum, train apprentices, and co-assess performance, ensuring tight alignment between training and economic needs.

5.3.2 Learning on the Job, Beyond Apprenticeships

Not all work-based learning (WBL) requires the long-term commitment of apprenticeships. Lighter models can still build relevant skills while giving firms flexibility to test talent and react to changing technologies.

Internships and Co-ops: First Taste of Work

Short internships and longer, credit-bearing co-op placements expose learners to real workplaces without a formal employment contract. They are time-bound, focused on applying classroom knowledge to real tasks, and often embedded in academic programs. Employers are expected to offer meaningful assignments, basic supervision, and feedback—rather than full training plans. Germany's Duale Hochschule, for example, alternates three-month blocks of study and work, rapidly building technical and transversal skills while improving employability and pre-employment screening for firms.

Projects that Teach and Deliver

Project-based training/learning (PBT/PBL) turns real business challenges into the curriculum. Participants tackle authentic problems, produce concrete deliverables, and strengthen technical, analytical, and teamwork skills. Employers mainly define the challenge, act as "client" or supervisor, and assess the final product, without needing to hire participants or invest heavily in training infrastructure. Tech companies such as Google use PBT to develop minimum viable products with new technologies, accelerating learning while generating

business value and aligning training with strategic priorities.

Staying Ahead: Continuous Training and Credentials

Continuous training (CT) institutionalizes upskilling and reskilling throughout a worker's career—crucial where technologies shift fast. Firms invest in regular training cycles, digital academies, and upskilling roadmaps, as Siemens does to keep engineers current in automation, robotics, and Industrial IoT. Alongside CT, professional certifications (e.g., Cisco, PMI, Microsoft) and micro-credentials (e.g., AWS or Azure badges such as "Serverless Architecture" or "MLOps") validate specific competencies through standardized, portable assessments. Employers may require or fund these credentials, even if external providers deliver the training. Together, CT, certifications, and micro-credentials reduce technological obsolescence, speed adaptation to new tools, and give firms clearer signals when hiring for specialized roles.

TABLE 9 BRINGING IT TOGETHER: EMPLOYER RESPONSIBILITIES ACROSS WBL MODELS

MECHANISM	EMPLOYER COMMITMENT	NATURE OF EXPOSURE TO INDUSTRY DYNAMICS
Apprenticeships	Very high: employment contract, structured training plan, mentorship, assessment	Deep, continuous immersion in real production systems
Professional Practices / Internships	Moderate: supervision, structured tasks, feedback	Short-term exposure to workplace routines and culture
Project-Based Training / Learning	Moderate: define project, provide guidance, evaluate output	Exposure to problem-solving, innovation processes
Continuous Training	High but internal: recurring upskilling investment	Ongoing adaptation to new technologies and processes
Professional Certifications	Low–Moderate: sponsorship, incentives	Exposure to standardized, industry-wide competencies
Micro-credentials	Low: firms identify or validate needed skills	Highly targeted exposure to emerging technical domains

Industrial transformation demands flexible and accessible skills development

High-performing TVET systems ensure that work-based learning programs are not isolated interventions but integrated components of a broader skills ecosystem. A key feature of such systems is the availability of flexible pathways and recognition of prior learning (RPL), which allow learners to build on accumulated competencies and progress through increasingly advanced qualifications.[78] This articulation ensures that vocational credentials can count toward higher-level degrees, enabling smooth transitions from technical programs to tertiary studies—for example, from a technical college diploma to a university engineering program. Strengthening these credit-transfer mechanisms and expanding higher technical and vocational education and training (HTVET) opportunities elevates the prestige of TVET, improves graduate employability, and aligns training with evolving industry needs.[79] This broad and adaptable approach—focusing on *upskilling* and *reskilling*—is crucial for ensuring that all workers, irrespective of their prior experience or educational level, are empowered to thrive and contribute fully to the economy of the future.[80]

Articulation is also essential from an employer's perspective: when training programs form part of a coherent system, employers can trust the consistency of skills across institutions, participate more effectively in curriculum design, and rely on clear talent-development pathways that support long-term workforce planning. In this way, integrated TVET systems help ensure that work-based learning contributes not only to individual advancement but also to sector-wide competitiveness and innovation.

78 International Labour Organization. (2024). *Global skills programme*.

79 UNESCO-IESALC. (2025). Strengthening higher technical and vocational education and training: a strategic pathway to sustainable development. https://unesdoc.unesco.org/ark:/48223/pf0000393711_eng.

80 World Economic Forum. (2024). The reskilling revolution: Better skills, better jobs, better education for a billion people by 2030. https://initiatives.weforum.org/reskilling-revolution/home.

Concluding Thoughts: Moving forward towards Industry Transformation in Latin America and the Caribbean

The evidence presented throughout this publication makes a clear and urgent case: Latin America and the Caribbean must fundamentally **rethink how skills development systems are designed and governed**. In an era defined by rapid technological change, global competition, and shifting production models, traditional supply-driven approaches are no longer sufficient. Countries that fail to adapt risk widening skills shortages, slowing industrial upgrading, and reinforcing structural inequalities.

A New Role for Industry: From Beneficiary to System Architect. Sustained competitiveness requires moving industry from passive recipients of talent to active architects of the skills ecosystem. This is the very essence of a demand-driven approach—one in which industry not only identifies its workforce needs but also co-leads the design and delivery of training aligned with future value chains.

