

Preparing Gwadar Youth for the CPEC Economy: The Role of Higher and Technical Education: A Systematic Review

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Abstract

The economy of Gwadar and Balochistan is set to undergo a dramatic turnaround with the infrastructure and construction initiatives anticipated to come on board as part of the China-Pakistan Economic Corridor (CPEC). To achieve this potential, youths in all occupational levels, technical and operational, managers and professionals will all need to participate. This study brings together evidence on the relationship between the preparation of youth for employment in the economies of developing countries and the two forms of education: Technical and Vocational Education and Training (TVET) and Higher Education (HE) at university level and extends the implications to Gwadar. Based on a Campbell Collaboration synthesis methodology, the review brings together 30 counterfactual studies, 15 of which are experimental or quasi-experimental studies in low- and middle-income countries (LMICs) at TVET and 15 at university level higher education. Results suggest that there are stream differences in the rates of employment, career trajectories, and occupational transitions. The employment outcomes for the typical TVET programme are typically small, fragmented, and short-lived, unless they are designed to be part of a dual system of vocational training that is linked to the industry. By contrast, university-level interventions create formal, larger, more enduring wage premiums, from 20% to over 35%, especially for engineers, technologists, commercialists and analysts. The result showed that there might be a risk of “over-vocationalization” in the port town of Gwadar, which can result in localizing the jobs in lower end of the value chain while high-value logistics, engineering, and port-management positions could also be outsourced. Integrated TVET upgrading, extension of university facilities and local-employment provisions that are enforceable are necessary for preventing an enclave economy.

Keywords: CPEC, Gwadar, technical and vocational education and training (TVET), higher education, youth employment, Balochistan, systematic review

Introduction

China Pakistan Economic Corridor was launched by China in 2015 under its Belt and Road Initiative to be an example of a large-scale bilateral economic partnership between two countries within South Asia; it has been estimated that there will be over \$62 billion invested on projects

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such as power plants, roads, SEZs, ports etc. Strategic location on the Arabian Sea coast of Balochistan province makes Gwadar an important port city for trade between India and China through its southern anchorage point. The transformation of this place from an old fishing village to a modern-day deep sea transshipment port and industrial free zone has led to hopes of employment opportunities, economic diversification, and regional growth.

Nevertheless, there are some issues that need to be considered when dealing with demographics and education levels. Pakistan's biggest state in terms of size yet least populous is Balochistan where there are still many issues regarding education. The adult literacy rate is around 44%, which is much lower than the national average of 58%; also, rural female literacy rates are less than 15% according to Pakistan Bureau of Statistics. Despite having large amounts of money invested on ports and highways within Gwadar district there is still poor education system due to lack of higher-level colleges for engineers and managers; inadequate vocational schools; and disconnects among teachers from companies that come up after CPEC project implementation.

International development experience provides clear cautionary lessons: capital-intensive infrastructure investments executed in educationally marginalized regions frequently foster enclave economies. Executive positions, engineering jobs, and administrative work in these areas are done by foreign nationals who come from other countries whereas locals have limited opportunities for higher paying job like engineers etc. they can do simple tasks at home without much skill set required. Demographic pressure is high as more than sixty percent of Gwadar's population are less than twenty-five years old who enter the job market each year through obtaining certification for technical skills and higher education relevant to developing trade sectors.

The Interdependent Dual-Track Framework: Higher Education and TVET

An integrated two-way approach to managing human resources is needed for a business development plan within an economic zone. According to UNESCO, TVET is about studying technology, practical skills, and occupational knowledge throughout the vocational continuum such as institutional technical education and firm-based apprenticeships. The TVET is an important part to economic development as it produces trained personnel such as engineers for machinery repair work, automotive mechanics, shipyard workers and civil engineering professionals.

The higher level is an important part to complete it. Advanced analysis degree programs are offered by tertiary colleges for becoming an analyst of data science, a port manager, a logistician engineer, a marine scientist, a software developer to design computers' architecture, and a regulator planner. A technological workforce is not sufficient for an economy to function properly; it requires skilled workers such as vocational technicians that are managed by local supervisors, system designers and administrators of industry operations. On the other hand, college degree holders may have poor job opportunities due to insufficient skilled labor force available for performing tasks at their place of work. To study both higher education and vocational training at once would be useful for understanding human capital development towards CPEC.

The CPEC economy in Gwadar spans multiple sectors with differentiated, two-tiered skill profiles:

- **Port and Logistics:** Operational container handling, marine mechanics, and crane operation (TVET), balance to be achieved through efficient port traffic management, customs brokerage laws compliance, and analysis of a multimodal supply chain network at Higher Education level).
- **Gwadar Free Zone Manufacturing:** Assembly Line Technicians, Quality Control Operators, Electromechanical Repairmen (TVET), Plant Management, Trade Finance, Industrial Engineering Oversight (Higher Education).
- **Civil Construction and Urban Infrastructure:** Surveyor, Heavy Equipment Operator, Certified Welders TVET Balanced With Civil Structural Environmental Engineers Higher Education.
- **Fisheries, Marine Processing, and Maritime Economy:** Fishery Processing and Marine Economics - industrialization of fish products through freezing technology, processing techniques for seafood industry along with aquacultural production practices as well as international standards on food hygiene certification process (Higher Education).
- **Energy, Desalination, and Municipal Utilities:** Power lines technician, turbine operator, and pipe fitter (TVET), electricians, and municipal utilities personnel such as desalination plant managers are employed by higher education institutions (Higher Education).

