TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

AN ESSENTIAL PILLAR FOR LATIN AMERICA AND THE CARIBBEAN PRODUCTIVE INDUSTRIAL POLICY

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FOREWORD

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SUMMARY

INTRODUCTION

The lack of qualified workers, a major topic within SDG no. 8, is recurrently mentioned by the Latin American and Caribbean (LAC) business sector as one of the relevant obstacles for the adoption of new technologies and, from there, to greater efficiency and quality of processes, products and services. In such a context, the role of public and private institutions mandated to foster vocational training must be considered. TVET institutions exist in several countries in the LAC region, creating a strong institutional foundation for skills development in the region. A large number were established during the decades of industrialization, with strong industrial policies that also involved a view toward the need for requisite skills development. A resurgence of interest in industrial policies, in the context of digital, green and demographic transformations, could present a similarly conducive environment for productive development policy discussions around the promotion and strengthening of vocational training institutions, to lay the foundation for more productive, competitive and inclusive development through skilling, reskilling and upskilling of workers. According to ILO/CINTERFOR[1] (2017) there are at least 18 Technical and Vocational Education and Training Institutions (TVET)[2] in 15 Latin America and Caribbean countries, with approximately 11 thousand training units, mobilizing approximately 166 thousand teachers and instructors and offering training opportunities to more than 15 million participants.

What is the stage of adoption of new technologies in LAC industries? What is the general level of education and qualification of the labour force? To what extent is the education system capable of providing quality education and training? Do technical and vocational education and training polices go hand in hand with industrial and innovation policies? To what extent TVET Institutions are playing a relevant role in strengthening the capabilities of the workforce especially in digital and "green" related technology solutions?

Considering these questions, this document presents a stylized assessment of the stage of development of Latin American and Caribbean TVET. Concerning the demand side, the analysis will discuss the stage of development of the business sector and their needs for qualified workers to face up to the digital and green transitions, specifying the type of companies and/or sectors demanding professional training. Concerning the supply side, the analysis will discuss how local institutions have evolved to structure programs and actions

1 CINTERFOR is the Inter-American Centre for Knowledge Development in Vocational Training, of the International Labor Organization (ILO), created in 1963, which currently coordinates a network of TVET institutions throughout Latin America, the Caribbean, Spain, Portugal, and Cape Verde.

2 Those National TVET Institutions share certain characteristics as they were created by a law, they have a tripartite governing body, a specific mechanism of financing and usually attends vocational training at a national level. The exception in this research is the case of Ministry of Labour in Chile where the area dedicated to national skills development policies was interviewed.

specifically aimed to develop competencies (skills, abilities and knowledge) in digital and green technologies. A relevant topic of the analysis concerns how the participation of business sectors occurs in the anticipation of demands and in the operationalization of programs and actions, stressing the role the most successful local experiences and their degree of recognition by society. This analysis will support the assessment of current challenges faced by National TVET institutions in articulation with policy implications.

The analysis is organized in 6 sections besides this introduction. The first presents a short overview of the education and training levels in Latin America and the Caribbean. The second section considers the stage of adoption of digital and green technologies by the business sector in Latin America and the Caribbean. The third section discusses how the demand for qualified workers has evolved in the region, confronting the needs of the business sector to the prevailing labour competences, with a special focus on the demand for skills and competences in emerging new technologies. The fourth section discusses the role of TVET Institutions in Latin America and the Caribbean to attend the demands of the business sector, with a focus on two aspects: (i) the institutional and governance context, (ii) the funding mechanisms utilized by these institutions to perform their mandates. The following two sections analyse 7 TVET institutions cases of strategies, capabilities and the demand of the business sector in supporting digital (SENAI, Brazil, SENA, Colombia, Guatemala and SENATI, Peru) and green transition processes (INA, Costa Rica, Ministry of Labour, Chile and INFOTEP, Dominican Republic). The final section presents some reflections about the TVET challenges face and the related policy implications to strengthen the role of Vocational Training Institutes as an effective conduit of industrial transformation in the light of emerging new technologies.

1 EDUCATION AND TRAINING LEVELS IN LATIN AMERICA AND THE CARIBBEAN: AN OVERVIEW

In the past 20 years, there has been a striking improvement in the education levels of Latin America's population. All Latin American countries have experienced a sharp decrease in the share of their population at the low-skilled level, with a corresponding increase in medium- and highly skilled adults, as measured by the number of years of education attained by the adult population. However, despite the increase in the years of schooling attained by adults in Latin American countries, an inadequate basic, technical, and socio-emotional skills development remains in the region, constituting a bottleneck to productivity growth and to the ability of Latin American workers to obtain gainful employment. There is also great variation in the average skill levels of different countries' populations. At one end of the spectrum, more than 70 percent of the adult population in Guatemala and Honduras is low- skilled and a scant number (6 percent to 7 percent) are highly skilled. At the other extreme, the adult populations in Argentina and Chile have attained skill levels that are closer to the OECD average (FISZBEIN et al, 2016).

Limited access and inadequate conditions at the different levels of education and training in Latin America and the Caribbean effect young population, with many youths do not even entering the labour market. Approximately 20 percent of Latin American youth are not in education, employment, or training (NEET), compared to a 16 percent OECD average. This phenomenon—NEET—is more associated with school dropout than labour market abandonment. It is estimated that two-thirds of NEET are young women, due to a number of interlocking factors including social stereotypes, and care responsibilities of children and/or other family members (Rogers and Hoyos, 2016). On the other hand, the share of young people in the region who choose technical education and vocational training is still low. The percentage of young people attending Technical and Vocational Education (TVE) is, on average, 8.3% of this age group. Those who attend vocational training programs account for 17.1% of the youth population. The combination of both formats amounts to a total of 25.5% of young people, which is low compared to OECD countries where the average reaches 40.6%.

There are signs of a tendency to encourage young women to train for occupations traditionally viewed as female professions. Greater attention toward inclusion of young women in

more technical fields, such as STEM professions could be a part of industrial policies that would support greater gender equality in the framework of productive development and competitive upgrading.

Concerning the knowledge, skills, and abilities demanded by employers, it is possible to distinguish four critical levels: tertiary technical and technological education; primary, secondary and technical education and training; skills and abilities for dealing with new technologies and, soft skills.

At the formal education level, technological and technical knowledge and skills are acquired through the study of technologies and related sciences and the acquisition of practical skills, abilities, knowledge relating to occupations in various sectors of economy. These skills are taught in specialized education programs in secondary schools (technical and vocational education and training) and in post-secondary education (tertiary non-university education, university education, and on-the-job training). Concerning tertiary education, a particular area of concern is the presence of skills gaps in the STEM fields in Latin America. On average, 14 percent of university degrees are awarded in STEM in Latin American countries, driven by low rates in STEM fields other than engineering, namely, the physical and biological sciences, mathematics, and computer science. For example, in Latin American countries, only 2 percent of graduates received degrees in the physical or biological sciences, compared to 10 percent in Canada and 7 percent in the United States. In contrast, Latin American countries fare slightly better in producing engineering graduates at levels closer to these other developed nations. There is, however, a wide variation within Latin America on the pursuit of engineering degrees: in several countries—including Colombia, Mexico, Panama, and Venezuela—engineering seems to account for most STEM degrees, whereas in other countries, engineering is well represented but does not crowd out participation in other fields of study. On the other hand, many students do graduate with engineering degrees but do not work as engineers: in Brazil, only 38 percent of engineering graduates are working as engineers, suggesting the presence of a mismatch between the skills sought by employers and those acquired by graduates.

The second level is related to foundational literacy and numeracy skills acquired in primary schools and reinforced in secondary schools. In Latin America, the development of basic skills in education is below international averages in PISA tests. For example, average reading and math scores based on the 2012 PISA assessment in Chile translated to a result about 1.5 to 2 grade equivalents higher than in Peru (which had among the lowest scores of the eight Latin American countries in which students took the PISA assessment that year). Performance varied greatly within countries as well, with disadvantaged children performing more poorly on these tests, with PISA results showing a gap of nearly two years between students in the top income quartile relative to those in the bottom income quartile in most Latin American

countries. PIAAC Survey conducted by OCDE also shows that in Chile, Ecuador, Mexico, and Peru, on average, up to 60% of adults have low levels of literacy and numeracy skills, which makes them more vulnerable to changing labour markets.