Achieving this model requires coordinated public-private action following a clear, structured roadmap:

- **Macro Level: A National Growth Vision.** Governments must articulate a long-term national development plan that explicitly identifies **priority sectors** with the highest potential for productivity, job creation, and technological upgrading. This provides the strategic anchor for all subsequent skills investments.

- **Industry Level: Industry-Specific Transformation Strategies.** Each priority sector needs a dedicated industry strategy that clarifies its transformation pathway. Only by understanding the technology, business models, and value-chain dynamics of each industry can countries develop skills strategies that are targeted, feasible, and future-proof.

- **Delivery Mechanisms: Prompt, Industry-Led Execution.** Countries must leverage mechanisms that reduce the lag between emerging skills needs and training delivery. These structures ensure responsiveness, coherence, and rapid curriculum renewal. More importantly, they generate ownership of the system among employers.

- **Mindset Change: Shared Responsibility for Skills.** Transformation requires changes in attitudes from all actors:
  - **Firms** must recognize that identifying skills needs and participating directly in training delivery is intrinsic to their competitiveness.
  - **Governments** must adopt a long-term, cross-administration perspective—moving beyond political cycles to institutionalize the institutional frameworks that allow the skills system to remain stable, sustained, and future-oriented regardless of changes in leadership.
  - **Workers** must adopt a culture of continuous learning to remain relevant and take ownership of their career trajectories.

The Business Case for Skills. Ultimately, skills development is not a social add-on—it is a core industrial policy. When industries actively steer the skills system, training becomes more responsive, relevant, and effective. Firms that invest in skills development strengthen their productivity, innovation capacity, and resilience; sectors become better positioned to attract investment; and economies achieve a more inclusive and sustainable growth.

For Latin America and the Caribbean, embracing this industry-led model is not optional. It is a prerequisite for competing in a rapidly evolving global economy and for ensuring that industry transformation benefits workers, companies, and society as a whole.

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Annex 1
Prioritized profiles in Mexico toward EV production

Prioritized Profiles (3 years)

	Professional	Technical	Trades
1 Industry 4.0	• Control specialist • Production supervisor • Electrification specialist	• CNC/metalworking technician • Electrical maintenance technician • Instrumentation maintenance technician • Mechanical maintenance technician	• Automotive line operator • CNC/PLC machine operator • Rework operator • Welder
2 Technology and Development	• Product and/or service development specialist • Product design specialist • Materials specialist	• Materials technician	
3 Quality and Processes	• Quality specialist • Process specialist	• Quality technician • Metrology technician	
4 Sustainability and Safety	• Sustainability specialist • Occupational health and safety specialist		
5 Logistics	• Automotive logistics specialist	• Programming technician	
6 Software and Automation	• Database architect • Data analysis and programming specialist • Cybersecurity specialist		
7 Projects	• Commercial specialist	• Logistics analyst	

- An analysis was conducted integrating secondary sources, surveys, workshops, and interviews to prioritize profiles and estimate demand.
- Based on this, two scenarios were defined: one with the key profiles in the present (3 years) and another with those projected for the future.
- The profiles are organized along two axes: a horizontal axis by training level (Professional, Technical, or Trades) and a vertical axis based on their area of knowledge, training, or performance—facilitating classification and analysis.
- What appears within the quadrants are examples of specializations that could fall at the intersection of the axes.estar en el cruce de ejes.

Prioritized Profiles (Future, 5-8 years)

	Professional	Technical	Trades
1 Energy storage	• E-mobility specialist • Energy storage specialist • Charging networks specialist • Autonomy projects specialist	• Electromechanical technician	
2 Advanced manufacturing of the future	• Process specialist • Autonomous driving specialist • Active/passive safety systems engineer • Mechatronics engineer • Advanced manufacturing specialist	• Metrology technician • Robotics maintenance technician	
3 Connectivity and interoperability		• Network design and installation technician	
4 Automation	• Robotics engineer • Automation and control engineer • Control systems specialist	• Automotive line robot programmer • Automated assembly systems programmer	

- For future profiles, the areas of knowledge that will be impacted over the long term were identified; therefore, a forward-looking strategy should be designed to develop these specializations.
- Four future themes are identified on the vertical axis, based on their area of knowledge, training, or performance: energy storage, advanced manufacturing of the future, connectivity and interoperability, and automation.

Annex 2
Automotive Skill Pack Example

INTRODUCTION TO INDUSTRY PROCESS IMPROVEMENT

1 Program Modules

Optimization of production processes and continuous improvement	**8 HOURS**
Process automation	**12 HOURS**
Technology tools for the automotive industry	**4 HOURS**
Total	**24 HOURS**

3 Educational Resources

Human:
- Instructors with experience in manufacturing and automotive management.
- Facilitators for hands-on sessions.

Technological:
- Simulation software (e.g., Arena, FlexSim).
- Online learning platforms (LMS).

Materials:
- Technical manuals and guides.
- Demonstration equipment for Lean Manufacturing.

2 Evaluation Strategies

Diagnostic Assessment: Initial questionnaires to identify baseline level.

Formative Assessment: Tasks and exercises during each unit.

Summative Assessment: Final project: design and optimization of a process within an automotive value chain.

Participant Feedback: Satisfaction surveys and module evaluation.

4 Student Graduation Profile

Graduates of this module will be professionals trained to identify, analyze, and optimize processes in the automotive industry value chain, integrating lean manufacturing tools, sustainable practices, and emerging technologies. They will be prepared to propose innovative solutions that increase competitiveness and operational efficiency, aligned with global industry trends.


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