Higher Education and TVET in Balochistan: Current Realities and Institutional Evolution

Historically, Baluchistan had a slow expansion of its educational system. Since its establishment in 1970, the University of Balochistan at Quetta has been an institution for almost fifty years to be a single public college within this state. Although there are new universities such as Balochistan University of Information Technology, Engineering and Management Sciences (BUITEMS), located at Quetta; Lasbela University of Agriculture, Water and Marine Sciences (LUAWMS), situated at Uthal; and the University of Turbat that have increased accessibility to people living within the Makran region, Gwadar was not a separate institution for many years before now.

In this context, the University of Gwadar (UG) is a crucial institutional transformation. It is originally established as a regional sub-campus of the University of Turbat in 2017 and later upgraded and chartered as an independent and autonomous public university by the University of Gwadar Act, 2021. The university is currently functioning from the main campus in Sarawan Avenue (New Town Phase IV, Gwadar), and is working on building the residential campus in Mouza Shabi, with a 500 acre master-planned layout, using funds from the federal Public Sector Development Programme (PSDP). Academically, UG is an institution that is organized into two main faculties:

Faculty of Management Sciences, Commerce, and Social Sciences: includes Management Sciences, Commerce, Economics, Education, English and the Centre of History and Archaeology.

Faculty of Science, Engineering and Technology (SSET): which includes the departments of Computer Science, Chemistry and Zoology.

To directly address the opportunities in corridors, the university created a dedicated Study Centre for the CPEC and a Centre for Maritime Affairs & Marine Sciences, incentivizing institutional scholarship to be centered around Maritime Economy, Port Management & Regional Trade. In addition, the university has established international academic cooperation, and has signed Memorandums of Understanding (MoUs) with some Chinese universities such as Jiangsu University and Shandong Institute of Commerce and Technology for academic exchange and curriculum development. It also establishes institutional linkages with Pak-China Technical and Vocational Institute (PCTVI) in Gwadar, which helps vocational diploma holders move on to degree courses in the area of engineering and technology.

While important institutional achievements have been made, the University of Gwadar is facing structural challenges typical of institutions in the periphery of developing countries:

- **Terminal Faculty Deficits:** Severe difficulties in attracting and retaining senior doctoral-level faculty in high-demand technical specializations (marine engineering, international maritime logistics, data systems, and environmental science) due to regional living infrastructure deficits.
- **Capital and Operational Fiscal Constraints:** : Frequent power cuts from the national grid, limited availability of freshwater resources, and poor broadband connectivity in Gwadar district, which harms the academic work and high-tech teaching laboratories.
- **Basic Utility Deficits:** Interruption in national grid electrical supply, severe shortage of water resources and unreliable online infrastructure in Gwadar district, which is causing conflict in education and high-tech teaching labs.

At the same time, the vocational training network in Gwadar, established by the recently created PCTVI with the older public vocational training centers, had faced various challenges, such as conducting courses based on supply, having no structured on-the-job training systems, and no formal impact evaluation of vocational training about labour market placement (National Vocational and Technical Training Commission [NAVTTTC], 2022).

Theoretical Perspectives and Political Economy Dynamics

The human capital theory is the basis of the economic rationale for the investment of education and training with the assumption that education and training increase individual productivity, which leads to an increase in individual earnings and to an increase in income growth in the aggregate (Becker, 1964; Schultz, 1961). Under corridor and SEZ conditions, however, the human capital equation is made contingent upon institutional mechanisms. The studies on skills mismatch point to the fact that providing more education than needed, but not adequately linked with the needs of the private sector, creates education-funded unemployment, whereas industries face the problem of a shortage of qualified technical workers (International Labour Organization [ILO], 2020). To do this, Finegold and Soskice (1988) reinforce the need to create a functioning ecosystem for the development of functional skills that involves training providers, universities, private companies and public bodies in institutional, co-construction processes.

The technical dynamics are in play in a delicate political economy of Balochistan. CPEC is a multifaceted geopolitical project driven by Sino-Pakistani bilateral deals, unequal resource

