



# Assessment of Training Delivery Practices and Quality Constraints in TVET Institutions: Evidence from North Shewa Zone, Ethiopia

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## Abstract

This study aimed to explore issues and practices related to quality training delivery in North Shewa Zone TVET colleges. A mixed-method research design was utilized. A questionnaire, semi-structured interviews, and document analysis were incorporated. Out of 296 questionnaires distributed, 285 valid responses were obtained (response rate = 96.3%), 171 trainees, 66 trainers, 36 staff, and 12 management personnel. Data were analyzed by using descriptive statistics and thematic analysis. The study revealed a significant gap between CBT's formal adoption and its practical implementation. Training delivery remains predominantly theory-oriented, with minimal real-world work application constraining development in competency. The study found challenges, including insufficient infrastructure, limited access to training equipment, weak industry linkages, insufficient professional development for trainers, and low institutional governance engagement. The study further identifies a substantial digital learning gap, characterized by weak ICT infrastructure and minimal integration of digital learning systems. The study suggests enhancing infrastructure, strong industry collaboration, continuous professional development, and expanded digital technology integration. The study also reiterates the need for stakeholder involvement and internal quality assurance mechanisms to support sustainable and effective quality-driven implementation of competency-based training in TVET colleges.

## Subject Areas

Mechanical Engineering, Pedagogy

## Keywords

Competency-Based Training, TVET, Quality of Training, Institutional

## 1. Introduction

Technical and Vocational Education Training (TVET) has been increasingly recognized as the strategic mechanism for developing workforce competencies, supporting industrial transformation, and promoting sustainable development. By emphasizing “learning by doing,” TVET facilitates alignment between training outputs and evolving labour market demands. In the context of rapid technological change, TVET systems are expected to generate relevant and adaptable competencies, support school-to-work transitions, and improve workforce productivity, thereby contributing to broader economic development [1]. The effectiveness of TVET systems can be understood through the integration of Human Capital Theory, competency-based training (CBT), and Institutional Theory. While Human Capital Theory suggests the investment in skills enhances productivity and economic growth, empirical evidence specifies that such returns depend on the quality, relevance, and labour market alignment of training provision. This suggests that the effectiveness of skills formation is not solely determined by investment levels, but by the extent to which training systems are institutionally embedded and responsive to labour market dynamics [2].

Competency-based training (CBT) frameworks emphasize that effective competency acquisition requires coherence among curriculum design, instructional delivery, and assessment systems to ensure that competencies reflect actual workplace performance [3]. From an institutional theory perspective, formal adoption of policies alone does not guarantee the effective implementation, as organizational practices are often constrained by resource limitations, structural rigidities, and governance inefficiencies. This policy practice gap reflects the variations in institutional capacity, coordination mechanisms, and administrative effectiveness in TVET systems [4]. The empirical evidence consistently identifies training delivery quality as a multidimensional construct encompassing curriculum relevance, infrastructural adequacy, trainer competence, industry linkage, and institutional support mechanisms. Deficiencies in these dimensions constrain practical training opportunities, weaken competency acquisition, and reduce the responsiveness of TVET systems to labour market demands [5].

In Ethiopia, TVET has been placed as the main component of national development program strategies aimed at accelerating industrialization, addressing youth unemployment, and enhancing workforce productivity. This policy commitment is reflected in the adoption of a competency-based training system under the National TVET Strategy [6] [7].

These efforts were further reinforced by subsequent reforms implemented in the Education Sector Development Program (ESDP). This reform process is further supported and justified by the recent sectoral analysis highlighting continued

emphasis on skills development and system strengthening within Ethiopia's education and training framework [7] [8]. Despite these efforts, a considerable amount of empirical and policy-oriented literature highlights persistent implementation challenges, including inadequate infrastructure, obsolete equipment, weak industry collaboration, lack of digital skills, and limited professional development opportunities for trainers [9].

Existing studies on the Ethiopian TVET system have largely focused on macro-level reforms and system expansion, with limited attention to institutional practices and training delivery processes. Consequently, the operational determinants of training quality, particularly those related to curriculum implementation, resource capacity, human development, stakeholder engagement, and governance effectiveness, remain insufficiently explored [10].

Accordingly, this study adopts a descriptive, theory-driven approach to examine training delivery and quality challenges in public TVET colleges in North Shewa, Ethiopia, identifying key gaps and informing improvements in quality and alignment with labour market needs.

### **1.1. Statement of the Problem**

In Ethiopia, increasing youth unemployment and rapid population growth have heightened the need for market-relevant skills, leading to Technical and Vocational Education and Training (TVET) becoming a key instrument for workforce development. However, the efficiency of TVET is still constrained despite the adoption of the competency-based training (CBT). Persistent institutional challenges, such as inadequate infrastructure, obsolete equipment, weak industry partnerships, and limited continuous professional development, led to low-quality practical training, resulting in skill mismatches [11]. This indicates a systemic mismatch between policy intentions and implementation. While Human Capital Theory emphasizes the skill relevance for productivity, and CBT frameworks require coherence among curriculum, instruction, and assessment, such integration remains weak in the Ethiopian context [12].

Moreover, existing studies largely emphasize macro-level reforms, with limited empirical attention to the institutional operational level [13]. Therefore, this study analyzes institutional and instructional factors affecting training delivery in public TVET colleges in the North Shewa Zone, identifying key gaps and proposing improvements for quality and labour market alignment.

### **1.2. Research Questions**

- 1) What are the dominant training delivery practices implemented in public TVET colleges in the North Shewa Zone?
- 2) What institutional and instructional factors affect quality training delivery?
- 3) Which strategic interventions are required to strengthen training quality in TVET institutions?

### 1.3. Research Objectives

#### *General Objective:*

To assess training delivery practices and identify the institutional and instructional factors affecting training quality in public TVET colleges in the North Shewa Zone, Ethiopia.

#### *Specific Objectives:*

- 1) To assess training delivery practices in TVET institutions in the study area.
- 2) To examine institutional and instructional factors affecting training quality.
- 3) To identify priority strategies for improving training quality.

## 2. Methodology

### 2.1. Research Design and Approach

A mixed-methods descriptive survey research design was employed to examine training delivery practices and challenges affecting the quality of TVE training in the North Shewa Zone. The study used both quantitative and qualitative approaches to provide a comprehensive analysis of institutional conditions, training processes, and contextual factors influencing training quality. The implementation of a mixed-methods approach is particularly appropriate for capturing the complexity of institutional dynamics through the convergence of numerical data and in-depth qualitative insights [14] [15].

