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Implementation of Competence-Based Education and Training in Livestock Training Institutes in Tanzania: Effectiveness, Challenges, and Industry Partnerships

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Abstract

Competence-Based Education and Training (CBET) is designed to align student skills with industry needs. This study assessed the implementation of CBET in Tanzania's Livestock Training Institutes (LTIs), focusing on curriculum inputs, teaching methods, and industry partnerships. Using the Context, Input, Process, and Product (CIPP) evaluation model, data were collected from tutors, students, and employers. Results showed moderately effective (overall effectiveness delivery index = 0.6263). The curriculum inputs and Industrial partnership components received relatively lower effectiveness ratings 62.5% and 71%, respectively, but weaknesses in resource availability (57.3%). Tutors rated CBET implementation lower than students, particularly in teaching methods and inputs. Key gaps included inadequate ICT tools, library resources, excursion facilities, and learner-centered assessment methods. The study concludes that implementation of the CBET approach was rated by tutors as moderately effective, owing to the shortages of resource and the need for substantial training and learning facilities and infrastructural support. It was recommends improving tutors' capacity in delivery of learner-centred and experiential teaching methodologies, alongside improvements in infrastructure, stronger industry partnerships, updated instructional resources, and improve assessment practices to ensure training outcomes that match with labour market demands.

Keywords: *Competence-Based Education and Training, Livestock Training Institutes, Industry Partnerships, experiential teaching methodologies, Workforce Development.*

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1. Introduction

Unlike traditional education systems that focus predominantly on theoretical knowledge, CBET aims to equip students with hands-on competencies that align with labour market demands and therefore making graduates more acquitted with employability skills (Mulder, 2017; Kafyulilo et al., 2021; Mulenga and Kabombwe, 2019). Studies show that CBET enables graduates' transition smoothly into the workforce (Okolie et al., 2019). However, the implementation of CBET in developing countries faces challenges that limit its effectiveness and impact (Mosha and Warioba, 2022). Tanzania has adopted CBET in its technical and vocational education system, including livestock training institutes (LTIs) to address the persistent issue of graduate unemployment and skill mismatches and skills gap in the labour market (URT, 2016 NACTVET, 2022; Senjiro and Lupeja, 2023).

Whereas the livestock sector in Tanzania contributes approximately 7.4% to the national GDP and provides employment to millions of people, particularly in rural areas (FAO, 2021). Effective CBET implementation in LTIs is therefore required to produce a skilled workforce capable of improving livestock productivity, food security, and economic growth (Kimario and Otieno, 2022). However, concerns remain regarding the actual implementation of CBET in LTIs. Studies indicate that many institutions face challenges such as inadequate infrastructure, skill gaps and mismatch between training and labour market needs, insufficient industry collaboration, and ineffective teaching methodologies (Tadesse and Melese, 2016; Guàrdia et al., 2021; Kemei et al., 2022). These challenges emphasize the need for a comprehensive evaluation of CBET implementation in Tanzania's livestock training institutes to identify gaps and propose evidence-based solutions.

While several studies have examined the implementation of CBET in Tanzania's technical and vocational education sector, there remains a lack of in-depth research focusing specifically on livestock training institutes. The majority of existing literature has concentrated on general vocational education, with little emphasis on livestock industry (Kanyonga et al., 2019; Wang et al., 2021; Shukurani et al., 2023). Moreover, many studies show the theoretical foundations of CBET but fail to assess its practical implementation, particularly with industry engagement, resource availability, and competency-based assessments (Ayonmike, 2014; Baartman and de Bruijn, 2011). In addition, there is limited evidence comparing the perspectives of tutors and students regarding CBET effectiveness in LTIs.

A comprehensive assessment of challenges in curriculum delivery, learning methodologies and industry partnerships is required; otherwise, the underlying inefficiencies may continue to be implemented (Deißinger and Hellwig, 2011; Musobo and Gaga, 2012). This study aimed to conduct an evaluation of CBET implementation in Tanzania's livestock training institutes. Using the Context, Input, Process, and Product (CIPP) model and applying a deductive triangulation approach, the study systematically assessed the effectiveness of CBET in equipping students with industry-relevant skills (Shahanga and Kasambala, 2024). By addressing these aspects, the study provides empirical evidence to support policy recommendations for strengthening CBET in Tanzania's LTIs. The findings can be used by training institutions, industry stakeholders, and policymakers seeking to improve livestock technical education and training to meet labour market demands effectively.