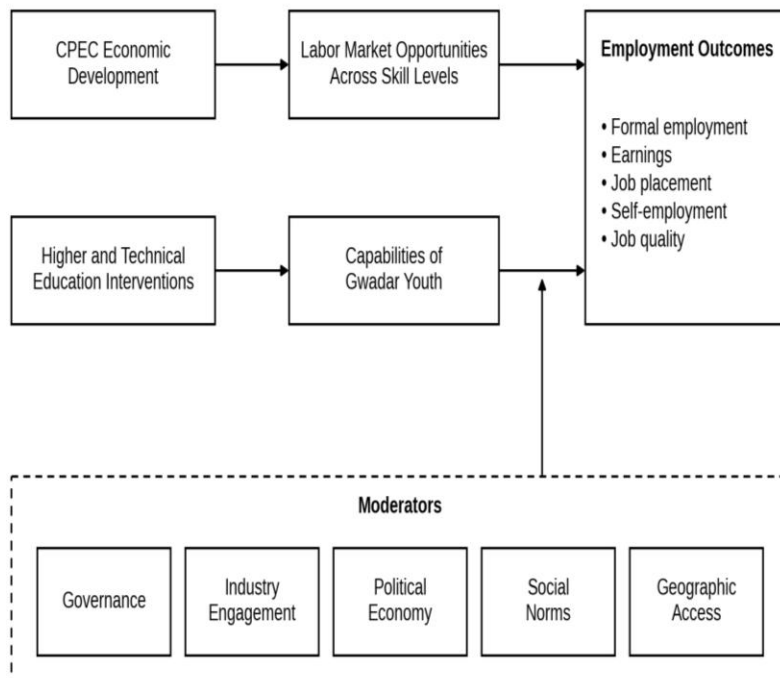
distribution within the country, security issues, and local sociopolitical grievances (Small, 2015; Wolf, 2020). Over the years, local communities have complained about the marginalization of their youth in the informal sector and their lack of opportunities to participate in formal jobs under the employment pipelines of CPEC; they have feared that the projects will attract non-local workers, rather than local ones (Khetran, 2017). These employment distributions could be the result of a genuine shortage of skills in the local labour market, of a bias of employers, or of an absence of effective coordination, but are of critical institutional significance. In addition, limitations on students and trainees' mobility due to security issues may affect young women more than men. Lastly, the statutory local content frameworks and workforce localization requirements of CPEC infrastructure and free zones have never had effective monitoring systems put in place.

Conceptual Model for Gwadar Youth Preparation

Combining these theoretical approaches, Figure 1 shows the conceptual framework for this review. The economic development opportunities created by CPEC create multiple layers of employment possibilities and higher and technical education interventions strengthen capabilities among the youth. Governance structures, industry engagement, political economy dynamics, social norms and geographic access moderate the transformation of these skills into real job outcomes: formal employment, wages, job placement, self-employment and job quality.

Figure 1

Conceptual Model for Preparing Gwadar Youth for the CPEC Economy



Note. Authors' synthesis.

Methods

Protocol and Standards

This review followed the Campbell Collaboration policies and guidelines (Campbell Collaboration, 2019) and adhered to the PRISMA 2020 reporting standard (Page et al., 2021). A review protocol was predetermined.

Eligibility Criteria

Studies were included if they met seven pre-established criteria. The study had to be done in a low- or middle-income country (LMIC), as defined by the World Bank. Second, it needed to be published or reported in the time frame from January 1, 2000 to March 31, 2024. Third, the study needed to address an institutional intervention in post-secondary technical education, vocational education and training (TVET), or university-level higher education, such as credit expansions, merit- or need-based scholarships, degree curricula, or higher technical diplomas, and/or thresholds for university quality. Fourth, the target population had to be young people between 15-35 years. Fifth, the study had to report at least one objective or quantifiable employment outcome, such as employment rates, labor earnings or wages, or self-employment. Sixth, eligible studies had to employ an experimental design, including a randomized controlled trial (RCT), or a rigorous quasi-experimental design (QED) with a well-defined comparison or control group, such as regression discontinuity design (RDD), difference-in-differences (DiD), propensity score matching (PSM), or instrumental variables (IV), with appropriate controls for baseline differences. Single group pre-post designs were not considered due to the lack of an appropriate counterfactual. Last, and not least, there was no language restriction, so that eligible evidence could be accepted with no regard for the language in which the evidence was reported.

Search Strategy and Screening

The electronic databases searched were from January to March 2024, and included EconLit, ERIC, ProQuest Dissertations and Theses, Scopus, Web of Science, JSTOR, IDEAS/RePEc, Google Scholar, HEC Digital Library, and CNKI. Search words intersected three areas: education and training interventions (TVET, higher education, universities, apprenticeships), labour market outcomes (employment, income, wages), and study design (randomized, experiment, quasi-experimental, regression discontinuity and matching). Grey literature was first searched across repositories such as the World Bank, Asian Development Bank (ADB), ILO, Inter-American Development Bank (IDB), Abdul Latif Jameel Poverty Action Lab (J-PAL), International Initiative for Impact Evaluation (3ie) and Pakistan Institute of Development Economics (PIDE).

All titles and abstracts were screened to the eligibility criteria independently by two reviewers. The full text of potentially eligible articles were obtained and independently reviewed. The interrater agreement was fairly high ($\kappa = 0.82$ for screening abstracts and titles; $\kappa = 0.79$ for screening full text). Any disputes were settled by third party mediation.

Data Extraction and Quality Appraisal

The pairs of reviewers used the same instrument for data extraction to include information on metadata, cohort features, econometric identification methods, and outcome estimates, which were done independently. The Cochrane Risk of bias tool (Higgins et al., 2019) was used to assess the quality and risk of bias for randomized trials, and the ROBINS-I tool (Sterne et al., 2016) was used for non-randomized quasi-experiments. The studies that employed RDD were carefully evaluated on the matters of variable manipulation around score thresholds and sensitivity to bandwidth.