The third level is related to specific sets of skills. The broad concept of digital competence refers to a set of technological knowledge, skills, and abilities that may be fully or partially acquired before entering the workforce (GOMEZ, 2021). Some digital competences are required to use and interact with technology in order to fulfil specific tasks, while others are required to design, create and maintain tools and solutions for different industries. Different digital skills create different categories of digital users and job profiles, being recurrently divided into three levels (basic, intermediate, and advanced), following ITU (2020) Digital Skills Toolkit. In Latin America, evidence presented by ECLAC (2022) shows that there is a gap between the OECD and LAC at every level of digital skill, although the gaps tend to increase as the skill level also increases. According to ECLAC (2021) less than 40% of the population has basic knowledge of computing, such as copying a file/archive or sending a mail electronic mail with an attached file. For intermediate activities such as the use of basic arithmetic formulas in a spreadsheet; the creation of electronic presentations using presentation software; or the transfer of files between computers and/or devices, these proportions are less than 30%. Regarding more advanced computing skills such as connecting and installing new devices, or download and install software, less than 25% of the population has this knowledge. In all in the countries considered, less than 7% of people report having written a program computer using a language of programming.

It is also possible to consider technical skills specifically linked to the transition towards an environmentally friendly pattern of development, which involves the broader concept of green skills (AUKTOR, 2020). The LinkedIn platform defines three categories of skills according to the level of sustainability they imply (ALFONSO et al, 2022). Green skills themselves are directly related to tasks and activities that promote sustainability (e.g. pollution prevention). Ambivalent green skills may or not be used for sustainability (as, for example, in vehicle fleet management). Adjacent green skills, on the other hand, can support the acquisition of basic and ambivalent green skills (for example, formal skills in the field of biology). Considering these skills, the jobs could be classified in three categories: “green jobs” that cannot be performed without extensive *green competence* (e.g. solar energy consultant); “greening jobs” that can be performed with some *green competence*, and knowledge; “greening potential jobs” that can be performed with *green competences*, but occasionally require more levels of this competence (e.g., logistics manager); “not green jobs” that does not require *green competences* (e.g. nurse).

The transition to low-carbon economies presents an opportunity for job creation in Latin America, with the demand for green competences rising significantly in the region. In fact,

different sectors should be considered “potentially green”, as not all jobs in these industries are green, given the present distribution of tasks. In Latin America, it is estimated that there are about 64 million jobs approximately 19% of the labour force that directly depend on ecosystem services, which includes jobs in the agriculture, forestry, fishing, renewable energy, tourism, textile, and textile sectors, chemical and industrial processes that depend on water (ILO and IDB, 2020). The potential for creating green jobs in the region linked to a decarbonization process is estimated at 15 million new jobs.

Finally, socio-emotional skills—also often called soft skills, transversal skills, and by many other terms—refers to a broad set of skills that may be acquired in multiple settings (school, jobs, home, volunteering) and are relevant to any job. They include, for example, critical analysis, negotiation, social perception and collaboration skills. These skills are recurrently cited as one of the most needed skill sets by senior executives surveyed across Latin American countries. A survey conducted in early 2010 with 1,176 private firms in Argentina, Chile, and Brazil revealed that when asked about the value of different types of skills, firms report valuing socio-emotional skills more than they value general or industry-specific knowledge (IDB, 2012). The score assigned to socio-emotional skills was almost twice the one assigned to knowledge and about four times the one given to industry-specific skills. Although Latin American educational systems directly promote cognitive abilities development, in general they do not address the development of socio-emotional skills, particularly in primary and secondary schools. Brazil, Chile, and Mexico do, however, include the development of socio-emotional skills as an objective in their education systems, although only Chile and Mexico include them specifically in their curricula.

2 THE ADOPTION OF DIGITAL AND GREEN TECHNOLOGIES IN LATIN AMERICA AND THE CARIBBEAN

New technologies, new organizational models and evolving worker preferences are generating new forms of work and new demands for skills. Existing categories of occupations are being replaced, modernized and new ones created. Most jobs will change and there are many worries about the potential for massive unemployment, precarious work, workers with little or no bargaining power, and skills gaps as people age. Tasks are disappearing, evolving, and emerging, generating fundamental changes in labour markets and in the demand for skills.

In relation to the process of digitalization, different methodologies have been developed to estimate its potential impact on employment levels. ECLAC occupational analysis estimates indicate that 16% of jobs in LAC are at high risk of automation, ranging from 5% in Bolivia to 29% in Uruguay. A further 16% may change substantially (occupations at medium risk of automation). These estimations were calculated using an adjusted occupational analysis methodology following WELLER et al (2019) and labour force survey data. Evidence presented in OECD et al. (2020) indicates that labour markets are partially polarized in most LAC countries, with the share of employment and wages growing substantially for high-skilled and some low-skilled jobs, especially in the service sector, and falling for middle-skilled jobs. Manual work in highly automatable occupations, such as machine operator or equipment repair, has declined significantly, and wage gains in other automatable occupations have decreased. However, these changes are smaller than observed in other regions and the OECD area (IDB 2022).

Concerning the digital transition in Latin America, UNIDO (2022) found that a very small fraction (just over 1 percent) of surveyed manufacturing firms in Latin America are using what they define as “Fourth Generation–smart production 4.0” digital technologies. Taken together, nearly 30 percent of firms are using integrated (3.0) digital technologies and lean production (2.0) digital technologies (CALZA et al, 2021).

Evidence from surveys conducted by INTAL-IDB in 2018/19, 2020 and 2022/23 in a set of five Latin America countries (Argentina, Brazil, Chile, Colombia and Mexico) indicate that the adoption of digital technologies expanded in the post-pandemic years but at a lower average

speed and more selectively than in 2020 (INTAL-IDB, 2023). The size of the company and the type of activity seem to influence the levels of technological adoption: large companies and service providers appear to be more advanced than SMEs and manufacturing companies. Cloud computing (78%) and digital platforms and mobile services (74%) are consolidated as the most widespread technologies, used by almost 8 out of 10 companies consulted. The ranking of the top 5 is completed with cybersecurity (45%), the Internet of Things (44%) and cyber-physical integration systems that allow machine-to-machine communication (37%). Opposite to expectations, technologies based on Data Science (big data and big data analysis) and artificial intelligence slowed down with respect to the pandemic: 3 out of 10 companies -that do not use them- show intentions of use them in the short term.

Concerning the process of green transition, a point to consider is that the LAC region is especially vulnerable to the effects of climate change due to its geographic location, territorial distribution of its population, and infrastructure and dependence on natural resources for economic activities (OECD et al 2022). In fact, 13 of the 50 countries identified as most affected by the climate emergency are in LAC. The transformation of the energy matrix is also key to accelerate the green transition in LAC. Despite 17 million people still have no access to electricity, Latin America endowed with high potential for renewable energy resources; at present, renewables account for 33% of total energy supply in the region, compared to just 13% globally. Investing in renewable technologies can substantially reduce GHG emissions while also providing lower-cost power and, for some LAC countries, reducing reliance on imported fossil fuel products.

According to REN21 (2022), Latin America and the Caribbean countries invested 9.7 billion USD in renewables in 2021, with 22 countries presenting renewable energy targets, including 3 countries committed to reach 100% of Renewable Energy by 2050. Brazil, Costa Rica and Colombia are the leading countries in terms of renewable share in total final energy consumption in the region, while Mexico, Chile and Venezuela stand out as leading countries in terms of renewable installed capacity in the region. Latin America and the Caribbean represent 5.7% of global wind power capacity addition, with Brazil being the third ranking country for newly wind power installed capacity, representing nearly 66% of additions in Latin America and the Caribbean.

The construction sector, which includes housing construction and building materials, is also a sector with potential to adopt environmentally friendly technologies. Over the last years' improvements to make housing construction more environmentally friendly have been made in Mexico, Peru, Colombia, Argentina, and Panama. The tourism is also a sector to be impulse in a context of green transitions. This potential can be associated not only with the strengthening of environmentally conscious tourism practices, but also with the adoption of environmental management practices in traditional tourist activities. The region is a net

exporter of agricultural products, presenting an opportunity for the development of green technologies in areas such as the use of technological tools (such as Geographic information (GIS) and remote sensing (SR)) for the monitoring, planning and management of natural resources. We can also mention the use of agricultural practices and livestock that reduces the environmental impacts; the use of agricultural-environmental modelling for decision making in precision agriculture and the waste management practices in the agricultural sector. Concerning the transport sector, even though the transport sector remains the largest contributor of CO_2 emissions, there are green initiatives in cities like Bogotá, Buenos Aires and Fortaleza that show that the region is trying to reduce these emissions through a progressive greening of urban infrastructure.

A successful transition to net zero emissions will be contingent on a generalized process of decarbonization. Advancing a green transition can potentially add 10.5% more net jobs in LAC by 2030. Thus, green windows of opportunity will be associated with the need for corresponding capabilities which could allow for catch-up or leapfrogging in green transition technologies.

3 THE DEMAND FOR QUALIFIED WORKERS

3.1 THE NEEDS OF THE BUSINESS SECTOR AND THE PREVAILING COMPETENCES: AN OVERVIEW

A growing body of evidence indicates that educational systems in Latin America are not providing businesses with the human resources those businesses need to thrive and grow. According to FISZBEIN et al (2016), employers throughout Latin America increasingly report difficulties in finding qualified applicants for vacant positions: 42 percent reported this in 2015 employer surveys, compared to 34 percent in 2010. Additionally, it takes significantly longer to fill a skilled position in Latin America(an average of six weeks) than does in other regions of the world (compared to three weeks in South Asia). The primary reason for this discrepancy is a general lack of valued skills in job candidates.