### 2.2. Population and Sampling Techniques

The population of the study comprises 1,132 individuals, including trainees (695), trainers (254), administrative staff (138), and management personnel (45). The sample size ( $n = 296$ ) was determined using a finite population correction approach at a 95% confidence level and a 5% margin of error (see Section 2.3).

A multi-stage sampling technique was employed. First, five TVET colleges, Debre Birhan Polytechnic College, Almaz Boehm Polytechnic College, Mehal Meda Polytechnic College, Meragna TVET College, and Lemi TVET College were purposively selected based on predefined criteria: institutional maturity, enrollment size, program diversity, level of competency-based training (CBT) implementation, and proximity to major industrial hubs. These criteria were used to ensure the inclusion of institutions with varied operational capacities and differing levels of industry exposure.

Second, populations were stratified into four groups (trainees, trainers, administrative staff, and management), followed by proportionate simple random sampling within each stratum to make sure representativeness. Management participants ( $n = 12$ ) were contained within the survey. Among these, five management participants were selected through purposive sampling into semi-structured interviews due to their roles in the leadership position and experience to provide in-depth qualitative insights. Department heads joined focus group discussions (FGDs) to help validate results through data triangulation and enrich contextual understanding. Although purposive sampling selection allowed for the inclusion

of information-rich and contextually diverse cases, it may limit statistical generalizability; therefore, the findings are interpreted in terms of analytical transferability to similar TVET institutional contexts.

### 2.3. Sample Size Determination

Sample size was determined using the finite population correction (FPC) formula [16].

$$n = \frac{N}{1 + N(e)^2} \tag{1}$$

Where:

$N = 1,132$  (total population)

$n$  = required sample size

$e = 0.05$  (5% margin of error) at a 95% confidence level. Substituting these values:

$$n = \frac{1,132}{1 + 1,132(0.05^2)} = 296$$

To ensure proportional representation across strata, proportional allocation was applied:

$$n_k = \left(\frac{n}{N}\right) \times N_k \tag{2}$$

Where:

$n_k$  = sample size for stratum  $k$

$N_k$  = population size of stratum  $k$

$N = 1,132$  (total population)

$n = 296$  (total sample size)

This approach preserves population structure, minimizes sampling bias, and supports valid subgroup inference (See **Table 1**).

**Table 1.** Sample distribution of respondents ( $N = 1,132$ ;  $n = 296$ ).

Stratum $k$	Population size ( $N_k$ )	Sample size ( $n_k$ )	Sample proportion (%)
Trainees	695	182	61.5%
Trainers	254	66	22.3%
Administrative staff	138	36	12.2%
Management personnel	45	12	4.0%
<b>Total</b>	<b>1,132</b>	<b>296</b>	<b>100%</b>

### 2.4. Data Collection Instrument

Data were collected using a structured questionnaire based on training quality and competency-based training (CBT) frameworks. Instrument targeted trainees,

trainers, management, and administrative staff, comprising two sections: demographics and a 30-item five-point Likert scale. Items were developed using a construct-driven approach covering curriculum relevance, trainer development, infrastructure adequacy, industry linkages, and institutional support mechanisms. Qualitative data were obtained through open-ended items, semi-structured interviews, and focus group discussions (FGDs), supplemented by document analysis and policy frameworks.

## 2.5. Reliability and Validity of the Research Instrument

### 2.5.1. Reliability

To determine the clarity and internal reliability of the questionnaire, a pilot test was performed on 20 participants. Cronbach's alpha was used to determine reliability, yielding  $\alpha = 0.823$ . This value was within an acceptable range for internal consistency of the 30-item scale, which shows a reliable instrument in data collection [17]. Due to the exploratory nature of this study and the relatively small number of participants in the pilot sample ( $n = 20$ ), construct-level reliability coefficients (e.g., Cronbach's alpha for curriculum relevance, infrastructure, trainer competency, industry linkage, and institutional support) were not computed.

As noted by [18], Reliability estimates for sub-scales are sensitive to both the number of items and sample size, and may produce unstable results when based on small samples. In addition, general methodological guidance suggests that small sample sizes (e.g., below 50) provide weak support for stable statistical estimation [19]. Given that the pilot sample comprised only 20 participants, construct-level reliability analysis was not considered appropriate. Therefore, only the overall scale reliability is reported in this study (See [Table 2](#)).

**Table 2.** Reliability analysis of the measurement scale (Pilot test,  $N = 20$ ).

Cronbach's alpha ( $\alpha$ )	Number of items	Interpretation
0.823	30	High internal consistency; reliable scale

Note: Construct-level reliabilities were not computed due to the limited pilot sample size ( $n = 20$ ). Future research with larger pilot samples should examine construct-level reliability.

### 2.5.2. Validity of the Research Instrument

Content validity was established by the expert evaluation of item relevance, clarity, and representativeness. Construct validity was ensured by grounding the instrument in Human Capital Theory and CBT frameworks, with the measurement constructs aligned to recognized TVET standards. The Face validity was confirmed by the pilot testing to assess clarity and interpretability. In addition, inter-item correlation analysis provided evidence of internal consistency and convergent validity, strengthening the overall validity of the instrument [20].

## 2.6. Response Rate

Of the 296 questionnaires distributed, 285 valid responses were received (response

rate: 96.3%), meaning a dominant participation and low non-response bias in the study:

$$\text{Response Rate (\%)} = \frac{\text{Number of Returned Questionnaires}}{\text{Number of Distributed Questionnaires}} \times 100 = \frac{285}{296} \times 100 = 96.3\% \quad (3)$$

## 2.7. Data Analysis Methods

For quantitative data analysis, descriptive statistics (frequencies, means, and standard deviations) were applied using SPSS (Version 2024) with variability measures to assess response dispersion. Qualitative data were audio-recorded, transcribed, and analyzed through a rigorous thematic analysis approach. A combination of deductive and inductive coding approaches was utilized to develop themes through iterative refinement. The integration of quantitative and qualitative findings was conducted at the interpretation stage using a triangulation approach.

The results from quantitative data were first analyzed to identify critical patterns associated with the training quality, resource availability, and trainee outcomes. These findings were then compared with qualitative evidence from interviews, focus group discussions, and document analysis to explain underlying reasons and situational context. Convergent findings were used to strengthen the validity of results, while divergent findings, such as the mismatch between reported training engagement and low job readiness, were further interpreted using qualitative insights.