2.0 Methodology

2.1 Study area and population

The study was conducted in selected livestock training institutes (LTIs) across Tanzania. The target population included: Tutors responsible for delivering CBET programs, finalist continuing students enrolled in CBET-based diploma and certificate programs and employers in the livestock value chain. The inclusion of tutors, students and employers ensured a well-rounded evaluation of CBET implementation from both instructional and experiential perspectives.

2.2 Study design

This study adopted a deductive triangulation approach, combining quantitative and qualitative data collection techniques to evaluate CBET implementation in livestock training institutes. The Context, Input, Process, and Product (CIPP) model developed by Stufflebeam (1983) was employed as the primary evaluation framework due to its ability to assess the quality of curriculum implementation for continuous improvement (Gandomkar and Mirzazadeh, 2014).

2.3 Sampling procedure and sample size

A stratified random sampling technique was used to ensure adequate representation of tutors and students across different LTIs. The sample size was determined using Krejcie and Morgan's (1970) formula, resulting in 350 respondents (150 tutors and 200 students) across multiple institutions. Structured questionnaires with a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) were administered to tutors and students to evaluate CBET implementation based on curriculum inputs, teaching methods, assessment techniques, and industry linkages (Toosi et al., 2021). Semi-structured interviews were conducted with tutors, department heads and industry representatives to assess the alignment between CBET training and labour market expectations. Finally, institutional reports, policy documents, and previous research studies were analyzed to contextualize findings and compare them with global best practices in CBET implementation.

2.4.0 Data analysis

2.4.1 Descriptive statistics

Quantitative data were analyzed using descriptive statistics, including means, percentages, and standard deviations. The CIPP model was employed to evaluate the CBET curriculum implementation (Stufflebeam, 1983), as it can precisely estimate the quality of curriculum implementation for further improvement (Gandomkar and Mirzazadeh, 2014). With CIPP (C- Context, I- Input, P- Process, and P- Product), each component of the model addresses different aspects of programme evaluation, making it particularly useful for assessing the effectiveness of curriculum delivery particularly in livestock training institutes. A 5-point Likert scale was used to assess the effectiveness of the CBET curriculum implementation by evaluating the total score for each item provided by an individual respondent. The Likert scale measured respondents' by rating the statements related to the CIPP model's components and responses were rated from 1 (Strongly Disagree) to 5

(Strongly Agree) (Toosi *et al*., 2021). The CIPP model's elements were used to develop an effectiveness index (EI) (Darma, 2019; Lemma and Trivedi, 2012).

The EI was computed to assess the overall effectiveness of CBET implementation based on context, input, process, and product evaluations.

The formula used was:

$$Effectiveness\ \ index = \frac{Total\ \ implementation\ \ Score\ obtained\ by\ a\ respondent}{Expected\ Maximum\ Score\ a\ respondent\ can\ obtain} X100$$

Where:

$coeeiscore^{]i}$	=	the context evaluation score of the ith respondent
COEEIMAXj	=	the maximum score for context evaluation
$inpeeiscore^{]i}$	=	the input evaluation score of the ith respondent
INPEEIMAXj	=	the maximum score for input evaluation
$peeiscore^{]i}$	=	the process evaluation score of the ith respondent
PEEIMAXj	=	the maximum score for process evaluation
$preeiscore^{]i}$	=	the product (Industrial partnerships) evaluation score of the ith respondent
PREEIMAXj	=	the maximum score for product (Industrial partnerships) evaluation
TNS	=	Number of attributes

The total mean scores for each individual respondent were converted into a standardized mean score for the effectiveness delivery index (EDI), which is a multivariate index comprising five variables, each corresponding to one of the attributes mentioned in formula. Then, a one-sample t-test was used to determine whether the mean effectiveness indices for context, input, process, and product evaluations differed significantly from the population mean. Additionally, an independent t-test was conducted to compare the perceptions of tutors and students regarding curriculum effectiveness.