Data from the 2010 World Bank Enterprise Survey reveal that the proportion of firms identifying an inadequately trained workforce as a major constraint in Latin American countries is more than double that observed in OECD nations, comprising 34 and 16 percent, respectively. The survey also reveals considerable variation in Latin American countries when it comes to the percentage of firms stating that an inadequately educated workforce is a major constraint (19 percent for the country with the lowest percentage reported, Panama, vs. 75 percent for the country with the highest percentage, Brazil). There is evidence that lack of technical skills is an important source of these difficulties. Manpower Group (2021a; 2021b) finds that this problem has been escalating. From 2010 to 2015, the region saw an increase of 8 percentage points in the share of employers reporting that an inadequately educated workforce posed a barrier to hiring (from 34 to 42 percent).

GONTERO and NOVELLA (2021) mention an ILO study that compares ten countries of the region, stressing that, on average, 52.5% of the workers have an educational level appropriate for the position they occupy; about 31.3% have a lower educational level (underqualified) and 15.7% have an educational level higher than that required for the position they hold (overqualified). According to this methodology, in some countries of the region (Ecuador, El Salvador, Paraguay and Uruguay), more than half of the workers show a mismatch of skills. This study also estimates an indicator of the mismatches by comparing the proportion of jobs that require high skills with the proportion of workers with high educational levels in the same country. According to this indicator Brazil, Costa Rica, Ecuador, and Mexico show a relative balance, while in countries, such as Argentina, Colombia, Peru and the Bolivarian

Republic of Venezuela the proportion of highly educated workers is substantially higher than the availability of jobs in the economy that require that level.

According to a study carried out by OECD, Development Bank of Latin America (CAF) and ECLAC, mentioned by GONTERO and NOVELLA (2021), two out of three young Latin Americans are not duly qualified for jobs that require skills techniques, professionals or complex management. In addition, 50% of formal companies reported problems to fill vacancies (compared to an average of 36% among the countries of the OECD). The latest results presented in 2021 indicate that, after the COVID-19 pandemic, more companies reported difficulty getting the talent they need, with this proportion increasing from 45% to 69% globally (Manpower, 2021). For example, in the case of Argentina, while in 2019 50% of employers declared having difficulties in covering jobs, in 2021 72% have done so. A survey carried out by the World Bank in different years indicates that 28.6% of companies in the manufacturing sector declared that the insufficient training of workers was a limitation for the development of their businesses. Countries with a higher-than-average percentage were Argentina, Brazil, Chile, Colombia, Costa Rica, Honduras, and Uruguay, as well as countries of the Caribbean such as Bahamas, Barbados, Grenada, Saint Vincent and the Grenadines, Saint Kitts and Nevis, and Trinidad and Tobago. According to ILO-CINTERFOR (2017), employers in Latin America report greater difficulties in meeting the demand for skills than in other regions. In the formal sector, 36% of enterprises report that they struggle to fill their vacancies, compared with 22% in sub-Saharan Africa and in East Asia and Pacific, 17% in South Asia, 15% in the OECD and 14% in Eastern Europe and Central Asia.

According to INTAL-IDB (2023) the problems to hire qualified workers in Latin America increase in the post-pandemic period (2022/23): almost 7 out of 10 companies admit to having problems recruiting workers with the desired job training and skills, a situation that differs substantially from that registered in 2020, when only 27% of companies recognized these problems. The share of companies with problems to hire personnel with the required training and skills varies among the five countries surveyed by INTAL-IDB. In Argentina, 83% say they have had problems hiring in the last year; in Brazil 74%; in Mexico 68% and in Colombia 64%. On the other hand, in Chile, only 53% of the companies recognize this difficulty. Among the factors that hinder the hiring of personnel, in the post-pandemic period, companies identify “business uncertainty” in the first place, and, in second place, the “low quality of the educational system” (69%), followed by due to “the shortage of workers trained in new technologies” (62%) and the “high tax cost of hiring” (62%). The ranking of the five main obstacles is completed with the “lack of tax incentives for hiring”; the “business uncertainties” (with 54% and 53% of the companies respectively consider them very important).

Among the obstacles considered “important or very important” for the hiring of personnel, the quality of the educational system is indicated as a serious obstacle in Argentina (80%) and

Colombia (75%), compared to 68% in Mexico, 66% in Chile and 57% in Brazil. Concerning the shortage of workers trained in new technologies, with a mean of 61% to the five countries, indicating as a more relevant obstacle in Argentina (74%) and Colombia (66%), compared to in Mexico (59%), Brazil (54%) and Chile (53%). High labour taxes are a particular concern for companies in Brazil (73%) and Colombia (67%). In their daily actions, companies are forced to overcome these difficulties adopting strategies of a diverse nature. In the post-pandemic period, the two most widespread are the offer of salary incentives (22%) and training courses given in the company itself (21%). To a lesser extent, some companies choose to change recruitment methods and channels (15%). Compared to 2020, when many companies solved the problem by redefining jobs (26%), in the post-pandemic, this strategy is used by only 14% of companies.

3.2 THE DEMAND FOR SKILLS AND COMPETENCES IN EMERGING TECHNOLOGIES

Concerning the process of digital transformation, evidence collected by INTAL-IDB (2023) indicated that in the post-pandemic period, 7 out of 10 companies have problems hiring workers with the necessary training and job skills, a significant increase since 2020. The low quality of the educational system, the shortage of workers trained in new technologies, and the high tax cost of hiring are the main obstacles identified. The quality of the educational system is indicated as a serious obstacle in Argentina (80%) and Colombia (75%). The shortage of workers trained in new technologies reaches its maximum in Argentina (74%), while the lack of tax incentives for training is pointed out as very important in Colombia (73%).

INTAL-IDB (2023) also points that the use of government training and training programs for personnel is still very incipient in the region, not only due to the ignorance of the companies about its existence, but also, to a certain mismatch between the offer and the needs of the companies. On average, only 2 out of 10 companies use them in the post-pandemic period, which implies a reduction of -9 pp compared to 2020 and -6 pp compared to 2018/19. In addition, 4 out of 10 do not use them because they are not familiar with them and 3 out of 10 because they do not meet their expectations. This problem occurs more strongly in Argentina, which appears as the country with the highest percentage of companies that are aware of the public offer of training programs and, at the same time, is the country with the highest percentage of companies that consider that these programs do not fit to your needs.

Also, according to INTAL-IDB (2023), the pandemic has been a turning point by positioning soft skills above hard ones and physical abilities, a trend that continues in the post-pandemic. Currently, 57% of companies value soft skills as “key skills”; 50% hard; and 34% to physics. Among the soft ones, cognitive abilities (61%) and systemic abilities (60%) stand out as “key”. Among the hard ones, those of resource management (56%). On average, 3

out of 10 companies recognize shortages of hard (35%) and soft (34%) skills, levels that exceed 8 p.p. and 9 pp to those of the pandemic, and 3 pp and 2 pp to those of 2018/19. Even though hard skills in STEM are not among the most valued in the post-pandemic, they are at the same time, along with administration skills, very absent or difficult to gather; 36% of companies consider them "missing". Among the soft ones, there is a lack of process skills (37%).

The transition to new green jobs implies development of active labour market policies and well-targeted social policies to support those workers and households who will be negatively impacted by the green transition. In Latin America countries, some experiences of policies and actions to incentive a green transition may be stressed. Peru has developed of the Green Jobs Plan as part of the country's new employment policy; Barbados has strengthened the support to the National Statistics Service in measuring green employment.; Uruguay has worked with economic sectors with high levels of job insecurity and environmental impact; Mexico developed a Green Jobs Program with Mexico City; Argentina has Identified employments linked to bioenergy production, based on a sustainable rural development approach; Guyana has developed an employment impact assessment of a development policy based on environmental sustainability; Argentina and Peru have focused on Decent Work for waste recycling electronic and electrical. Concerning vocational training with an environmental focus, it is possible to mention the FOIL Project, in Central America and Dominican Republic, oriented to the identification of new professional training needs linked to green objectives.

Evidence also suggests that the benefits from switching to greener technologies are higher when levels of digital technology uptake are also higher, and that detrimental environmental effects related to the proliferation of digital technologies - such as carbon emissions and e-waste - are weaker in regions with greater adoption of green technology. While Latin America is certainly not the greatest contributor to Green House Gas (GHG) emissions, the low levels of digital technology adoption may present a double whammy, because firms already struggling with lower productivity and facing uncertainty may not gain as much from adopting greener technologies. Digital technologies also provide tools that are useful in the context of environmental actions to address climate change in the fields of Monitoring, Mitigation and Adaptation. This twin transition could also widen productivity gaps between firms and productive sectors since, despite the benefits and opportunities it brings, investing in new technologies is uncertain and has long-term payoffs. While large firms inserted in global value chains will increasingly rely on green suppliers whose production methods can be traced and verified (typically using digital technologies), suppliers will thus have to comply with green and digital standards to be able to participate in the global economy, which can be a challenge for SMEs. This event is mirrored in policy agendas of developed countries, where the two topics, until lately located in separate policy agendas, are being

intentionally integrated as a part of development strategy, a path yet to be strengthened in Latin America.