## 2.8. Measurement and Scaling of Variables

Responses were obtained from five-point Likert scales. Depending on the item, scales ranged from 1 = strongly disagree/very low to 5 = strongly agree/very high, depending on the item context. Mean values were calculated to summarize response tendencies. While standard deviations were employed to assess response variability. The Higher standard deviations indicate a greater difference in responses, reflecting uneven institutional conditions.

## 2.9. Operational Definitions of Variables

The main constructs in this study were operationalized using specific questionnaire items based on CBT and training quality frameworks to assess practices and notify quality improvement. *Curriculum relevance* refers to alignment of training content with occupational standards and labour market demands (Q1 - Q6). *Infrastructural adequacy* represents the availability and functionality of workshops, tools, and equipment for practical training (Q7 - Q12).

*Trainer competence* represents technical, pedagogical, and industry-related expertise of trainers (Q13 - Q18). *Industry linkage* refers to the extent of collaboration between TVET institutions and industry, including workplace learning and stakeholder engagement (Q19 - Q24).

*Institutional support mechanisms* encompass administrative capacity, resource

allocation, and policy implementation (Q25 - Q30).

### 2.10. Qualitative Procedure

Semi-structured interviews ( $N = 5$ ) were conducted with purposively selected TVET management staff (deans) based on their leadership roles and experience. In addition, a focus group discussion (FGD) consisting of seven department heads from selected institutions was conducted to capture shared perspectives on training quality. Each interview lasted approximately 35 - 60 minutes. Relevant institutional documents, training curricula, competency standards, assessment guidelines, institutional performance reports, and TVET policy and strategy were also reviewed to support data triangulation.

Data analysis followed a systematic thematic analysis procedure. First, audio recordings of the interviews and FGD discussions were transcribed verbatim. Second, initial codes were generated through open coding by identifying meaningful units related to training practices and challenges. Third, the codes were grouped into categories of themes using a combination of deductive (theory-driven, based on CBT and training quality frameworks) and inductive (data-driven) approaches.

Finally, themes were developed through iterative refinement and cross-validation with quantitative findings to ensure consistency and analytical rigor.

### 2.11. Ethical Consideration

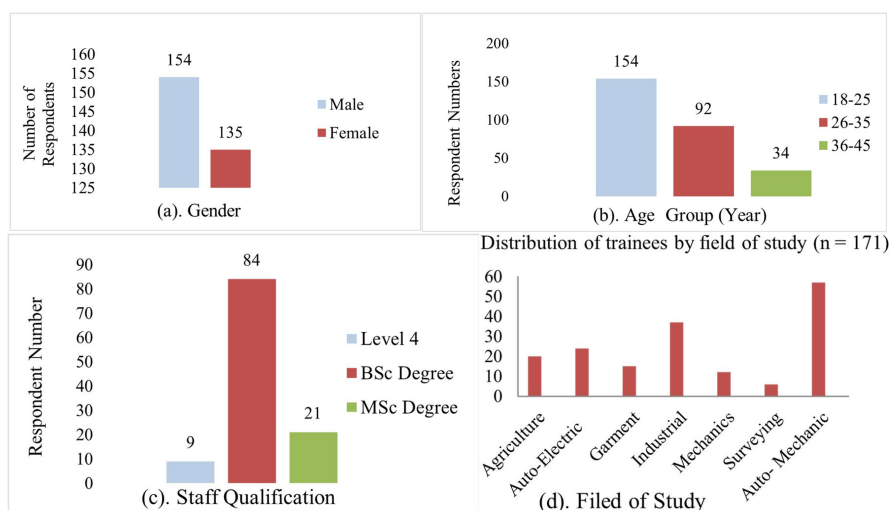
This study was conducted based on official permission obtained from the participating TVET colleges before data collection. The study was based on voluntary participation and informed consent from all the participants. Respondents were assured confidentiality of their information, and it would only be used for academic research purposes. Personal identifiers have been removed for anonymity.

## 3. Major Findings

This chapter presents the key findings on training delivery methods and quality-related constraints in TVET institutions within the study area. Following an initial profile of respondent demographics and institutional characteristics, which establishes the contextual groundwork, the chapter proceeds to analyze and interpret the core findings on training delivery and quality constraints, integrating descriptive statistics and variability measures with qualitative evidence to support interpretation and triangulation.

### 3.1. Demographic Characteristics of Respondents

Out of 285 valid responses, 171 (60.0%) were trainees and 114 (40.0%) were staff, including trainers, management, and administrative members. Regarding gender, 150 (52.6%) were male, and 135 (47.4%) were female, showing a relatively balanced composition of gender and age distribution. **Figure 1** displays the demographic analysis.



**Figure 1.** Respondents demography ((a)-(d)).

Generally, the demographic characteristics show that the sample was sufficiently diverse, experienced, and representative, providing a reliable foundation for examining training delivery practices and challenges in public TVET colleges in the North Shewa Zone.

### 3.2. Assessment of Training Delivery Methods in TVET Colleges

These sections of the data analysis focused on the independent variables (instructional practices, curriculum revision, industry linkages, resource capacity, and assessment systems) that affect training delivery methods in the study area. Therefore, the researcher tried to organize, present, analyze, and interpret quantitative and qualitative data as follows. Evidence from **Table 3** and Clustered bar chart **Figure 2**, triangulated with qualitative data, revealed the structure, coherence, and degree of integration of training delivery practices.