2.4.2 Inferential statistical analysis

Quantitative data were analyzed using SPSS version 26 (IBM Corp., 2019). Inferential statistics, including t-tests, were employed to test for significant differences in perceptions between tutors and students. Furthermore, thematic analysis was used for qualitative data from interviews, allowing for an in depth understanding of contextual issues affecting CBET implementation. Additionally, EpiInfo was used to complement the analysis. EpiInfo was chosen for its efficiency in managing structured questionnaire data, its user-friendly interface for rapid statistical outputs, and its suitability for field-based training research. Graphs and data visualizations were generated using OriginLabPro 2025, which offers advanced features for creating high-quality charts.

3.0 Results

3.1 Descriptive results of CBET implementation components

The mean score for CBET implementation inputs was 57.3%, indicating moderate availability of resources. Teaching and learning processes scored higher (73.2%), while industry partnerships scored 71.6%. Tutors consistently rated CBET lower than students, particularly for inputs (48.7% vs. 65.9%, p = 0.05) and processes (60.9% vs. 86.6%, p = 0.009). No significant difference was found in industrial partnership ratings (p = 0.994). Key resource gaps included ICT tools, excursion facilities, and library resources, while underutilized pedagogies included portfolios, peer assessment, and industry guest speakers (Table 1). Significant variation was observed between tutor and student responses regarding the IPP variables (Figure 2-4) and (Table 1). The students' responses were more variable and the density is high on the upper side of the distribution (Figure 2).

The "*Inputs"* score of tutors was 48.7%, significantly smaller than 65.9% of the students (p=0.05). The "*Process"* score of tutors was 60.9%, significantly lower than 86.6% of students (p=0.009). Violin plots in Figure 3 shows that the students' responses were less variable and the density is high on the upper side of the distribution. Similarly, process scores (teaching and learning and assessment methods) of students were less variable and the density is high on the upper side of the distribution (Figure 4). Unlike the other CIPP variables, the "*Product"* score did not differ between tutors and students (p=0.994). Generally, the IPP scores for tutors