Technical and vocational education and training (TVET) in Latin America and the Caribbean

Technical and vocational education and training (TVET) is defined by UNESCO (1984) as "those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupation in various sectors of economic life."

The ILO's Human Resources Development Recommendation, 2004 (No. 195), emphasizes the importance of education, training, and lifelong learning as integral components of sustainable economic growth and employment creation. It calls on governments, employers, and workers to renew their commitment to lifelong learning, recognizing that these factors contribute significantly to personal development, access to culture, and active citizenship. The recommendation also highlights the need for comprehensive economic, fiscal, social, and labor market policies that are consistent with these principles.

3.3 THE INSTITUTIONAL AND THE GOVERNANCE CONTEXT

Technical and vocational education and training is the main actor responsible for the development of youth skills and to keep adults' skills updated. It is one of the two most important sources of career development in the region. Institutions offer a wide variety of services and in most countries they can be characterized by five types: i) Public TVET institutions with own funding and administrative autonomy; ii) Formal private TVET institutions, which usually work by supplementing the public TVET service provision; iii) Informal private TVET institutions, which are mostly unregulated and without quality assessment; iv) Enterprise training offer, including on-the-job training and the outsourcing of courses; v) Secondary technical education and higher technical education institutions, including technical colleges and public and private technological schools. ILO-CINTERFOR (2017; 2020) illustrates the variety of institutional arrangements in Latin America, distinguishing several types of TVET institutions than can be classified according to their management, public or private, and their scope, regional or sectoral. According to these criteria, four groups of institutions are identified: i) Public sector institutions and national coverage; ii) Private sector institutions and national coverage; iii) Public sector institutions and local coverage; iv) Private sector institutions and local coverage. iv) public and private with sectoral coverage and generally, national coverage.

Three major groups of institutions can be distinguished.

TVET Institutions could be national public institutions such as INA in Costa Rica, SENA in Colombia, INADEH in Panama, INFOP in Honduras or INFOTEP in the Dominican Republic. They are governing bodies of the national training system. In this group there are also institutions that are part of Sistema S from Brazil (SENAI, SENAR, SENAC, SENAT) which follow the established education and training public policy and provide training in their own centres.

Second, there are institutions that only take part in the definition of policies, which are articulated at the sectoral level, but that carry out training actions through third party centres or institutions. This is the case of SENCE in Chile, INCAF in El Salvador, SINAFOCAL in Paraguay, INEFOP in Uruguay.

Third, there are institutions that carry out specific training within the framework of the national policies formulated by the Ministry of Labour or by governing Institutions, comprising private TVET institutions of national scope or sectoral coverage.

According to data collected by ILO/CINTERFOR for 2015 (ILO-CINTERFOR, 2017), about 10,925 vocational training centres and units, as part of the national or sectoral TVET institutions were responsible for the provision of training in Latin America. Of these, 39% were their own centres, 55% were outsourced centres, 4% were own mobile units and 2% were outsourced units. In fact, training supported by collaborating centres or third-party training institutions, accounts for half of the provided capacity. According to ILO-CINTERFOR (2017), more than 15 million participants are enrolled in TVET programmes, in 17 Latin America and Caribbean countries.

The governance of these institutions varies. A first aspect refers to the presence of bipartite and tripartite dialogue mechanisms at strategic levels such as the management of vocational training institutions and the implementation of training, as in the case of National Councils who lead and govern national institutions. Governance also involves the certification of competencies, within national certification systems, such as CONOCER in Mexico and ChileValora. There are also governance mechanisms at the sector level in which the business sector is directly committed to the definition of training actions and their follow-up, as demonstrated by the SENA sectoral working groups in Colombia, by the SENAI sectoral technical committees in Brazil or by the sectoral councils in Argentina among others.

In Uruguay, employers and workers are joined together in bipartite committees to update occupational profiles in the construction and paper and pulp industry. Others examples of bipartite participation in the development of programs includes: i) Sectoral Technical Committees coordinated by SENAI in Brazil and managed by Brazilian industrialists; ii) Sectoral Working Groups coordinated by SENA in Colombia, comprising business chambers and unions, represented in a Tripartite Board of Directors; iii) Sectoral Councils promoted

by the Ministry of Labour, Employment and Social Security (MTEySS), in Argentina; iv) the National System for the Certification of Labour Competencies, ChileValora, in Chile; v) the Council for Standardization and Certification of Labour Competences CONOCER in Mexico, coordinated by a tripartite board of directors, whose objective is to plan, implement, promote and update the Standardized System of Labour Competency and Certification System for Labour Competency; vi) the Bipartite Training Committees (CBC, in Spanish) in Chile, which are mandatory for enterprises with over 15 workers and undertake the task of agreeing on and evaluating training programs for workers and providing advice to enterprises with regard to training.

4 EXPERIENCES IN TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING FOR THE DIGITAL TRANSFORMATION PROCESS

4.1 THE DIGITAL TRANSITION FOR VOCATIONAL TRAINING INSTITUTIONS

From a vocational training perspective, the digitalization of the business sector of any economy must face a double challenge. On the one hand, institutions must have the capacity to timely respond to the increasing demand for skills imposed by the digital economy. On the other, TVET institutions must engage in their own digital transformation, of management processes as well as of the process of delivering education and training. Digital competences will be necessary for both workers and TVET officials. The expected systemic changes in companies and training institutions also require many kinds of skills essential to digital economy, but should not be confused with specific digital skills, with the latter revolving around the ability to operate and produce with digital tools; but by themselves, they do not allow workers to navigate the changes that are taking place in the economy and society.

According to ILO-CINTERFOR (2017), Vocational Training Institutions from several countries in Latin America have mobilized efforts to face up the double digital challenge. Concerning initiatives to improve digital literacy, Uruguay and Peru have both introduced National Digital Literacy Plans (*Plan Nacional de Alfabetización Digital*), with the goal of training individuals in information and communication technologies (ICT) skills, in the use of computer tools as well as mobile devices. Argentina has a National Digital Inclusion Plan (*Plan Nacional de Inclusión Digital*) with similar objectives. The Digital Talent for Chile is a public-private initiative that offers digital skills training to improve the employability of vulnerable groups with low skills through pilot programs and initiatives that allow participants to develop skills

to access quality jobs, in line with the demands of the digital economy. In Costa Rica, the *Programa de Innovación y Capital Humano para la Competitividad* (Innovation and Human Capital for Competitiveness Programme) developed by the Ministry of Science, Technology and Telecommunications, the IDB, and the Coalition of Development Initiatives (CINDE), is a scholarship programme in areas of high labour demand, covering 100% of the cost of the training in the areas of science, technology, and innovation. The objective is to support individuals to improve their skills in the fastest-growing areas of the labour market, and thereby to contribute to the country's competitiveness.

According to ILO-CINTERFOR (2022) the role of TVET in a scenario of intense digitalisation of productive processes must be articulated with improving and upgrading labour skills. A digital competent workforce has not only a direct impact on the efficiency of organisations, but also an indirect impact as the adoption of digital technologies generates externalities and spill-overs effects. The digitalisation scenario, traversed by strong complementarities between labour qualifications and new technologies, and the inexistence of market solutions for the provision of workers' skills, evidenced by clear skills gaps, provide a renewed justification for public interventions in vocational training. Public policies are especially important for the strengthening of five capabilities of vocational training institutions.

Capacity to anticipate the future demand for skills. It refers to the institutional capacity to analyse the future demand for labour skills, in order to understand how technology will impact the structure of labour competencies in different occupations. In this sense, the traditional statistical systems (based on household surveys produced by state statistical systems) on which the analysis of the labour market is based, do not usually provide the necessary information for the prospective analysis of the demand for qualifications. To overcome these limitations, it is necessary to exploit non-conventional sources of information (high-frequency administrative microdata, vacancy analysis, etc.) and rely on the joint work of data analysts, labour economists and specialists in education and professional training, as well as qualitative analyses at sectoral levels, to generate the necessary information. Additionally, it is important to consider a set of soft skills that are configured as complementary to modern technologies, for example, critical thinking, social and communication skills.

Capabilities to develop impact assessment analysis of digital educational technologies in vocational training. Bearing in mind the high dynamism of the digitalization process in its multiple facets and the continuous impact that this has on the educational process, vocational training systems need to assess the impact and cost-effectiveness of their learning activities.