**Table 3.** Assessment of training delivery practices in TVET colleges ( $N = 285$ ).

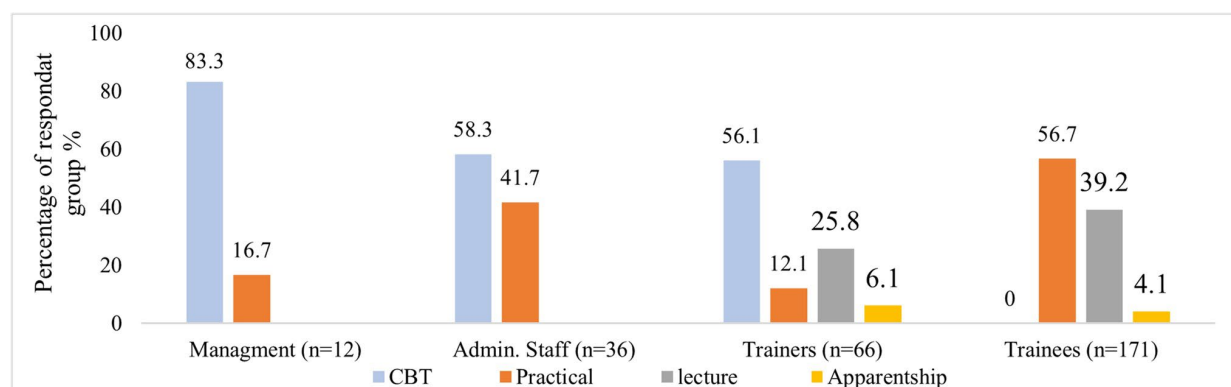
Items/dimension	Key empirical evidence (%)	Issues	Interpretations
<b>Instructional practice</b>	<i>CBT</i> : 0.0 ( <i>trainees</i> ), 56.1 ( <i>trainers</i> ), 83.3 ( <i>management</i> ), 58.3 ( <i>admin</i> ); <i>Practical</i> : 56.7 ( <i>trainees</i> ), 12.1 ( <i>trainers</i> ), 41.7 ( <i>admin</i> ), 16.7 ( <i>management</i> ); <i>Lecture</i> : 39.2 ( <i>trainees</i> ), 25.8 ( <i>trainers</i> ); <i>Apprenticeship</i> : 4.1 ( <i>trainees</i> ), 6.1 ( <i>trainers</i> ); <i>Digital</i> : 0.0 ( <i>all respondents</i> )	Policy-practice mismatch	Inconsistent implementation of CBT
<b>Curriculum revision</b>	<i>Revision every year</i> : 0.0 ( <i>all respondent group</i> ); <i>Every two to three years</i> : 64.9 ( <i>trainees</i> ), 11.1 ( <i>admin staff</i> ); <i>Rarely revised</i> : 80.3 ( <i>trainers</i> ), 91.7 ( <i>management</i> ), 61.1 ( <i>admin staff</i> ), 31.6 ( <i>trainees</i> )	Weak curriculum revision	Outdated curriculum limits responsiveness to labour market requirements
<b>Industry linkage</b>	<i>Strong linkage</i> : 16.5; <i>Moderate linkage</i> : 45.6; <i>Weak linkage</i> : 22.8; <i>No linkage</i> : 15.1	Weak collaboration	Limited work-based learning

Continued

<b>Training quality execution (staff perspectives)</b>	<i>Strongly disagree/disagree:</i> 66.5 (trainers), 53.5 (management); <i>I don't know:</i> 20.8 (management), 12.5 (trainers); <i>Agree/strongly agree:</i> 21.0 (trainers), 25.5 (management)	Low institutional confidence	Weak implementation
<b>Involvement in practical training</b>	<i>High/very high:</i> 62.2 <i>Moderate:</i> 33.8 <i>Low:</i> 4.0	Trainee perception inconsistency	Limited practical exposure hinders competency gain
<b>Resource capacity</b>	<i>Adequate training resources:</i> 31.6; <i>Standard machinery and tools:</i> 27.7; <i>Well-organized workshops:</i> 18.9; <i>Digital learning facilities:</i> 9.8; <i>None of the above:</i> 11.9	Infrastructure constraints	Resource constraints limit effective training delivery
<b>Evaluation system efficiency</b>	<i>Highly effective:</i> 2.5; <i>Moderately effective:</i> 15.8; <i>Improvement required:</i> 67.4; <i>Not effective:</i> 14.4	Weak CBT assessment	Assessment systems fail to measure competencies

Note: Percentages for instructional practices do not sum to 100%, as respondents were allowed to select multiple training methods. This reflects the combined use of instructional approaches across institutions.

Findings presented in **Table 3** and **Figure 2** revealed a pronounced policy-practice gap in instructional delivery practice. Competency-based training (CBT) was reported by trainers (56.1%) and managers (83.3%); but was reported absent at the trainee level (0%), indicating largely symbolic implementation. In actual training practice, trainees reported greater reliance on hands-on training delivery (56.7%) alongside substantial use of lecture-based training practice (39.2%), reflecting a hybrid but inconsistently applied instructional model. Apprenticeship or cooperative training remains marginal ( $\leq 6.1\%$ ), and digital learning was entirely absent (0%), highlighting limited adoption of work-based and technology-supported approaches.



**Note.** Values represent the percentage of each respondent group identifying the method as dominant in their institution. Digital/e-learning = 0.0% across all groups. Rows may not sum to 100% where respondents reported no single dominant method.

**Figure 2.** Dominant instructional method reported by each stakeholder group: evidence of policy-practice decoupling in CBT implementation ( $n = 285$ ).

Qualitative evidence supports the observed variation in instructional practices,

highlighting weaknesses in instructional development and resource availability. As noted, “*there are no systematic preparations made by the trainers to deliver quality training; some prepare only based on their competency level*” (Dean/Management Interview), while “*trainees lose interest when training is delivered without sufficient tools and clear instructions*” (Department Heads, FGD). These findings indicate a pronounced misalignment in instructional delivery and implementation capacity. Further evidence underscores structural constraints, as “*shortages of machines, inadequate training materials, and skill gaps among trainers*” limit effective practical training (Dean /Management Interview). Similarly, participants noted that “*trainers rely on traditional methods due to limited access to updated training and lack of motivation,*” and that “*differences in trainers’ backgrounds and experience levels create inconsistency in training delivery*” (Department Heads, FGD). This reflects the persistence of resource-driven and capacity-related constraints shaping instructional practices. Observation findings further corroborate the issues, revealing limited availability of training materials, such as machines and books. In some departments, equipment is shared among large groups of trainees, resulting in low practical training engagement. These conditions reinforce the dominance of passive, lecture-based approaches over competency-based training methods.

Consistent with the preceding findings on instructional misalignment, **Table 3** further reveals significant weaknesses in curriculum revision practices. No respondent group stated that curriculum revision was done every year (0%), which shows a lack of an adequate review process. Whereas trainees noted moderate revision cycles (64.9%), trainers (80.3%), and management (91.7%) indicated that curricula are rarely updated, reflecting substantial disparity and weak institutional coordination. These patterns suggest ineffective governance and limited institutionalization of curriculum review processes.

This inconsistency is reinforced by qualitative evidence, as noted: “*the curriculum is aligned with international standards, but lack of training materials undermines its implementation*” (Dean/Management Interview), demonstrating a gap between formal curriculum design and actual operational apprehension. Furthermore, variations in trainer preparation, particularly reliance on outdated curricula, create inconsistencies in delivery. Structural constraints, including machines, training materials, and technological resources, further restrict effective implementation and responsiveness to labour market demands.