Narrative Synthesis and Handling of Overlapping Samples

This review uses a narrative synthesis method with extensive evidence tables (Campbell Collaboration, 2019; Higgins et al., 2019) as this approach is suitable for a substantial amount of heterogeneity across interventions, national labor markets, and econometric specifications, and as these variance parameters are incompletely reported in primary econometric working papers.

A number of analyses included investigated the same public youth training programmes either within different cohorts, waves of programmes or econometric specifications:

The experience in Latin America illustrates the importance of measuring and assessing youth employment and higher-education interventions at various stages and groups of implementers. Alzúa and Brassiolo (2006), Elias et al. (2004), Card et al. (2011), and Ibararán et al. (2014) have evaluated Proyecto Joven in Argentina at various cohorts and sequential phases, respectively, and Juventud y Empleo in the Dominican Republic. In the same vein, PROJOVEN in Peru was assessed in different implementation phases, namely, by Chong and Galdo (2006) and Diaz and Jaramillo (2006). In higher education, evidence from Colombia looks at various university programmes and financial mechanisms such as the studies of Camacho et al. (2017), Londoño-Vélez et al. (2020), MacLeod et al. (2017), Riehl (2020) and Saavedra (2009). Chile's evidence comes from the evaluations of higher education admissions and credit schemes made by Hastings et al. (2013), Kaufmann et al. (2013), Reyes et al. (2016), Solis (2017) and Zimmerman (2014).

This review is a narrative synthesis of evidence, not a meta-analytic statistical pooling of estimates to get a summary effect, so each study is considered independently, without the influence of the statistics on the other studies.

Confidence in each finding was rated by the authors based on the risk-of-bias ratings, consistency of direction of findings across studies, number of studies, and directness to Gwadar using a GRADE-style approach. There were three additional elements added a posteriori: a certainty rating; a sensitivity check, where the comparison was limited to randomized trials and high-quality studies; and a description and review of the non-causal sources in Pakistan (NAVTTTC and TEVTA reports, graduate tracer studies, and CPEC workforce data). Pakistani sources were not assessed for risk of bias and were not used for synthesis due to their high risk of bias.

Results

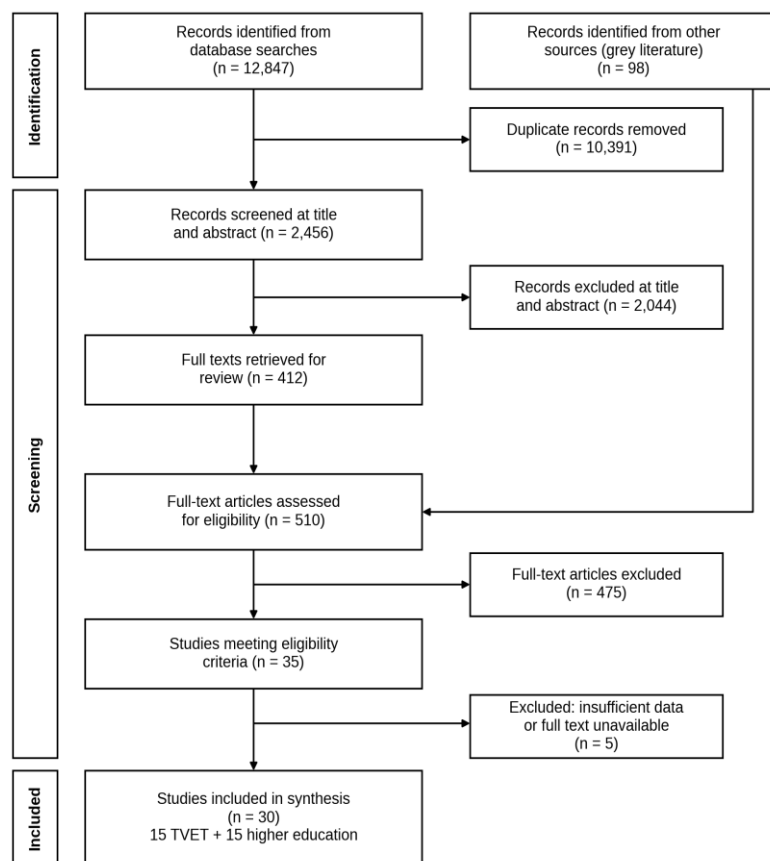
Flow of Literature Reviewed

The search and selection of a study is presented in detail in Figure 2. A total of 12,847 records were found using database searches. Following duplicate removal (10,391), 2,456 were screened on title and abstract, of which 2,044 were rejected and 412 were retrieved for full-text review. 98 records were found in grey literature and other non-database sources and examined directly at full text, resulting in a total of 510 full-text articles to be assessed for eligibility.

After full-text assessment, 475 articles were excluded because they did not fulfill the eligibility criteria. Thirty-five studies were eligible for all requirements. Of these, five studies were excluded as they were either too old to be included or the full text was not available, and 15 studies were excluded because it was not possible to extract outcome or design information, resulting in 30 studies being included in the review, which comprised 15 TVET studies and 15 higher education studies.