Capabilities to develop sectoral training programs. From a strictly business perspective, the private benefit of the training is less than the social benefit since a person could change companies and the investment would end up being appropriated by competing companies. In this sense, sectoral programs can help identify niches with high demand for employment

and mitigate this type of coordination failure and collective action problems between companies, combining training and other support and follow-up services.

Training in management practices. Evidence on the link between digitalisation and productivity reveals the existence of synergies between technologies, workforce skills, and the quality of business management practices, such as lean production principles. In addition, the productive impact of digitalisation in Latin America depends on its widespread adoption by a broad segment of low-productivity small businesses. So, the digitalisation-productivity link of micro and small companies depends on the development of internal capacities, including the training of digital skills and models and tools business practices, including lean production principles.

Capacity to incorporate new pedagogical practices and learning tools. Digitalisation has a strong impact on the functioning of TVET institutions, generating opportunities to renew organizational formats and pedagogical proposals. This is expressed, for example, in the growth of distance professional training modalities, e-learning and hybrid and flexible curricular designs. On the other hand, in a context of dual labour markets such as those that characterize many Latin American countries, the gaps in on-the-job training opportunities between the formal and informal sectors are also an important dimension to consider, due to the potential that new technologies must develop job training programs that address social inclusion. In addition, it is important to investigate how the heterogeneous development of national digital infrastructures in Latin America, in terms of cost, penetration and quality, has conditioned the digitization trajectories of the Vocational Training institutions.

Below is a summary of some actions developed and implemented by professional training institutions to face the challenges of digital transformation in the region.

4.2 SENAI (BRAZIL)

In SENAI, the incorporation of technologies associated with digital transformation began, more intensely, in 2016, with updates of professional profiles and curriculum designs for occupations most impacted by the dissemination of technologies associated with industry 4.0. In 2018, implemented a digital transformation program, with the premise to offer courses associated with the theme in a national scope, based on a standardised national curriculum. Working groups were created with representatives of companies and the academia to identify key technologies and the urgency of vocational training. From then onwards, SENAI constantly updated its courses to meet the exponential growth in demand. For example, in 2020, in comparison with 2018, it was noted a 95.6% growth in demand for courses about digital transformation. Currently, the demands for these courses come from all sectors served by SENAI, from the most dynamic sectors from a technological point

of view, such as the automotive sector, to more traditional sectors, such as the textile and clothing sector and metalworking.

During the pandemic, thanks to the previous engagement in anticipating processes of change, SENAI was able to implement internal digitally minded, organisational-oriented changes, starting with the structuring of a digital marketplace to offer its courses. In addition, an internal program (Programa SENAI Mais Digital), was launched to improve the dimensions of infrastructure, processes, and personnel, with strong investments in all the Institution's schools. One of the objectives was the implementation of at least one concept plant of industry 4.0 enabling technologies in each training centre, across the country. In parallel with the process of technological modernization of schools, SENAI invested heavily in the connectivity of schools, students, and teachers. As an example, we can cite the organization of a hackathon, which involved around 8,000 teachers to solve their real problems in the classroom. For the establishment and standardization of digital processes, SENAI, together with TOTVS (a Brazilian software company), developed a school management solution for its units. Currently, almost 60% of enrolments are made through the digital process.

Two other initiatives from SENAI are relevant in this context, (i) the structuring of the curriculum in three blocks, one for general industry skills, one for sectoral skills and the third one that needs to keep the pace with changes in technology and (ii) SENAI has recently introduced changes in the curriculum structure in order for participants of all courses (from a certain qualification level upwards) to work project based all through the course. This is key for technical skill development but also for digital economy skills needs.

4.3 SENA (COLOMBIA)

SENA operates in all regions of the country from the capital, passing through the municipalities or intermediate cities and even reaching the most remote rural areas of the country, and in the coastal zone. That is why there is a lot of demand to meet the demand of the different economic sectors of the country in accordance with the digital stage of development of each region. The way to organize the demand is therefore to be closely related to the productive sector, that is, with the companies. SENA is always in constant communication with the business sector. For the development of professional profiles, a curricular design group is initially coordinated, made up of instructors from the institution that generates a profile proposal that is validated by the sector companies.

The magnitude of the demand of the productive sector and the possibilities to offer adequate training is carried out through negotiations forum (*mesas de negociación*) a Colombian traditional mode of promoting the public-private interactions for public policy formulation purposes. These forums include the education and vocational training and in

such matters the business sector, trade unions, industrial policy-related agencies and SENA work out training priorities.

In recent years, the entity has focused on software development and on internet of things and artificial intelligence. During the pandemic, for example, there was a great demand for professionals in the field of cybersecurity and SENA offered several complementary courses due to the urgency of the demand. To increase its own capabilities in the digital field, SENA establishes agreements with leading ICT companies. For artificial intelligence vocational training, SENA is acting together with the main global companies to update the technological infrastructure and instructors. Hence, it should be noted that SENA's training is based on technical knowledge and skills and soft skills, such as communication, teamwork, and idea generation. The incorporation of digitalisation in SENA allowed it to expand its offer of technologists, in addition to reducing design and development time. in two years, the institutions were able to expand their supply of technologists from 2 to 10.

4.4 INTECAP (GUATEMALA)

In Guatemala, employers are already beginning to demand that graduates have digital skills and command of the English language. Currently the sectors that are most looking for these professionals are banking and insurance, the tourism sector and agribusiness. To meet such demand, INTECAP's strategic plan places emphasis in the development of the technical content of methodologies and the management of processes of the organization.

To offer courses for the digital transformation, INTECAP identifies the demand through labour market studies and prospective studies and through technical roundtables, made up of academia, the business sector, and labour representatives. In general, the institution seeks to develop digital skills and knowledge of a foreign language, now it is English, in all the axes of its training offer. For the institution, the digital transformation must be based on interactive platforms that are friendly to the new generations and that facilitate learning and the development of skills and competencies. In addition, new training methodologies can be incorporated that allow the offering of customized courses. One of the initiatives under development is the offer of digital training, technical assistance, and labour certification services. In the construction of training centre's or in the configuration of mobile units, INTECAP already acquires digital technologies that can communicate with a digital platform which can be connected remotely.

INTECAP also has an institutional digitalization strategy, which aims to strengthen the use of digitalization in institutional services and processes to facilitate interaction with external and internal clients and allow work to be efficient and effective, in addition to training workers. of the institution in the use of optimization tools, digitization and automation, and

interactional robotics. For the updating of teachers and instructors, INTECAP runs a training of trainers' process. These methodological innovations aim at having a pool of teachers able to help students develop future/digital economy skills.

Finally, INTECAP has developed a new service to recognize and certificate certain digital skills. In alliance with technological firms, INTECAP can teach, assess and recognize digital competencies usually related to international program languages and private firms like Amazon Web Services, CYSCO, Microsoft, among others. Some of these digital skills are in the most demanded for programming and data analysis in Guatemala as in the world.

4.5 SENATI (PERU)

In Peru several studies point out the increasing adoption of digital technologies by companies. Consequently, the demand for services from SENATI is on the raise especially from the food industry followed by firms from the service sector such as the financial sector. Even though large and medium-sized companies have the leadership in the demand for specific professionals with digital skills, SENATI has sought to support SMEs. It has done so by engaging its professionals in the development of technical solutions that are adequate to the SME reality such as the adaptation of digital solutions to the existing reality of SME´s equipment and processes.

SENATI has been at the forefront of national efforts to attend such demand, and it is the leading institution providing training for ICT technical careers.

To do so SENATI has set up alliances with leading international technological institutions to strengthen its own competences in a way to be at the forefront for providing education and vocational training in the areas of mechatronics, software development, cybersecurity, Big Data, and artificial intelligence. SENATI is also making efforts to incorporate the knowledge associated with digital processes into other careers such as logistics and industrial management. In its effort to advance in the digital transformation process, SENATI has developed "friendly" platforms that allow students to simulate the processes they conduct in person in workshops for management related careers as well as for careers of a more technical nature.


PROCESSING.....
PROGRAM RUNNING...
Robotic Arm Performan
64%
86%
73%
64%

5 EXPERIENCES IN TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING FOR THE GREEN TRANSITION PROCESS

5.1 THE GREEN TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING INSTITUTIONS

The harmonization of economic, social, and environmental policies to support sustainable development requires the mobilizations of TVET institutions to contribute to furthering the transition towards green economies and the creation of green jobs. Green jobs, in addition to sustainable-orientated policies and technologies, can contribute to minimizing certain sectors' environmental impact while supporting economic growth (TORRES, 2021). Additionally, green jobs can also help to ensure decent work for all. In a fully sustainable economy, all occupations incorporate "green" elements, through a combination of new jobs and existing occupations that are being retrofitted, to promote sustainability and enable the efficient use of energy and resources. This process requires upgraded and specialized knowledge, skills, training and / or experience of the workforce to meet the skills demands and seize the available employment opportunities.