Similarly, focus group discussions revealed that curriculum effectiveness is influenced by both resource limitations and instructional dynamics, as “*trainees lose interest when training lacks sufficient equipment and clear practical instruction*” (Department Heads, FGD). Limited professional development further constrains trainers’ ability to update their knowledge in line with technological change. This indicates that curriculum relevance is not only a design issue but also an implementation and capacity challenge.

Weak industry linkages are the main barrier to delivering quality training. Alt-

though only 16.5% of respondents reported a strong linkage compared to 22.8% weak and 15.1% no linkage at all, despite 45.6% indicating moderate cooperation. This pattern suggests that existing partnerships are largely superficial rather than functionally embedded. Qualitative evidence supports this interpretation, as “*departments are not yet actively creating linkages with companies and organizations*” (Department Heads, FGD), reflecting limited institutional commitment to sustained linkage. Consequently, opportunities for workplace learning and effective feedback mechanisms for curriculum alignment remain constrained.

Furthermore, observational findings indicate that instructional practices are shaped more by resource limitations than by cooperative training principles, as group work was used as a compensatory strategy due to limited equipment. Overall, the predominance of moderate and weak linkages, combined with minimal strong partnerships, indicates that structured apprenticeship and cooperative training systems are underdeveloped. This restricts trainees’ exposure to real work environments and undermines the practical effectiveness of competency-based TVET delivery.

Following the weak industry partnership identified in the preceding analysis, staff opinions also show a lack of faith in the use of high-quality training. A majority of respondents, 66.5% of trainers and 53.5% of management, expressed disagreement with quality training, while only a limited proportion indicated a positive response (21.0% and 25.5%, respectively). In addition, a notable share of respondents reported uncertainty (20.8% of management; 12.5% of trainers), suggesting an inconsistent understanding of quality training standards. This pattern reflects not only weak implementation capacity but also the absence of a shared institutional framework for ensuring and evaluating quality training delivery.

Trainee viewpoint indicates generally a relatively positive response in relation to practical training exposure given by the trainer, with 62.2% reporting high or very high, compared to 33.8% moderate, and only 4.0% low. This divergence highlights a mismatch between perceived practical training involvement and actual training effectiveness. However, qualitative evidence tempers this positive perception, as “*trainees lose interest when training is delivered without sufficient equipment and clear practical guidance*” (Department Heads, FGD), indicating that practical training is conditional on resource availability and instructional quality. This suggests that reported practical training engagement does not necessarily reflect meaningful or sustained competency development.

Building on the preceding on the trainee practical training involvement outcome gap, resource capacity, and training evaluation systems emerge as critical structural constraints on training quality. While 31.6% of respondents reported access to adequate training resources and 27.7% point out access to standard tools and equipment, key resources remain limited, particularly digital learning facilities (9.8%) and sufficiently equipped workshops (18.9%), with 11.9% indicating a complete absence of essential resources. This reflects uneven and insufficient in-

frastructure for effective competency-based training. Qualitative evidence reinforces this constraint, as “*there are shortages of machines and training materials that hinder effective training delivery*” (Dean/Management Interview), highlighting systemic limitations in resource provision.

Similarly, trainee evaluation exhibits significant weaknesses in competency validation. Only 2.5% rated them as highly effective, while the majority indicated a need for enhancement (67.4%) or considered them ineffective (14.4%). Qualitative findings further reveal that “*evaluation systems are not yet well organized and should integrate trainees, trainers, market demand, and curriculum responsiveness*” (Department Heads, FGD).

Entirely, the findings point out the dominance of passive, lecture-based methods, a structurally constrained TVET system, where inadequate resources and weak assessment mechanisms reinforce broader institutional misalignments, ultimately undermining training quality and labour market responsiveness.

### 3.3. Major Constraints Affecting Quality Training Delivery in TVET Colleges

This section analyzes the key constraints on quality training delivery practice in the study area, emphasizing how material conditions, institutional capacity, and governance structures jointly shape training effectiveness and labour market alignment. The findings, summarized in **Table 4** and a clustered bar chart with error bar **Figure 3**, triangulated with interview, FGD, and observational evidence.

**Table 4.** Resource & infrastructure constraints affecting quality training delivery practice ( $N = 285$ ).

Framework	System	Items/dimension	Key empirical evidence	Variability	Analytical interpretation
Human capital theory	Input	Alignment of workshop with competency standards	Management: $M = 2.75$ , $SD = 1.29$ , $S^2 = 1.13$ ; Trainers: $M = 2.65$ , $SD = 1.92$ , $S^2 = 1.13$	High ( $SD$ up to 1.92)	Infrastructure constraints affect competency formation
		Availability of supply/raw materials	Management: $M = 2.42$ , $SD = 0.99$ , $S^2 = 0.99$ ; Trainers: $M = 2.58$ , $SD = 1.29$ , $S^2 = 1.13$	Moderate	Inconsistent material quantity disrupts the continuity of practical training
		Accessibility of machine/equipment, and hand tools	Management: $M = 3.92$ , $S = 0.99$ , $S^2 = 0.99$ ; Trainers: $M = 3.00$ , $SD = 1.23$ ; 74.2% report limitation, $S^2 = 1.1$	High variability ( $SD = 1.23$ )	Inequitably accessed resources
	Output	Training outcomes satisfaction	76.1% dissatisfied; 75.1% not job-ready	High divergence	Training delivery fails to produce labor market-ready competencies