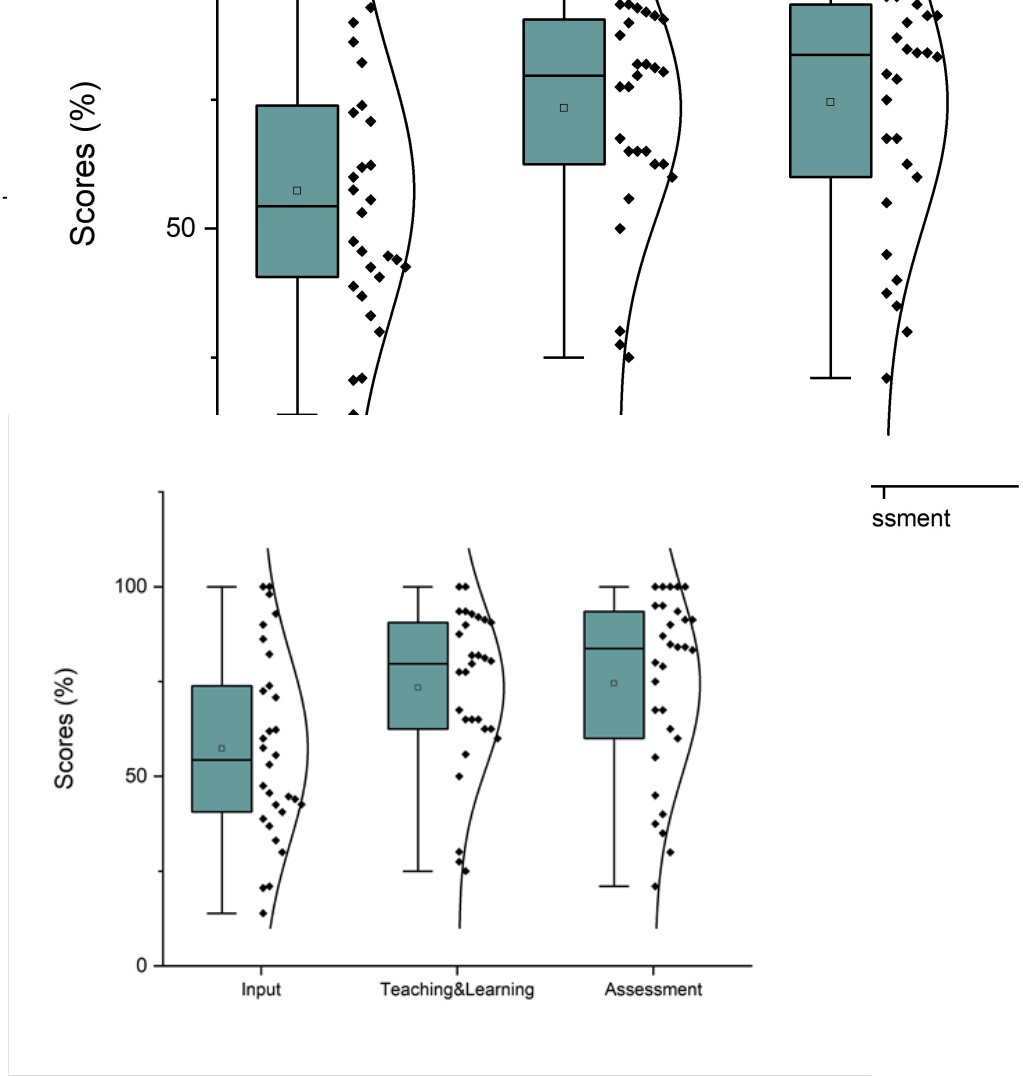

Figure 1: A boxplot with overlaid scatter points and density distribution of scores of respondents based on CIPP model

The boxes represent the interquartile range (IQR), with the central horizontal line showing the median corticosterone level for each CBET element. The whiskers extend to the minimum and maximum values within 1.5 times the IQR. The small square inside the box represents the mean effective score.

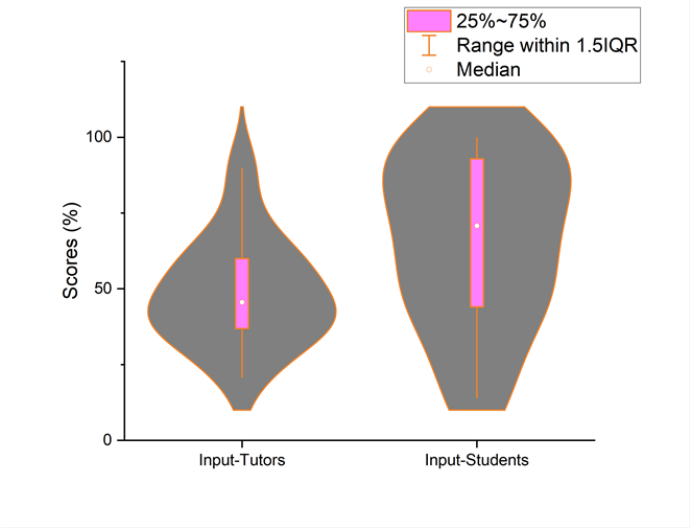

Figure 2: Violin plots showing the density of inputs scores between tutors and students.

The students' responses are more variable and the density is high on the upper side of the distribution