According to ALVARADO (2017), Latin America are facing six challenges which may affect countries' efforts to provide the skills required for green jobs:

I. Urbanization. Latin Americas' mega-metropolis are growing and developing without proper planning, causing the emergence of serious environmental and social crises, imposing serious challenges to education and TVET systems because of the structural differences between larger developed urban zones.

I. Environmental and natural resource degradation: in this context, TVET systems, with particular focus on skills development to make current occupations greener, play an important role.

II. Skills mismatches: TVET systems need to be more flexible in incorporating green skills and need to be aligned to the needs of enterprises, not only focusing on the short-term

goals and needs, but also teaching skills useful for the medium- and long -term goals and objectives of sustainable development.

III. Lifelong learning: TVET should not only focus on technical and vocational content but also include other skills that are useful for lifelong learning, with the sustainability component being present all along the education cycle and throughout the process of training students.

IV. Social factors: Family education also plays an important role in achieving the Sustainable Development Goals (SDGs), and education and TVET systems must realize that education should not only be formal but should also impact the whole community and social life.

V. Public-Private Partnerships: TVET must be inserted in broader ecosystems that allows the generation and development of synergies between the productive, educational, and public sectors.

In a more resource efficient, greener, and competitive economy, the costs of renewable technologies tend to be reduced (i.e., wind, photovoltaic), promoting a favourable investment climate and demanding vocational training to allow for the diffusion of these technologies in the business sector. TVET is also relevant for the development and adoption of new ecological solutions to development problems characterized by pollution, water scarcity, waste disposal and traffic congestion in its cities. TVET has also a key role to play in teaching skills that can be functional for the development of green innovations, even very simple ones. For example, banana waste can be used for the construction of pallets, which helps to reduce the use of forest material and the better use of waste production.

On the other hand, connecting the route to a sustainable development with the notion "social cohesion" is within the vocational training and education agenda as it leads to the access to job opportunities and societal participation especially for those from poor and marginalized backgrounds. An example of this perspective is the so-called "Intelligent Comforts" (CECI) developed in Costa Rica, structured as a national network of community centres located in different parts of the country that offer diverse services.

Below is a summary of some actions developed and implemented by professional training institutions to face the challenges of green transition in the region.

5.2 MINISTRY OF LABOUR (CHILE)

Since the turn of the new century, Chile is engaged in a process of change of its energy matrix. Different and ideologically diverse administrations have maintained political and policy priorities over the subject. Energy laws facilitated a reconversion process through which thermal power plants were closed and substituted by renewable sources. Chile, thus,

has had to face a transition from two perspectives: an industry that is created and an industry that is destroyed. This imposed great challenges across different public spheres, including those engaged in vocational training.

The Ministry of Energy has worked hand in hand with the Ministry of Labour and Social Welfare to identify the potential workforce to be impacted by the energy transition process and to develop professional profiles for reconversion and new tasks. At the same time, the business sector has brought in professionals with the capability to technically train their own staff, including their role as multiplier agents. However, the established process has its limitations: institutions and companies have not been able to reach out and improve the capabilities of workers from sub-contractors.

To face this challenge, the government has intervened with SENCE and Chile Valora, which are the competency training and certification services in the country, to offer the territories that are affected by the sectors closures a set of training to seek a certain degree of employability. One specific activity in this field has been the develop of an anticipation of skills need exercise in Green Hydrogen production. This activity was made with the SENAI´s methodology and technical coordination of ILO/Cinterfor and has produced several occupational profiles in that sector. At the end of 2023 this exercise will conclude with several recommendations for TVET institutions and enterprises.

5.3 INA (COSTA RICA)

Costa Rica has a long-established and successful national strategy to make the country an environment reference for the world. Within such a context, companies have sought to generate "friendly" products and practices from an environmental point of view in order to strengthen their capacity to compete in international markets in particular firms from the tourism, food, and agricultural industries. Such business strategies place considerable demand on.

Through its strategic plan INA has delineates and prioritise actions to attend the demand of the productive sectors. For that INA developed a curriculum model in which all technical areas (e.g., mechanics, Information and Communication Technology) must incorporate environmental competencies as part of their teaching process, not only as something transversal but as practices and attitudes to change the student culture.

To improve its own competencies INA established cooperation agreements not only with the productive sector but also with national environment related institutions, such as SINAC (*Sistema Nacional de Áreas de Conservación*) or MINAE (*Ministerio de Ambiente y Energía*). In the fishing sector, for example, the institution trains and develops alternative fishing proposals. The INA has a "teaching farm" for organic agriculture, which trains people to work in agricultural systems based on the organic structure of production. Other examples

include training in bioeconomy and circular economy for the food industry and training for the installation of photovoltaic panels and systems.

In addition to training, INA has an environmental management area that aims to integrate different areas of the companies in the search for productive efficiency in accordance with environmental rules and regulations.

5.4 INFOTEP (DOMINICAN REPUBLIC)

In the Dominican Republic, companies are starting to develop business strategies around sustainability-related concepts in order to improve efficiency, strengthen value chains and induce customer fidelity.

At INFOTEP, the environmental dimension of vocational training started to be incorporated from 2014 onwards, when the institution implemented a prospective study that revealed the importance of environment-related themes. From such study followed a national consultation with the relevant stakeholders of the institution. Such consultation confirmed the findings of the foresight exercise that placed green jobs as a relevant agenda for the economic future of the Dominican Republic over the next 10 years.

INFOTEP participated in the anticipation of skills needs exercise with SENAI methodology and ILO/Cinterfor support. The chosen sector was renewable energies with emphasis in solar energy. It also identified several new required occupational profiles and generated recommendations to improve and update training programs.

As in other national contexts, at the Dominican Republic large business groups are already placing demand on INFOTEP to strengthen the capabilities of their employees in recycling and energy saving issues. However, at other business segment, INFOTEP is still promoting awareness campaigns on the importance of green jobs for the future of the country. For this, the institution has coordinated many workshops to raise the awareness and the capabilities of not only companies but also with INFOTEP's teachers, and employees. For example, the institution designed a cleaner production course, and this was aimed at teachers and that group of advisors.


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6 REFLECTIONS AND POLICY IMPLICATIONS

The digital and green transitions in LAC countries are challenging processes. The adoption of digital and green technologies by the business sector is still at an infant stage. A very small fraction of manufacturing firms of the region has adopted advanced digital and/or green technologies. Differences in technology adoption are directly related to the size, sector and direction of sales: those of larger size, operating in technology intensive sectors and with an export propensity tend to be more advanced than their counterparts of smaller size, coming from traditional activities and selling to local markets, despite the evidence that this adoption has expanded in the post-pandemic years. There is also evidence that high levels of digital technology uptake facilitate the adoption of greener technologies. The integration of digital technologies' adoption into firm's practices provides a critical support needed for the green transition. Conversely, firms already struggling with lower productivity due to technological gaps in production processes may have greater difficulties in adopting greener technologies.

In fact, employers throughout LAC report difficulties in finding qualified applicants for vacant positions, with a significant proportion of firms identifying an inadequately trained workforce as a major business constraint. There are also evidences that the problems to hire qualified workers in Latin America increased in the post-pandemic period (2022/23), with the quality of the educational system being indicated as a serious obstacle for the hiring of qualified personnel. Furthermore, it is important to note that the digital divide which existed prior to the pandemic was exposed starkly during lockdowns. The restrictions for social distancing during the pandemic also revealed the different dimensions of digital exclusion in the region between those individuals, households and regions that had access to connectivity, adequate equipment and digital skills and those who were being left behind in the digital transition.

According to evidence collected by INTAL-BID (2023), in the post-pandemic period, 7 out of 10 companies have problems hiring workers with the necessary competences, with soft skills being positioned above hard ones and physical abilities.

In summary, exiting technology gaps stems from a context of: (i) narrow demand of LAC industries, given the infant stage of development; (ii) low levels of qualification of the labour force, at all degrees of formal education; (iii) limited capacity of the education system to provide quality education and training, which also reflects the social and economic

inequalities in the region and, (iv) a historic dichotomy between education and training on one side, and industrial and innovation policies, on the other.

The region must continue investing in strengthening the quality of education, to promote the development of skills in equal conditions, reducing the historic dissociation between education and TVET policies and industrial policies, through a wide spreading of formal and non-formal learning activities in the workplace. In a context of accelerating technological advances, mainly driven by the processes of digital and green transition, the mismatches between labour market needs, and available supply may intensify, primarily affecting the most vulnerable workers who are less able to adapt quickly. To face this challenge, it is essential to promote technological innovations with the potential to offer new employment opportunities, increase the productivity of workers and facilitate the acquisition of new skills through flexible learning systems in which TVET assume a critical role. These approaches are also crucial components for the necessary adaptation toward systems of lifelong learning, which are fundamental to enable continuous skilling, reskilling and upskilling of workers, as they must learn and acquire new competencies throughout their working life.