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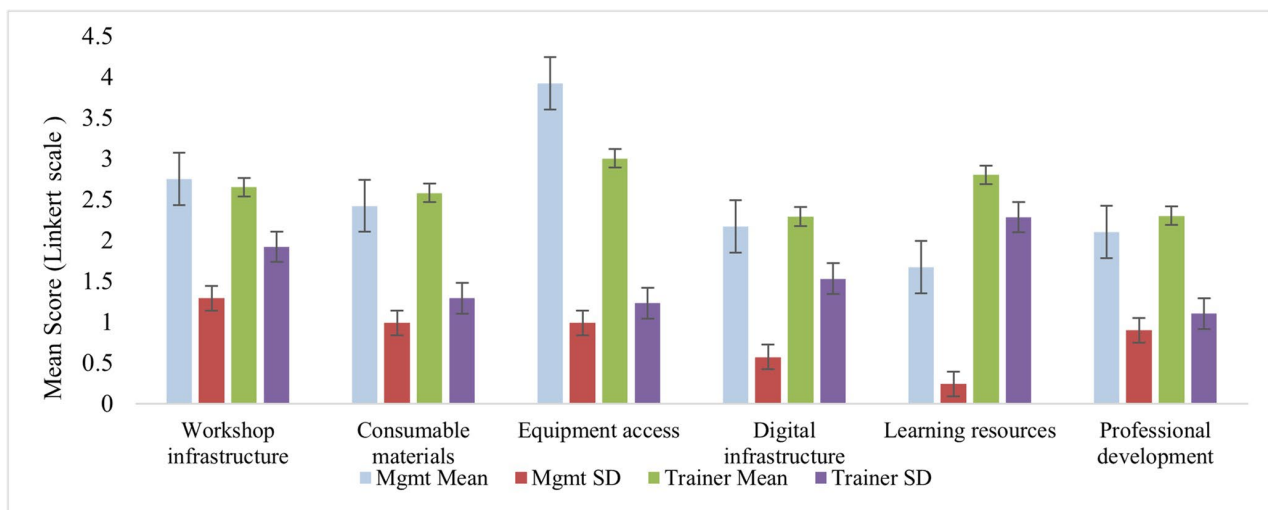
<b>CBT framework</b>	Process	Trainees' faces quality training	Hands-on training limited opportunities = 33.4%, Using outdated pedagogical approaches = 14.4%, Scarce facilities = 29.1%, Limited opportunity to apprenticeship training = 16.1%, Budgetary limitations = 7%	Moderate	Pedagogical failure, insufficient practical exposure undermines competency-based training
		Digital infrastructure availability	Management: M = 2.17, SD = 0.57, S <sup>2</sup> = 0.57; Trainers: M = 2.29, SD = 1.53, S <sup>2</sup> = 1.23	Uneven access (SD up to 1.53)	Weak digital infrastructure affects the possibility of modern training.
		Training resource	Management: M = 1.67 SD = 0.24, S <sup>2</sup> = 0.49; Trainers: M = 2.80, SD = 2.28, S <sup>2</sup> = 1.51	Extreme variability (SD = 2.28)	Uneven access weakens instructional consistency
		Evolution system effectiveness	67.4% need improvement; 2.5% highly effective	Low	Weak assessment undermines skill certification
<b>Institutional theory</b>	Institutional factors	Budgetary constraints affect training delivery	Significantly affects = 72.2%, Slightly affects = 13.9%, Does not affect delivery = 13.9%	Consistent across group	Financial limitations restrict operational capacity
		Management involvement in addressing training constraints	Highly = 2.5% Moderately = 32.6% Minimally = 56.5% Not involved at all = 8.4%	Consistent pattern	Limited leadership undermines coordination and system effectiveness
		Trainers professional development programs	Continually available = 15.8% Occasionally available = 19.3% Irregularly available = 49.5% Not available = 15.4%	Consistent pattern	Inadequate trainer development limits pedagogical quality and technological adaptation
		Institution/industry linkages	Weak (22.8%) + None (15.1%)	Moderate	Weak partnership limits workplace training occasion

Note: Where, M = mean, S<sup>2</sup> = Variance and S.D = Standard deviation. The mean value of <3 is taken as disagree, the value of = 3 is moderate and the value > 3 agrees, based the questionnaires.

From a Human Capital Theory perspective, effective skill formation depends on the availability and efficient utilization of training inputs. But the findings reveal both limited access and structural uneven distribution. Key infrastructure indicators such as workshop infrastructure adequacy (Trainers: M = 2.65, SD = 1.92; Management: M = 2.75, SD = 1.29) and raw material supply (M ≈ 2.42 - 2.58) fall below acceptable thresholds, indicating weak foundational conditions for competency development.

High variability further suggests unequal training environments across institutions rather than uniform scarcity. A clear allocation utilization gap was evident in equipment access, where management reports relatively favorable availability ( $M = 3.92$ ,  $SD = 0.99$ ), while trainers report only marginal access ( $M = 3.00$ ,  $SD = 1.23$ ), with 74.2% indicating operational limitations. This disparity is reinforced by qualitative evidence, as “*there are shortages of machines and training materials that hinder effective training delivery*” (Dean/Management Interview), confirming systemic inefficiencies in resource provision and use. Overall, insufficient infrastructure, weak digital capacity, delayed material supply, and limited training resources constitute major structural barriers to effective, practice-oriented training.

Grounded in the principle of competency-based training (CBT), effective competency development requires sustained practical training engagement; however, 33.4% of respondents report limited access to practical training, while other constraints include inadequate facilities (29.1%), limited job placement or apprenticeship opportunities (16.1%), using outdated teaching methods (14.4%), and financial challenges (7%). These findings indicate that practical exposure central to CBT is significantly compromised.



Note: Error bars represent  $\pm 1$  standard deviation. Scale: 1 = very inadequate/strongly disagree; 3.0 = neutral threshold (dashed line); 5 = very adequate/strongly agree. All mean scores except management-reported equipment access fall below the 3.0 neutral thresholds, indicating systemically unfavorable institutional conditions. Highlighted rows denote dimensions with the largest inter-group perception gaps.

**Figure 3.** Mean scores and standard deviation ranges for institutional constraint dimensions by respondent group ( $n = 285$ ).

Process-related indicators consistently fall below the neutral level, with notable variability across respondent groups. Weak digital infrastructure ( $M \approx 2.17 - 2.29$ ) and highly uneven learning resources ( $SD$  up to 2.28) indicate significant disparities in instructional conditions. Qualitative evidence reinforces this pattern, as “*trainees become less interested when training lacks sufficient equipment and clear instruction*” (Department Heads, FGD), highlighting a practical training engagement effectiveness gap.

Assessment systems further intensify these challenges. A substantial majority of respondents (67.4%) indicate that competency-based assessment methods require improvement, while only 2.5% rate them as highly effective and 14.4% consider them ineffective. Qualitative evidence reinforces this gap, as “*there are no consistent preparations made by trainers for assessment*” (Management Interview), indicating procedural inconsistency and weak standardization in evaluation practices.

From an institutional theory perspective, these patterns reflect broader governance and capacity limitations. Financial constraints significantly affect training delivery (72.2%), limiting institutional capacity to maintain infrastructure and training operational effectiveness. Involvement of management in addressing training challenges is also limited, 56.5% reporting minimal involvement, 32.6% moderate, 2.5% high, and 8.4% no involvement, indicating weak leadership and coordination. Similarly, professional development systems remain weak, with 49.5% reporting rare availability and 15.4% no availability of up-skilling and re-skilling training opportunities, limiting trainers’ ability to update their skills in line with technological advancements.