Figure 2

PRISMA 2020 Flow Diagram of Study Search and Selection



Note. TVET = technical and vocational education and training. Format follows the PRISMA 2020 flow diagram (Page et al., 2021).

Descriptive Profile of Included Studies

The 30 studies included in the publication dates were published from 2004 to 2023. Eleven of the 30 studies were published after 2015. The 24 studies (9 TVET and 15 Higher Ed) were of quasi-experimental designs, while the 6 studies were randomized experiments (all involving TVET).

Geographically, 20 studies were conducted in Latin America: Chile (6: Aedo & Pizarro, 2004; Hastings et al., 2013; Kaufmann et al., 2013; Reyes et al., 2016; Solis, 2017; Zimmerman, 2014); Colombia (6: Attanasio et al., 2011; Camacho et al., 2017; Londoño-Vélez et al., 2020; MacLeod et al., 2017; Riehl, 2020; Saavedra, 2009); Argentina (3: Almeida & Galasso, 2010; Alzúa & Brassiolo, 2006; Elias et al., 2004); Dominican Republic (2: Card et al., 2011; Ibarrarán et al., 2014); Peru (2: Chong & Galdo, 2006; Díaz & Jaramillo, 2006); and Mexico (1: Canton & Blom, 2010). Four studies were undertaken in East Asia and the Pacific – China (2: Glewwe et al., 2022; Li et al., 2012); Indonesia (1: Newhouse & Suryadarma, 2011); and the Philippines (1: Yamauchi et al., 2023). Two of the studies were conducted in South Asia with one in India (Maitra & Mani, 2017) and one in Nepal (Chakravarty et al., 2019). One was from the Middle East (Groh et al., 2016) and one was from Sub-Saharan Africa (Kenya) (Hicks et al., 2011), with two evaluations being multi-country or cross-regional evaluations: the multi-country LMICs evaluation (Biavaschi et al., 2013); and the BRIC comparative evaluation (Carnoy et al., 2014). No interventions for higher/technical education were found that fulfilled the inclusion criteria for rigorous counterfactual evaluations.

Table 1

Main Intervention Characteristics of Included Studies (N = 30)

Characteristic	<i>n</i>
Type/model of TVET*	
Technical education	2
Vocational education	1
Vocational training programs	10
On-the-job training (firm internships)	7
Apprenticeship / Dual-system training	1
Type of higher education intervention*	
University scholarship / need-merit financial aid programs	2
University student loan / credit expansion programs	3
University degree admission / college quality thresholds	6
University faculty quality / accreditation standards	2
University enrollment cohort expansion policies	2
Key program features*	
Sequential TVET components (two-phase classroom + workplace)	6
Incorporates labor intermediation / placement services	5
Incorporates training specifically for self-employment	2
Incorporates non-TVET life skills / soft skills	4
Degree-granting tertiary academic instruction	15

Note. Categories are not mutually exclusive, that is, multi-component interventions incorporate more than one of the features, and counts in a category may exceed 15 studies in each stream.

Pakistan-Based Descriptive Evidence

None of the evaluations in this subsection were able to fulfill the causal design criteria, thus this evidence is descriptive only. It reports outcomes for trainees or graduates without a valid comparison group, has not been appraised using the risk-of-bias tools and has not been used in the synthesis. It's added to indicate where local data end and to demonstrate the available local data.

The NAVTTC tracer studies of two recent public programmes show that 53% of the trainees were employed after follow-up: 37,440 trainees of the public programme Skills for All (2023) and 51,692 trainees of the public programme Prime Minister's Youth Skill Development Program, Batch-I (2024). Out of the employed trainees, 38% insisted that they are earning more than Rs 50,000 per month; 18% were earning between Rs 31,000 to Rs 50,000 (The Nation, 2026). A World Bank baseline survey of the graduates of TEVTA in Punjab also documents the labour market outcomes of provincial TVET graduates, and was designed as the baseline for an upcoming evaluation (Khan & Blom, n.d.). These statistics suggest that TVET placements in Pakistan are large but do not provide a comparison with an untrained group to isolate program effects from the selection into the program, and they offer no indication of wage growth or occupational mobility over time.

Data on the CPEC workforce are even more sparse. Official press reports state that 7,313 jobs have been completed and 10,425 more are expected in completed and under-implementation CPEC projects in Balochistan (Daily Ittehad, 2026). These counts do not break down by skill level, local residency or Gwadar, so it is not possible to determine whether local youth are promoted to technical or managerial positions. All the Pakistani evidence corroborates the notion that TVET can place the trainees, but it cannot test the central comparison made in this review. This is the reason for using the causal evidence available internationally as a basis for the Gwadar recommendations below and the reason for the emphasis on tracer studies and phased evaluation in Table 3.