TVET institutions are poised to engage in a constant process of change as the economies become more sophisticated, the rate of technical progress increases, the aspirations of peoples change over time and the accumulated learning in each institution evolves and strengthens along the years. Based on the previous analysis, ten policy implications can be put forward.

In the first place, **the permanent challenge of effectively aligning vocational training with labour market needs must be embedded at the core of TVET institutions**. To reduce the mismatch between the educational offer and labour market needs, in Argentina there are efforts to involve companies in the identification of employment skills requirements for the near future. In Chile, the public employment services use information on labour demand, collected through interviews, surveys and roundtables. In Brazil, different ministries can submit requests to the Ministry of Education for creating specific training well-adapted to the identified skill needs. In Mexico City, the *Diagnóstico de Competencias Demandadas* (DiCoDe, Demanded Skills Diagnosis) collects, structures, and visualizes information on local labour demand and supply using web scraping algorithms.

Secondly and, to reinforce the capacity to face up the previous challenge, **TVET institutions make efforts to involve of employers in the design of training programs**, in order to ensure that workers are being trained in skills that are effectively demanded. In fact, according to OECD (2021), in Latin America, 63% of workers who participated in training report to have received funding from their employer for at least one learning activity. In Argentina, the Ministry of Labour, Employment and Social Security tries to implement programmes based on the cooperation with companies to train individuals from the surrounding neighbourhoods.

Costa Rica have set up a country-level apprenticeship network with the objective to promote work-based training opportunities for vulnerable and marginalized youth. The Sistema S in Brazil operates as a network of institutions providing training services for the industrial (SENAI), commercial (SENAC), transportation (SENAT) and agrobusiness (SENAR) sectors, thus inducing links between vocational training and labour market needs.

Thirdly, **TVET institutions must support enterprises in their endeavour to become learning organisations**. SENAI and SENAC in Brazil, SENA in Colombia, CONALEP in Mexico, INFOTEP in the Dominican Republic or SENCE in Chile, have successful experiences localized in some demand niches for the implementation of apprenticeship scheme. In Brazil, SENAI, SENAC, SENAR and SENAT train around 412,000 apprentices which equals 5 every 1,000 employed workers. SENA, from Colombia, with 345,000 apprentices, reaches 17 every 1,000 employed workers, accounting for the highest proportion observed in dual training programmes in the region. In the case of other institutions, a level of more than 1,000 apprentices has been reached only by INSAFORP from El Salvador and INADEH from Panama.

In Brazil, companies in the automotive industry have partnered with SENAI to address their skills demands and agree on apprenticeship programmes. SENA, in Colombia, works with enterprises from different areas like microelectronics and wholesale distribution. In Peru, SENATI builds partnerships with the manufacturing industry to develop joint apprenticeship programmes. INSAFORP, in El Salvador, has established a partnership with the plastics industry to generate human resource training and development solutions. INFOTEP, in the Dominican Republic, implements training programmes for enterprises in the exporting sector and applies various methodologies for increasing productivity, such as the SCORE programme for the organic banana sector. SENATI in Peru maintains apprenticeship agreements with enterprises in various industries.

In fourth place, **the strengthening of dual education has to become a priority**. For that, the apprentice's time is shared between an educational institution and a firm, the latter providing work experience and practical training to develop occupational and socioemotional skills. Dual education programs in Latin America can be broadly separated along two dimensions—whether they target students or non-students, and whether they are operated by public or private entities. SMECK et al (2020) draws on an analysis of 40 public and private dual education programs in the region, including national-scale programs such as *Formar*e (Brazil), SENA (Colombia), SENESCYT (Ecuador), SENATI (Peru). In Brazil, *Formare* is a professional qualification program created and conducted by Fundação Iochpe in partnership with medium and large companies. Also in Brazil, SENAI launched in 2016 training courses following the German dual apprenticeship model, which will be run for three years alternating between training schools and enterprises. In Mexico, CONALEP, along with other institutions, is promoting the Mexican Dual Training Model, which intends to reach

10,000 participants by 2018. In Chile, the Society for the Development of Manufacturing Industries (SOFOFA) promotes dual apprenticeship programmes with technical and vocational secondary schools and the involvement of private enterprises, including the heavy machinery sector. In Colombia, SENA and several enterprises in the heavy machinery, telecommunications, and automotive industries, was launched a Dual education program. The new apprenticeship experiences can also be implemented both at the level of technical secondary education, as can be seen in the cases of Argentina (INET), Colombia (SENA-MEC) and Mexico (CONALE).

Fifth, **vocational training is a valuable instrument to induce learning for vulnerable groups and social inclusion**. To expand program coverage, many countries in Latin America are relying on distance education (OECD, 2021). Especially during the COVID-19 pandemic, some countries have intensified their efforts to deliver training at a distance, such as SENAI, in Brazil, which has strengthened web- and mobile-based distance learning channels. In Peru, *El Servicio de Ventanilla Única* (The One-Stop-Shop Service) targets vulnerable groups, such as unemployed, underemployed, young people, as well as enterprises, through services delivered both virtually and face-to-face with the support of national, regional, and local governments. In Mexico, the *Modelo Educación para la Vida y el Trabajo* (The Education for Life and Work Programme) was oriented to offer basic skills training and modular learning for young people and adults, permitting the participants to complete their primary and secondary education according to a modular curriculum.

In the same direction career guidance to adults are being practiced by TVET institutions. In Argentina, *Hacemos Futuro* (We create the future) was used to engage community leaders to mobilise low-skilled and early school leavers to engage in primary and secondary level qualifications. In Peru, in 2020, *El Programa Nacional para la Empleabilidad* (National Employability Programme) was created to support the population in extreme poverty, offering training, comprehensive assistance, certification of competencies and other employment services. In several countries, online guidance portals have also emerged in recent years, for example *La Bolsa Nacional de Empleo* (National Employment Exchange) in Chile, the *Observatorio Laboral* (Labour Observatory) in Mexico or *MiTrabajoFuturo* (*MyFutureWork*) website in Uruguay. Skills development plays a dual role, as a crucial component for boosting productivity and competitiveness for companies and sectors, while also acting to raise social equality and inclusiveness within the framework of industrial policies, especially in a region such as LAC which has demonstrated historically low levels of productivity as well as persistently high social-economic inequality.

In sixth place, **the development of quality assurance systems and skills certification will enable individuals to make skills visible and valuable in the labour market**. This requires building the capacity of providers to implement quality criteria, standardising certain aspects

of training programmes, such as curriculum setting, teachers training and credentials, class sizes and assessment methods. According to OECD (2021), in eight countries of the region (Colombia, Costa Rica, Dominican Republic, Guatemala, Mexico, Nicaragua, Paraguay, Peru) policies were put forward to regulate the quality of teacher training. Some countries have also advanced in establishment of a framework for the certification of informally acquired skills. In Chile, ChileValora is a public service that evaluates, recognizes, and certifies non-formal and informal skills, competencies, and knowledge of individuals according to a nation-wide framework. In Mexico, CONOCER (National Council for Standardisation and Certification of Labour Competences) is a public institution subordinated to the Ministry of Public Education through which individuals can have their skills assessed through a network of service providers. In Brazil, Rede CERTIFIC (National Network for Professional Certification, Initial, and Continued Training) is a programme that aims to formally recognize the knowledge, skills and professional competencies acquired by individuals during their working lives.

Seventh, TVET institutions should improve training methodologies to promote organisational changes and adopt digital solutions in their processes and in their training activities. This trend involves investments and knowledge acquisition in order to promote the design and development of new curricula, training materials, technological innovation, training of trainers and adaptation of learning spaces, among other aspects. One of these changes is in the fast growth of distance training. According to ILO-CINTERFOR (2017), public vocational training institutions reported that they trained more than 4 million participants in 2015 using this form of training. The modular design of training allows for participants to start, leave and restart, especially in cases in which they need to enter the labour market early. Several institutions have also reinforced the programmes using the idea of training "itineraries" or "routes", such as SENAI, and SENAC, in Brazil, and ChileValora, in Chile. with its training routes, are recent examples of this. Some training centres of the National Apprenticeship Service (SENA) in Colombia keep their doors open at night or even 24-hours a day. The Technical Institute of Training and Productivity (INTECAP) of Guatemala offers weekend programmes. In several training sessions in SENAI, participants access practical exercises through interactive online environments under a trainer's guidance. Some examples of augmented reality, simulators and smartphone applications are already available at INA, SENA, SENAC and SENAI, and are being developed in other vocational training institutions in the region.