Weak industry linkages further reinforce these institutional gaps, with 22.8% reporting weak and 15.1% no collaboration, compared to only 16.5% strong collaboration. This constrains workplace-based learning and weakens alignment with labour market demands. Qualitative evidence confirms that “*departments are not yet creating links with companies*” (Department Head, FGD), while trainers’ knowledge “*remains outdated due to lack of continuous training*,” reflecting institutional-industry disconnect. These interrelated constraints culminate in a failure of skill conversion.

High levels of trainees’ dissatisfaction (76.1%) and lack of job readiness (75.1%) indicate that the training outcomes do not translate into the required employable competencies. The most important contributing factors include limited practical training (33.4%) and inadequate facilities (29.1%). Overall, the findings demonstrate that training delivery challenges are structurally embedded across input, process, and governance dimensions, resulting in a system-level failure to deliver labour market-relevant skills.

### 3.4. Strategic Recommendations for Enhancing Training Quality

This section synthesizes strategic interventions required to enhance the quality of TVET training delivery, drawing on quantitative evidence **Table 5** and triangulated qualitative findings from interviews, focus group discussions (FGDs), and observations.

As exhibited in **Table 5**, curriculum industry alignment emerges as the dominant reform priority, with institutional partnerships (35.4%) and curriculum revision (25.4%) accounting for over 60% of total emphasis, underscoring labour market misalignment as the core systemic constraint. However, qualitative evidence indicates that such alignment remains largely nominal, as “*departments are not yet actively creating linkages with companies and organizations*” (FGD), while implementation is constrained by resource deficiencies, “*although aligned with*

*international standards, it lacks adequate training materials*” (Interview). This difference between formal design and operational reality highlights the need to institutionalize cooperative training mechanisms and co-develop industry-responsive curricula to enhance training relevance and employability outcomes.

**Table 5.** Strategic reform framework for improving training quality in public TVET colleges.

Reform dimension	Strategic direction	Empirical evidence	Expected system effect
<b>Curriculum-industry alignment</b>	Strengthen industry partnerships and co-develop curricula	Strengthening partnerships = 35.4%; <i>“departments are not yet actively creating linkages”</i> (FGD)	Improves labour market alignment
	Revise curricula based on industry standards	Update training curricula with labor market requirements = 25.4%; <i>“aligned... but lacks implementation materials”</i> (Interview)	Enhances the relevance of competencies
<b>Infrastructure capacity (operational enablers)</b>	Invest in workshops, equipment, and consumable materials	Funding priority = 16.8%; <i>“20 trainees share one machine”</i> (Observation)	Enables effective practical training
<b>Technological integration</b>	Expand digital learning systems	Integration of digital learning technologies into training delivery= 11.9%	Improves flexibility and access to updated skills
<b>Trainer capacity (re-skilling/upskilling)</b>	Institutionalize continuous professional development	CPD = 10.5%; <i>“trainer knowledge becomes outdated”</i> (FGD); <i>“low motivation”</i> (Interview)	Strengthens instructional quality
<b>Governance &amp; quality assurance (sustaining mechanism)</b>	Strengthen monitoring, evaluation, and stakeholder engagement	Low management involvement= 64.9%; evaluation system effectiveness = 2.5%; <i>“assessment systems are not well organized”</i> (FGD)	Improves accountability and system coherence
<b>Pedagogical effectiveness (adding soft skills)</b>	Reinforce CBT, trainee-centered, practical approaches	Limited practical training access = 33.4%; <i>“group work used due to limited equipment”</i> (Observation)	Enhance CBT implementation fidelity
<b>Trainee practicable involvement</b>	Strengthen motivation, selection, and support systems	Hands-on training engagement = 62.2%; <i>“trainees lose interest...”</i> (FGD); involuntary admission (Interview)	Enhances participation and training outcomes

Building on curriculum-industry alignment, infrastructure capacity (16.8%) functions as a foundational enabler of effective training delivery. Despite its relatively lower prioritization, empirical and observational evidence suggest it is a binding constraint. Persistent shortages of equipment and consumables significantly limit practical training opportunities, as up to 20 trainees share a single machine (Observation). This clearly shows how resource scarcity distorts competency-based training (CBT) implementation and necessitates targeted investment in workshops, tools, and training materials to ensure sustained hands-on learning.

In parallel, integration of technologies (11.9%) represents a critical modernization route. Limited on ICT infrastructure and digital learning capacity restrict ac-

cess to up-to-date knowledge and flexible training modalities. Therefore, expanding digital and e-learning systems is not just supplementary but a strategic requirement for enhancing instructional innovation and system responsiveness.

Moreover, trainer capacity development (10.5%) remains a structurally weak component of the system. Evidence indicates that insufficient professional development undermines instructional quality, as “*trainer knowledge becomes outdated due to lack of continuous training*” (FGD), compounded by “*low motivation and inadequate preparation*” (Interview). Institutionalizing continuous professional development together with incentive mechanisms is therefore essential to strengthening pedagogical effectiveness and competency delivery.

At the governance level, weak management engagement for quality training (64.9%) and low assessment effectiveness (only 2.5% rated highly effective) highlight systemic accountability gaps. As revealed in **Table 5**, strengthening monitoring, evaluation, and stakeholder coordination mechanisms is imperative. This is further supported by qualitative findings, where “*assessment systems are not well organized*” (FGD) and “*stakeholder involvement is limited*” (Interview), reflecting weak institutional coherence. Enhancing governance structures will therefore improve coordination, standardization, and overall system performance.

Simultaneously, pedagogical effectiveness requires significant reform. Despite structured classroom arrangements, instructional delivery remains weak, as “*trainer motivation and mode of expression are poor*” (Observation), and “*practical training opportunities are limited*” (FGD). Furthermore, “*group work is often used as a compensatory strategy due to lack of equipment*” (Observation), indicating that teaching practices are shaped more by constraints than by CBT principles. Strengthening trainee-centered, practice-oriented approaches is therefore essential for improving learning outcomes.

At the trainee level, practical training engagement appears relatively high (62.2%); however, this coexists with structural disengagement. Qualitative evidence shows that “*trainees lose interest when training lacks sufficient equipment and clear instruction*” (FGD), while admission pathways further complicate motivation, as “*many trainees join TVET as a last option after failing national examinations*” (Interview). Additionally, observational findings indicate uneven participation patterns, with “*female participation relatively higher than male*” (Observation). The above dynamic trends highlight the need for comprehensive strategies addressing motivation, admission systems, and training conditions. Finally, the overarching themes from qualitative insights emphasize the need for broader systemic reforms, including improving the quality of training materials, upgrading trainer competencies, strengthening stakeholder engagement, and enhancing public awareness of TVET. As highlighted by management, “*filling skill gaps of trainers, ensuring training materials, and increasing stakeholder participation are key to improving quality*” (Interview). Similarly, FGDs stress the need for structured assessment systems and stronger institutional- industry linkages.