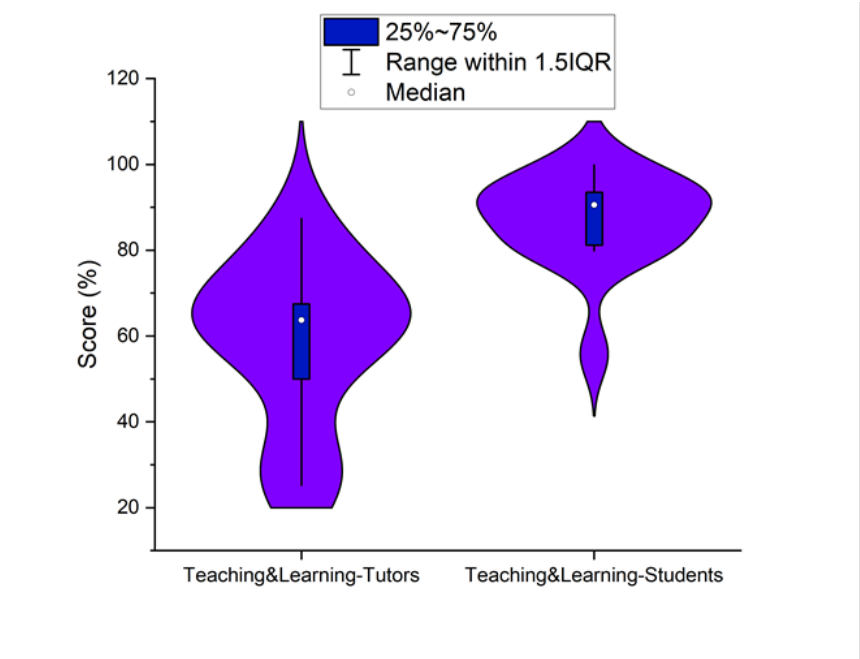

Figure 3: Violin plots showing the density of Process scores (teaching and learning methods) between tutors and students. The students' responses are less variable and the density is high on the upper side of the distribution

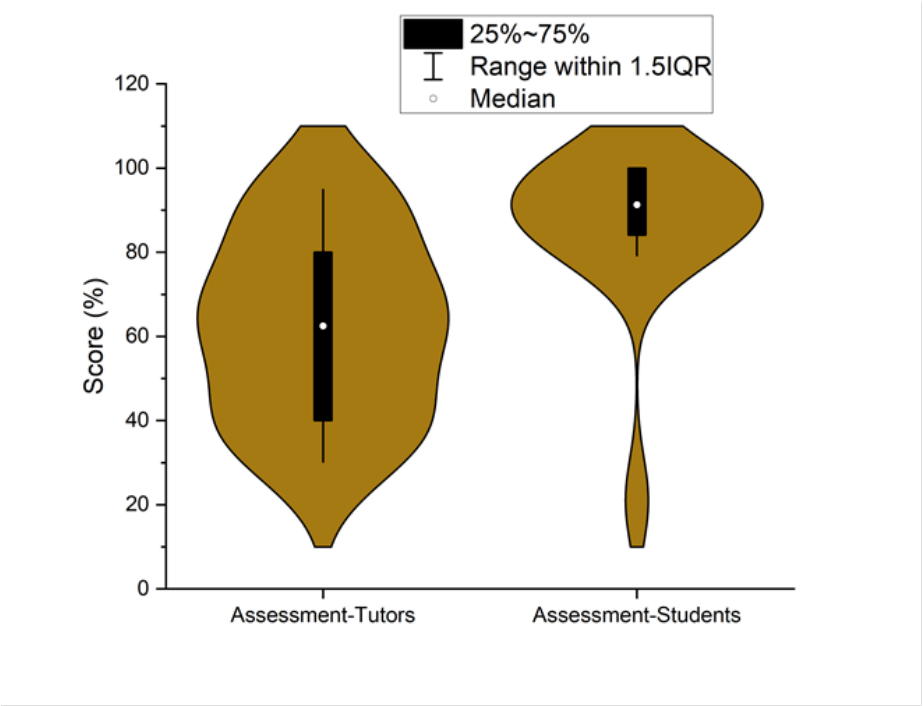

Figure 4: Violin plots showing the density of Process scores (assessment) between tutors and students. The students' responses are less variable and the density is high on the upper side of the distribution

Table 1: Mean scores of CBET elements between tutors and students compared using t-test

Attribute	Tutor-mean	Student-mean	Mean difference [mean[1] – mean[2]]*	t, df	P -value
Input	48.71 ± 4.58	65.87 ± 7.29	-17.17 ± 8.61	1.994 (28)	0.056
Process	60.92 ± 3.65	86.63 ± 5.06	-25.87 ± 4.63	5.582 (58)	0.0001
Context	74.20 ± 2.49	84.87 ± 2.70	-10.67 ± 3.67	2.903 (18)	0.0095
Industrial partnership	71.61 ± 2.99	71.56 ± 6.76	0.057 ± 7.40	0.007 (12)	0.994

*Mean score[1] – tutors Mean score[2] – for students

3.2 Overall perception of CBET curriculum implementation effectiveness

Tutors evaluated the effectiveness of CBET implementation in different areas (Table 2). The highest-rated category was context (74.20%), indicating strong support for the general theoretical framework of CBET. However, input (48.71%) received the lowest rating, showing concerns about inadequate teaching materials, infrastructure, and resources. The overall Effective Delivery Index (EDI) was 0.6263 suggesting moderate effectiveness but also revealing critical areas requiring improvement, especially in resource allocation and tutors' use of learner-centered pedagogies.