Comparative Synthesis: TVET Versus Higher Education

Employment Probability and Formal Job Placement

TVET interventions (n = 15). Most TVET assessments recorded positive point estimates for employment, although with small effect sizes and considerable variation across delivery design. Multi-component programs that incorporated classroom instruction and/or provided subsidized internships in the private sector in the Latin American Jóvenes model enhanced formal employment by 5 to 11 percentage points (Attanasio et al., 2011; Card et al., 2011). The positive placement effects found in the Employment Fund model in Nepal (Chakravarty et al., 2019) and voucher schemes in Kenya (Hicks et al., 2011) are similar. Standalone classroom instruction and short soft-skills trainings, however, did not achieve any employment outcomes without the mediation of the employers. (Groh et al., 2016)

Twelve higher education interventions (n = 12). University-level higher education interventions had large and structurally transformative effects on formal sector employment. In large-scale regression discontinuity and difference-in-differences assessments, tertiary education has been found to have a significant impact on driving youth out of precarious informal work and

into formal work under a contract with established protections (e.g., Camacho et al., 2017; Glewwe et al., 2022; Hastings et al., 2013; Kaufmann et al., 2013; Londoño-Vélez et al., 2020; Solis, 2017). Londoño-Vélez et al. (2020) showed that formal sector employment grows by more than 15 percentage points for Colombian young adults when the government provides merit/need-based financial aid to university enrollment. In Chile, Solis (2017) and Kaufmann et al. (2013) demonstrated that solving college-credit problems helped youth to enter into high retention-rate formal careers. Glewwe et al. (2022) and Li et al. (2012) discovered in China that the occupational transition rates of the college expansion cohorts increased at a higher rate than that of the secondary vocational cohorts into the professional or managerial position in corporate sector. Likewise, across LMICs, Biavaschi et al. (2013) showed that tertiary education significantly lowered the risk of youth experiencing long-term unemployment.

Wage Trajectories and Earnings Returns

TVET interventions (n = 15). Gains in earnings from vocational training were generally small, weak, and were related to industrial match quality. In Argentina, modest gains in wages were found for early youth training, but this effect was found to diminish over time (Alzúa & Brassiolo, 2006; Elias et al., 2004). The only TVET model that yielded significant and sustainable long-term wage premiums was the firm apprenticeship model in India (Maitra & Mani, 2017), and in Peru (Chong & Galdo, 2006; Díaz & Jaramillo, 2006), competitive providers, with three-year training being the most prevalent. In the Philippines, the firm apprenticeship model, with a training duration of three years, had been the most successful in terms of wage premiums and sustainable long-term earnings (Yamauchi et al., 2023); in India, subsidized tailoring training had yielded positive earnings (Maitra & Mani, 2017); and in Peru, competitive providers had produced modest gains (Chong & Galdo, 2006; Díaz & Jaramillo, 2006). The short-duration courses produced only small wage gains and soft-skills interventions did not produce any measurable wage increase (Groh et al., 2016). There was mixed evidence on returns to self-employment training, which depended on baseline assets (Almeida & Galasso, 2010), and, in general, vocational secondary schooling was not always superior to general secondary education (Newhouse & Suryadarma, 2011) with respect to earnings.

Higher education interventions (n = 15). Very high wage premia of 20% and more were found for people with a university degree and for those who attend university on a selective basis. Wage premia of over 35% were found for the university degree and for select university attendance. According to Londoño-Vélez et al. (2020), university graduates enjoyed a formal wage gap of 26% to 36% when they were eight years into their postsecondary education. Hastings et al. (2013) showed that selective university tracks have a large positive earnings premium, with a significant share of returns found in engineering, technology, and management sciences. Saavedra (2009) and MacLeod et al. (2017) have shown that the wage premium for going to a more selective and accredited university faculty is independent of initial student ability and is enduring. Studies by Reyes et al. (2016) and Zimmerman (2014) have shown that the premiums for higher education degrees for upper-tail executive and corporate managerial job positions are largely unavailable through vocational certification. Moreover, research on expansions of credit and loans (Canton & Blom, 2010), and degree completion via cutoff (Riehl, 2020) found that university access leads to sustained upward earnings trajectories, and that, at the BRIC level, value added growth in industry is linked to engineering higher education.

Gender and Security Considerations

Conclusions in this section are limited because the studies included rarely reported on the results broken down by gender. There are two trials of TVET which have a focus on young women, but point in opposite directions. No improvement in employment or earnings (Groh et al., 2016) was found for the soft-skills course offered to female Jordanian youth, while subsidized tailoring training in India increased earnings and employment (Maitra & Mani, 2017). This is consistent with the overall result that non-occupational training that does not involve employers is not effective, but occupational skills training is. None of the included higher education studies focused on the position of women per se, and none looked at mobility or security constraints of the type reported in Balochistan. Thus, there is no evidence that can prove that a university degree gives the same premium to Baloch women as to men. This indicates that, in countries with low female literacy rates (below 15%) in rural areas and limited mobility, infrastructure like campus, safe transportation, hostel facilities and dedicated support could be potential enablers. This is an inference from the context, not a conclusion of the studies included and an area of priority for gender-disaggregated tracer data.

Summary of Findings by Educational Stream

Table 2 places the two streams side by side for the three outcome domains.