In conclusion, improving training quality requires a coordinated, system-wide

reform approach integrating curriculum alignment, infrastructure investment, technological advancement, trainer development, governance strengthening, and pedagogical transformation.

#### 4. Discussion

This study examined the institutional, structural, and pedagogical determinants of training quality within the competency-based training (CBT) framework in TVET institutions in North Shewa Zone. The most significant findings of the study are that insufficient training infrastructure and limited access to functional workshop facilities constitute critical barriers to effective competency formation. The majority of respondents reported lack of modern technology equipment and insufficient practical training resources significantly restricts hands-on training opportunities, thus weakening the translation of theoretical knowledge into occupational competencies. This strengthens the argument that resource adequacy is a fundamental prerequisite for effective practice-oriented training.

Weak institutionalized industry linkages are major constraint. Although training institutions highlights some forms of collaboration exist, this linkage were weak and insufficient to support meaningful workplace training experience. Consequently, trainees have limited exposure to real world of work, which undermines the labour market relevance of acquired competencies and contributes to persistent skill mismatches.

Another key contribution of the study is the identification of a misalignment between training inputs and outcomes. Respondents were provided relatively positive perceptions of instructional delivery and curriculum coverage. The effectiveness of training depends on the degree of coherence and integration across curriculum design, instructional delivery, assessment practices, and institutional capacity.

An inconsistency was observed between the high number of trainees reporting participation in practical training and the low levels of job readiness and satisfaction. This can be explained by the difference between the availability and the quality of practical training. Although practical sessions are reported to exist, evidence shows that they are often limited by inadequate equipment, insufficient materials, poor workshop facilities, and weak linkage with industry. As a result, these sessions tend to be more theoretical demonstrations or minimally resourced practical activities rather than providing real skill-based experience. Although the practical training was reported as being provided, it did not necessarily translate into effective skill acquisition or labor market readiness. This finding highlights the importance of not only increasing practical training opportunities but also improving their quality, relevance, and alignment with industry requirements.

The findings also highlight institutional and organizational constraints, including weak governance mechanisms, inadequate support systems, and limited opportunities for continuous professional development among trainers, further undermine training effectiveness. These findings highlight that the success of CBT is

contingent upon the institutional environment within which it is implemented.

In general, the study advances to the development of systemic and ecosystem-based understanding of training quality in TVET system, emphasizing that competency development depends on combined effects of the interaction of institutional capacity, resource availability, industry engagement, and policy conditions. The findings underscore improving training effectiveness requires an integrated, implementation-focused approach that extends beyond curriculum reform to address broader structural and institutional constraints. However, the study is limited by its focus on selected institutions within the North Shewa Zone and its reliance on self-reported data, which may affect generalizability and introduce subjective bias.

Future research should adopt broader geographical scope and longitudinal designs to better capture the dynamics of CBT implementation, with particular attention to micro-level institutional practices such as instructional delivery, assessment systems, and industry linkages. Despite these limitations, the study contributes to TVET scholarship by demonstrating that training quality is fundamentally determined by systemic and institutional conditions, underscoring the need for coordinated policy and institutional interventions to enhance alignment between training systems and labour market demands.

## 5. Conclusions

Based on the empirical findings of this study on training delivery practices and quality challenges, several key conclusions can be drawn.

First, the effectiveness of training delivery is significantly constrained by structural and resource-related limitations. Inadequate training infrastructure, limited functionality of workshop facilities, and insufficient access to modern, industry-relevant equipment were consistently identified as major barriers to the implementation of practice-oriented training. These constraints restrict opportunities for hands-on training opportunity and weaken the process of competency formation.

Second, TVET institutions were generally perceived to perform reasonably well in delivering curriculum content and organizing instructional processes, the overall effectiveness of these training inputs in producing competent, labour market relevant graduates remains limited. This indicates that the presence of training structures does not necessarily translate into meaningful competency outcomes.

Third, a clear misalignment exists between training provision and labour market expectations. Weak linkage between institutions and industries, and limited exposure to real work environments reduce the relevance of acquired skills and contribute to persistent skill mismatches.

Fourth, institutional and organizational factors, including limited support mechanisms, weak governance structures, and insufficient professional development opportunities for trainers, constrain the effective implementation of CBT.

Finally, this study demonstrates the quality and effectiveness of TVET systems are determined by the interaction between institutional capacity, resource availa-

bility, industry engagement, and policy implementation conditions. Therefore, improving training quality requires a systemic and integrated approach that strengthens the alignment between training systems and labour market demands.

## 6. Recommendations

Based on the findings obtained from this study, several recommendations will be put forward to enhance the quality and effectiveness of training delivery practice within the TVET system.

First, curriculum reform must be supported by targeted investments in infrastructure and technological capacity: Targeted investments should be made to upgrade workshop facilities, modernize training equipment, and ensure the availability of industry-standard tools and technologies. Such interventions are critical for supporting practice-oriented training and improving competency formation.

Second, human capital development should be institutionalized through structured and continuous professional development programs for trainers. These programs should focus on emerging technologies, competency-based pedagogical approaches, and current industry practices, with career progression linked to demonstrate professional upgrading.

Third, enhancing institutional capacity and governance and financial accountability are necessary. Transparent budgeting, participatory planning, and performance-based resource allocation supported by quality assurance mechanisms such as tracer studies, employer feedback, and regular program evaluation can enhance institutional responsiveness and support continuous improvement.

Fourth, strengthening institutional-industry linkages is crucial. Structured and sustainable partnerships should be developed between TVET institutions and industry actors through: sector advisory boards, cooperative training models, apprenticeships and internships, joint curriculum development, and assessment systems. These mechanisms are essential for improving the relevance of training and facilitating smoother school-to-work transitions.

Fifth, training delivery should incorporate transversal competencies, including communication, teamwork, problem-solving, digital literacy, and entrepreneurship. Complementary learner support services, such as mentoring, career guidance, and internship coordination, can further facilitate the transition from training to employment.

Finally, strengthening coordination among key stakeholders is essential. Greater collaboration is required among TVET institutions, government bodies, and industry stakeholders to create a coherent and integrated system for skills development. Such coordination will enhance the alignment between education, training, and employment systems.

## Conflicts of Interest

The authors declare no conflicts of interest.

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