Table 2: Overall effectiveness delivery index

Attribute	Minimum %	Maximum %	Mean %	Mean Effective Index (Normalized)
Context	56.9	88.1	74.20	0.7420
Product	49.4	82.5	71.61	0.7161
Industrial partnerships	62.5	82.5	71.61	0.7161
Process	42.5	80.6	53.93	0.5393
Input	20.6	90.0	48.71	0.4871
Overall Effective Delivery Index	-	-	62.63	0.6263

4.0 Discussion

This study assessed the implementation of Competency-Based Education and Training (CBET) in Tanzanian livestock training institutes (LTIs), focusing on the availability of curriculum implementation inputs, teaching and assessment methodologies, industry partnerships, and the overall effectiveness of CBET. The findings provide critical insights into the strengths and gaps in CBET implementation, with implications for improving the alignment between training and labour market needs. The findings revealed that tutors and students had differing perceptions regarding the availability and utilization of CBET curriculum inputs. Tutors rated the availability of student outreach programs is designated into a training timetable as the highest (90.0%, Mean score 4.80), While the availability of essential equipment and vehicles for training and field excursions enabling were rated very low at 20.6% with mean score of 1.38. These deficiencies present obstacles to the effective implementation of the CBET curriculum, particularly in delivering practical, real-world learning experiences that are essential for competency acquisition.

In contrast, students reported a much higher overall availability of resources, with teaching staff qualifications and up-to-date library materials (100%, mean score, 5.00) were both rated highly, indicating that these resources were fully available and effectively utilized, providing strong support for both academic and practical learning. However, availability of computers for students (13.9%, mean score 2.26) and availability of classrooms, chairs, and tables (21%, mean score 2.36) were important low, pointing deficiencies of these essential resources.

The inadequacy of digital resources aligns with studies by Tadesse and Melese (2016) and Kemei et al. (2022), who found that limited technological infrastructure hinders effective CBET implementation in African vocational institutions. The lack of modern teaching aids and inadequate physical infrastructure may restrict practical training, which is crucial for CBET's hands-on learning approach. Studies in Kenya (Oviawe et al., 2017) and Ethiopia (Tadesse and Melese, 2016), also showed that insufficient funding for CBET resources limits the quality of vocational training. Without adequate infrastructure, practical learning in LTIs remains

compromised, affecting graduates' preparedness for the livestock industry. Addressing these resource gaps requires targeted investments in technology, improved funding for field training, laboratories, and enhanced library resources to ensure students acquire relevant competencies. Tutors indicated a strong emphasis on practical training (87.5%, Mean score 4.38), direct instruction (77.5%, Mean score 4.10), and competency-based assessment (67.5%). However, more innovative approaches like mentorship (50%, mean score 3.00), scaffolding (27.5%, mean score 2.45), and industry guest speakers (25%, mean score 2.33), were underutilized indicating a need for substantial improvement or re-evaluation of their integration within the curriculum.

The lower rating by tutors is consistent with findings by Shukurani et al. (2023), who examined constraints in CBET training implementation in Tanzania. The study concluded that while trainers possess the requisite an understanding of the CBET approach, challenges remain in fully supporting delivery with the intended CBET curriculum framework. This suggests that tutors may be more aware of systemic and contextual limitations affecting CBET implementation.

On the other hand, the higher student rating may reflect a more optimistic or surface-level understanding of the CBET framework, possibly influenced by their direct experiences in learning environments that, while seemingly supportive, may not fully adhere to CBET principles. These contrasting perspectives point to a gap between the theoretical underpinnings of CBET delivery approach and its practical implementation. This observation is similar with findings by Kimario and Otieno (2022), Mwagunga et al. (2020), and Muthomi et al. (2023), who found that both students and trainers often interpret and engage with CBET delivery in ways that diverge from the approach's core emphasis on outcomes, learner-centeredness, and performance-based assessment.