Eight, education and vocational training policies must go hand in hand with industrial policies. **An inclusive, sustainable, efficient and competitive development trajectory demands the breaking off institutional and policy silos.** In practically all the accounts in this document it was possible to verify the dissociation between these two dimensions of public policies (with punctual exceptions). But their inherent logic and international best

practices clearly demonstrate potential synergies and complementarities between these two policies

Nine, to face up the above-mentioned challenges in a world of rapid changes, TVET institutions must prepare for the future and anticipate the needs for new skills and competencies. Through foresight methodologies and specific and studies. For instance, FUNDAE and SEPE, with CINTERFOR participation, has developed a "preparing-for-the-future" program to develop the attitude of TVET institutions leaders to constantly foresight technologies, workers´ profiles and changing contents of training curricula. Along the same lines and in partnership with CINTERFOR, to update and create professional profiles, curriculum designs and courses, SENAI developed the *Foresight Model for Labour Market*, previously mentioned in the anticipation of skills need exercises for Hydrogen (Chile) and Solar energy (República Dominicana) which aims to identify changes in professional profiles and new professionals that will be demanded according to technological and organizational evolution in the next 5 and 10 years. These foresight exercises permit to modify vocational training programs according to the changes arising in the business, technology, and occupational settings, permitting to identify new socioemotional and technical skills that match occupational requirements in different sectors of the economy. Even though the use of methodologies for identify new skills by vocational training institutions is becoming increasingly widespread, coverage is still in its early stages.

Finally, regional cooperation can potentialize the endeavours of isolated national and international organisations in their quest to foster the capabilities of the labour force. Regional and international organisations such as UNIDO and ILO-CINTERFOR have long established networks with public and private organisations dedicated either to education and vocational training or productive development. Such networks can conform the bases upon which to build up digital-based learning platforms of best practices of an array of public goods such as policy instruments and policy practices.

REFERENCES

ALFONSO, M.; AZUARA, O.; MONDRAGÓN, M. **Green jobs and skills in Latin America**: a look at the Linkedin data. July, 2022. (IDB Technical Note, 2551). Disponível em: https://publications.iadb.org/en/publications/english/viewer/Green-jobs-and-skills-in-Latin-America-A-look-at-the-LinkedIn-data.pdf. Acesso em: 19 ago. 2025.

ALVARADO, I. **Greening TVET in Latin America. Virtual conference synthesis report, UNESCO-UNEVOC TVET Forum, 5 to 11 June 2017.** 2017. Disponível em: https://unesdoc.unesco.org/ark:/48223/pf0000373108. Acesso em: 19 ago. 2025.

AUKTOR, G. V. **Green industrial skills for a sustainable future**. Nov. 2020. Disponível em: https://www.unido.org/sites/default/files/files/2021-02/LKDForum-2020_Green-Skills-for-a-Sustainable-Future.pdf. Acesso em: 19 ago. 2025.

CALZA, E.; LAVOPA, A.; ZAGATO, L. **Advanced digital technologies and industrial resilience during the COVID-19 pandemic**: a firm-level perspective. Vienna, 2021. (Working Paper, 11/2021).

ECLAC. **A digital path for sustainable development in Latin America and the Caribbean**. Santiago, 2022. (LC/CMSI.8/3). Disponível em: https://issuu.com/publicacionescepal/docs/s2200897_en/s/28810893. Acesso em: 19 ago. 2025.

ECLAC. **Datos y hechos sobre la transformación digital, documentos de proyectos.** Santiago: CEPAL, 2021. (LC/TS.2021/20).

FISZBEIN, A., COSENTINO, C.; CUMSILLE, B. **The skills development challenge in latin america**: diagnosing the problems and identifying public policy solutions. Washington: Inter-American Dialogue and Mathematica Policy Research, 2016.

GOMEZ, S. C. **Digital skills:** skills for life. IDB - Inter-American Development Bank

GONTERO, S.; NOVELLA, R. **El futuro del trabajo y los desajustes de habilidades en América Latina.** Santiago: CEPAL, 2021. (Documentos de Proyectos, LC/TS.2021/206).

HANNI, M. **Financing of education and technical and vocational education and training (TVET) in Latin America and the Caribbean**. Santiago: ECLAC, 2019. (Macroeconomics of Development series, 200).

IDB. **Productivity and Human Resources Survey**. Washington, DC: IDB, 2012. (Unpublished).

IDB. **The 360 on Digital Transformation in Firms in Latin America and the Caribbean**. Dec. 2022. Disponível em: https://publications.iadb.org/en/360-digital-transformation-firms-latin-america-and-caribbean. Acesso em: 19 ago. 2025.

ILO. **Greening TVET and skills development**: a practical guidance tool. 2022. Disponível em: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_847095.pdf. Acesso em: 19 ago. 2025.

ILO; IDB. **Jobs in a net-zero emissions future in Latin America and the Caribbean**. 2020. Disponível em: https://www.ilo.org/wcmsp5/groups/public/---americas/---ro-lima/documents/publication/wcms_752069.pdf. Acesso em: 19 ago. 2025.

ILO-CINTERFOR. **The Future of vocational training in Latin America and the Caribbean**: overview and guidelines. Montevideo: ILO/CINTERFOR, 2017.

ILO-CINTERFOR. **Analytical inventory of experiences in the development and implementation of qualifications frameworks in Latin America.** Montevideo: ILO/CINTERFOR, 2020.

ILO-CINTERFOR. Digitalización, productividad y empleo: elementos para pensar la formación profesional en América Latina. **OIT/CINTERFOR NOTAS**, n. 14, Montevideo, Ago. 2022.

INSTITUTE FOR THE INTEGRATION OF LATIN AMERICA AND THE CARIBBEAN – INTAL; INTERAMERICAN DEVELOPMENT BANK - IDB. **Adopción tecnológica y habilidades digitales en Argentina, Brasil, Chile, Colombia y México**. 2023. mimeo.

INTERNATIONAL TELECOMMUNICATION UNION – ITU. **Digital Skills Insights 2020**. Disponível em: https://academy.itu.int/itu-d/projects-activities/research-publications/digital-skills-insights/digital-skills-insights-2020. Acesso em: 19 ago. 2025.

MANPOWER GROUP. **Manpower Group Employment Outlook Survey Q4 2021**. 2021a. Disponível em: https://www.manpowergroup.com/workforce-insights. Acesso em: 19 ago. 2025.

MANPOWER GROUP. **Escasez de talento 2021.** 2021b. Disponível em: https://www.manpowergroup.com.ar/investigaciones/datos-de-capital-humano/escasez-de-talento-2021. Acesso em: 19 ago. 2025.

OECD. **Future-Ready Adult Learning in Latin America Action Plan**. 2021. (https://www.oecd.org/els/emp/skills-and-work/adult-learning/adult-learning-latin-america-2021.pdf). Acesso em: 19 ago. 2025.

OECD. **Latin American economic outlook 2020**: digital transformation for building back better. Paris: OECD Publishing, 2020. Disponível em: https://doi.org/10.1787/e6e864fb-en. Acesso em: 19 ago. 2025.

OECD. **Latin American Economic Outlook 2022**: towards a green and just transition. Paris: OECD Publishing, 2020. https://doi.org/10.1787/3d5554fc-en. Acesso em: 19 ago. 2025.

REN21. **Renewables 2022 Global Status Report:** Latin America factsheet. Paris: REN21 Secretariat, 2022. ISBN 978-3-948393-04-5

ROGERS, H.; HOYOS, R. **Los "ninis" de América Latina**: ni estudian ni trabajan ni son comprendidos. 2016. https://blogs.worldbank.org/es/education/los-ninis-de-am-rica-latina-ni-estudian-ni-trabajan-ni-son-comprendidos-por-halsey-rogers. Acesso em: 12 set. 2023.

SMECK, S.; OVIEDO, M.; FISZBEIN, A. **Dual Education in Latin America**: challenges and opportunities. Jan. 2020. Disponível em: https://thedialogue.org/analysis/dual-education-in-latin-america-challenges-and-opportunities. Acesso em: 19 ago. 2025.

TORRES, B. **Transición justa y empleo verde en América Latina y el Caribe**: 10 años de trabajo de la OIT en la región. 2021. Disponível em: https://www.ilo.org/es/publications/transicion-justa-y-empleo-verde-en-america-latina-y-el-caribe-10-anos-de. Acesso em: 19 ago. 2025.

UNESCO. **Terminology of technical and vocational education**. Paris: UNESCO, 1984.

UNIDO. **Industrial Development Report 2020**: industrializing in the digital age. Vienna: United Nations Industrial Development Organization, 2020.

UNIDO. **Industrial Development Report 2022:** the future of industrialisation in a post-pandemic world. Vienna: United Nations Industrial Development Organization, 2022.

WELLER, J.; GONTERO, S.; CAMPBELL, S. **Cambio Tecnológico y empleo**: una perspectiva latinoamericana: riesgos de la sustitución tecnológica del trabajo humano y desafíos de la generación de nuevos puestos de trabajo. 2019. Disponível em: https://igualdad.cepal.org/es/digital-library/cambio-tecnologico-y-empleo-una-perspectiva-latinoamericana-riesgos-de-la. Acesso em: 19 ago. 2025.

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