Table 2

Summary of Findings by Educational Stream and Outcome

Outcome	Stream	Direction of effect	Studies (n)	Certainty
Employment / self-employment	TVET	Modest positive, heterogeneous; null for standalone soft-skills training	13	Moderate
Employment / self-employment	Higher education	Positive (formal employment)	5	Moderate
Wages / earnings	TVET	Small and often fading; durable only with dual apprenticeships	15	Low
Wages / earnings	Higher education	Large and persistent positive premia (20% to over 35%)	15	High
Occupational mobility	TVET	Not measured directly; one persistent apprenticeship premium	0	Low
Occupational mobility	Higher education	Positive (professional, managerial, and high-technology roles)	4	Low

Note. Study counts follow the outcomes; some studies discussed in the narrative report additional outcomes. Certainty ratings are the authors' GRADE-style judgments (see Certainty of Evidence). TVET = technical and vocational education and training.

Certainty of Evidence

Effects were not pooled so the confidence in each effect was rated with a GRADE-style approach adapted to narrative synthesis. These are the authors' interpretations based on the risk

of bias, direction of effect in studies, number of studies and direction to Gwadar. There is general confidence in the university wage premium: 11 of the 15 higher education studies were of high quality, eight employed regression discontinuity designs, and all found positive, significant effects. Confidence in higher education employment effects is moderate (five studies measured them) and confidence in occupational mobility is low (two studies rated medium, two studies measured it). In TVET, the level of confidence in short-term employment effects is moderate, with six randomized trials, some of which yielded positive results and others null, but all of which were rated as high quality with no concerns in Jordan. It is difficult to rely on TVET wage effects due to the fact that 5 out of 15 studies were rated low/medium, gains tended to be short-lived, and results were inconclusive. Likewise, the impact of TVETs in the long term is not very trusted, as the only long-term impact came from a quasi-experimental study on dual training for apprenticeships (Yamauchi et al., 2023) with medium-level effects. All ratings are for internal validity. All studies were carried out outside of Pakistan, with most of them in Latin America, therefore the ratings shown for the transfer of the study to Gwadar are not as high as they could be, and there was no possibility of assessing publication bias.

Sensitivity of the Conclusion

To see if this university over TVET result is true when inclusion is more limiting – the design labels and quality ratings. There were no studies re-extracted, this was a post hoc check. All six RCTs considered focused on TVET and therefore cannot be compared with each other, as there were no RCTs related to higher education. Of these six, four were positive (Attanasio et al., 2011; Card et al., 2011; Ibarrarán et al., 2014; Maitra & Mani, 2017), while one was mixed (Hicks et al., 2011), and the other null (Groh et al., 2016), yielding a modest but uneven profile of the effect of TVET. Six TVET studies (all RCTs) and 11 higher education studies (eight regression discontinuity, one difference-in-differences, and two other quasi-experimental) remain after restricting to high quality studies. The direction of the higher education advantage does not rely on lower rated education studies, as all 11 higher education studies reported positive, significant effects and so did the 4 medium rated studies. The most positive TVET wage outcome, in contrast, is a medium study rate. The argument of the conclusion is strong but the gap in size is not. The measures of outcomes differ (percentage-point employment gains versus percentage wage premia), and TVET trials recruited disadvantaged youth while the discontinuity studies estimated effects for students near the cutoff points for admission. The findings need to be interpreted as endorsement of a complementary rather than an explicit priority for a dual-track approach to research, and as consistent with the observation above that smaller quasi-experimental studies were more likely to report larger effects than randomized trials.

Discussion

Strategic Implications for Gwadar and CPEC

Based on the empirical synthesis, clear strategic guidance is set up for human capital development in Gwadar in the context of CPEC:

1. **No over-vocationalisation trap.** There is evidence from international experience that technical and vocational education and training is effective in training workers for jobs in operation. A TVET-based human capital development strategy for Gwadar will limit Baloch young people to technician and manual jobs while other higher level jobs such as

executive, logistics management, civil engineering and port administration will be permanently imported.

2. **The strategic imperative for the University of Gwadar.** The high wage premiums found in higher education assessments especially in engineering, commerce and analytical fields (Londoño-Vélez et al., 2020; Hastings et al., 2013) further justify the high investments in the University of Gwadar. The university needs to be supported to develop accredited terminal degrees in maritime logistics, port administration, data systems, marine biotechnology and coastal civil engineering.
3. **Establishing dual-model TVET pipelines.** Job-oriented trades must get rid of the classroom teaching concept at their Vocational Centers in Gwadar (like PCTVI). The classroom component of programs must be accompanied by subsidized internships with the private sector within CPEC enterprises as demonstrated by Attanasio et al. (2011) and Yamauchi et al. (2023).
4. **Enforcing binding local content policies.** If left unattended, human capital investment would not lead to local absorption without local hiring requirements. The regulatory quotas should include that CPEC companies in Gwadar Free Zone and port terminals should employ certified graduates from the local institutions

Costs, Time to Pay off, and Feasibility

Limited evidence of cost included in studies. No unit costs were extracted, and some studies (like the cost benefit analysis of the youth training program in Argentina, Elias et al., 2004) report the cost-effectiveness explicitly. It can thus not be compared as cost per graduate between streams. Yes the evidence does reflect a difference in time to payoff. The duration of the TVET programs was typically 3 to 6 months, but the benefits of these programs could be lost (Alzúa & Brassiolo, 2006; Elias et al., 2004), while the length of the higher education programs was 4 to 5 years and the increase of wages reported by Londoño-Vélez et al. (2020) was measured 8 years after the completion of the program. Gwadar requires a gradual process: TVET can provide operational labour in early phase of the CPEC and the returns from the university can be expected later. Faculty shortages, limited funding and utility deficits are limitations on feasibility. Programmes such as commerce, economics, and computer science, which require relatively less laboratories, can expand earlier, whereas marine and civil engineering have to wait for the Mouza Shabi campus and expert staff. In the studies included, financing models such as merit and need-based aid (Londoño-Vélez et al., 2020) and student loans (Canton & Blom, 2010; Solis, 2017) illustrate how the cost of financing can be distributed amongst students, although this cost to the public purse in Pakistan has not been calculated.

Implications for Practice

The synthesis produced five priority actions with responsible actors that are summarized in Box 1.

Box 1

Priority Actions and Responsible Actors

Actor	Action
Higher Education Commission (HEC)	Provide ring-fenced funding to complete the Mouza Shabi campus and offer retention incentives for doctoral-level faculty, starting with programs that need fewer laboratories.
University of Gwadar, with HEC	Introduce accredited degrees in maritime logistics, port administration, data systems, and coastal civil engineering, and pair them with need-based aid and secure transport and hostel places for women.
NAVTTTC	Rebuild Pak-China Technical and Vocational Institute (PCTVI) courses as dual programs that combine classroom teaching with paid internships in CPEC enterprises, and link them to degree pathways at the University of Gwadar.
Gwadar Development Authority and CPEC employers	Set enforceable, publicly monitored local hiring targets for the Free Zone and port terminals, and provide internship and apprenticeship places for certified local graduates.
NAVTTTC, HEC, and University of Gwadar	Use phased rollout or lottery-based admission to evaluate new intakes, run gender-disaggregated tracer studies, and record cost per graduate.

Methodological Priorities for Future Research

Table 3 translates the methodological limitations identified across the global literature into concrete research priorities for Gwadar and CPEC.

Table 3

Recommendations to Address Research Gaps, With Application to Gwadar and CPEC

Methodological issue	General recommendation	Application to Gwadar and CPEC
Lack of rigorous study designs	Implement randomized controlled trials or rigorous quasi-experimental designs (e.g., difference-in-differences, regression discontinuity).	Pilot upcoming NAVTTTC and University of Gwadar training intakes using phased rollouts or lottery-based admission oversubscriptions to establish experimental counterfactuals.
Absence of corridor-specific higher education evaluations	Evaluate the causal impacts of tertiary degree programs, university merit scholarships, and university-industry incubators in SEZs.	Rigorously track and evaluate labor market outcomes of University of Gwadar graduates relative to matched regional secondary graduates.
Lack of multi-component unbundling	Utilize multi-arm factorial trials to isolate independent contributions of technical skills,	Test whether adding soft-skills modules and placement assistance to standard technical training

Short follow-up horizons	soft skills, stipends, and placement services. Track cohorts beyond 24 to 36 months to evaluate long-term wage trajectories and career progression.	improves CPEC Free Zone hiring rates. Establish longitudinal tracer studies tracking Gwadar graduates across both CPEC construction and operational phases.
Incomplete effect size reporting	Consistently report baseline and endline group means, standard deviations, and exact test statistics.	Require all public and donor-funded skills evaluations in Balochistan to publish complete econometric variance parameters.

Limitations of the Review

There are a number of restrictions to be noted. First, the review is based on 30 robust causal studies, none of which were conducted in Pakistan or corridor economies, and thus extrapolations were based on the international literature. Second, there was econometric heterogeneity and reporting of incomplete variance data, which hindered formal pooling with a meta-analysis. Third, evaluations are strongly skewed towards Latin America with a smaller number from South Asia and Sub-Saharan Africa. Lastly, since there was no pooling of effects, it was not possible to formally assess the possibility for publication bias and it is possible that it occurred; smaller quasi-experimental studies tended to report larger positive effects than the larger scale randomized trials, but no formal test was conducted.

Furthermore, the certainty ratings are the authors' opinion and not a formal GRADE assessment and the sensitivity check was a post hoc analysis. The Pakistani evidence in this review has been descriptive, and has not been assessed for risk of bias, partly as a result of press reports on official data. The unit cost data was not extracted and so cost-effectiveness could not be compared between streams.

Conclusions

To equip the youth of Gwadar with the skills and knowledge needed for the economic opportunities provided by CPEC, proactive educational strategy with evidence-based approach is required. The global evidence clearly shows that TVE can enhance the employment and earning outcomes of youth – when TVE is integrated, aligned with employer demand and combined with structured workplace exposure. But vocational education is not enough to enable the upper-level executive and engineering and administrative requirements of a modern corridor economy. Federal and provincial government should invest substantially in modernizing higher and technical education facilities in Gwadar, implement local recruitment policies and integrate strict counterfactual assessment in the new human capital development projects so as to prevent formation of enclave economy in the city.

Declarations

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