The findings are consistent with Baartman and de Bruijn (2011), who argued that CBET effectiveness depends on varied instructional methods, integrating both theoretical and applied learning. The limited use of mentorship and scaffolding suggests that students might not receive sufficient guidance in their competency development, a gap that Lupeja and Komba (2021) also observed in Tanzania's vocational training system. The low presence of industry guest speakers further suggests weak industry engagement in education, a challenge also reported in Nigeria (Ayonmike, 2014). For Tanzania's LTIs, there is a need to enhance mentorship programs and promote industry engagement by inviting livestock industry experts as guest speakers. Additionally, increased use of student-centered pedagogies like problem-based learning and simulations can enhance skill acquisition. The study found that tutors perceived industrial partnerships as fairly effective, with facilitating skill development (82.5%) and improving employability (80.6%) receiving the highest ratings. Students strongly believed that CBET aligns well with industry needs (97.6%), but only 50.5% were satisfied with how CBET prepares them for employment. This finding is consistent with Okolie et al. (2019), who found that weak industry-academia linkages in African vocational institutions contribute to a skills mismatch in the labour market. Similarly, Wang et al. (2021) reported that stronger industry engagement leads to improved graduate employment outcomes in China. However, the fact that students rated employability preparedness lower suggests that partnerships in Tanzania's LTIs might not be effectively translating into job opportunities. To bridge this gap, Tanzania should foster structured apprenticeship programs, encourage livestock industry stakeholders to co-develop curricula, and increase industry-funded scholarships and internships. Tutors rated CBET effectiveness highest in context (74.2%) and industrial partnerships (71.6%) but lowest in input (48.7%) and process (53.9%). Students, however, had significantly higher scores in all categories, especially in process (86.6%). These differences were statistically significant ($p = 0.0001$), indicating divergent perceptions between tutors and students. Studies by Musobo and Gaga (2012) and Gandomkar and Mirzazadeh (2014) suggest that such discrepancies arise when tutors focus on structural and policy limitations, while students evaluate learning based on classroom experiences. The lower rating of process effectiveness by tutors may indicate challenges in implementing CBET methodologies due to resource constraints or lack of adequate CBET pedagogies delivering training among tutors. Addressing this gap requires capacity-building programmes for tutors to improve CBET instructional strategies and a more robust monitoring and evaluation framework to align student and tutor expectations. The findings align with global best practices in CBET implementation but also highlight significant challenges unique to Tanzania: Resource inadequacy, similar to challenges observed in Ethiopia and Kenya, calls for increased government and donor investment in training materials and digital learning resources. Weak industry engagement, suggests the need for structured industry-academia collaborations. To address the challenges in CBET implementation, Tanzania can adopt a strategy focusing on four key areas. First, enhancing CBET infrastructure by investing in teaching and learning facilities, modern libraries, and well-equipped laboratories will create an environment conducive to effective teaching and learning.

Strengthening industry linkages through internship programs, active industry partnerships, and industry-led certification processes to ensure that graduates possess skills that align with labour market demands. The capacity building for tutors is essential through continuous professional development focused on competence-based teaching methodologies, curriculum delivery, and assessment techniques. Lastly, policy harmonization aligning CBET delivering principles with current industry skill needs and international best practices will improve the relevance and adaptability of training programs. Together, these strategies can improve the effectiveness and impact of CBET in Tanzania.

Study Limitations

Limitation encountered during data collection was the reliance on respondents' memory recall, particularly for perception-based questions. This approach may introduce recall bias, as responses could reflect approximations rather than precise data. Time and resource constraints also limited the scope of the study, particularly in conducting longitudinal assessments of CBET implementation

5.0 Conclusion and Recommendations

5.1 Conclusion

The implementation of the CBET approach was rated by tutors as moderately effective, owing to the shortages of resource and the need for substantial training, learner-centered pedagogy, and learning facilities and infrastructural support.

5.2 Recommendations

The study recommends improving tutors' capacity in delivery of learner-centred and experiential teaching methodologies, alongside improvements in infrastructure, stronger industry partnerships, updated instructional resources, and improve assessment practices to ensure training outcomes that match with labour market demands.

6.0 Ethical considerations

Ethical approval was obtained from relevant authorities before data collection. Participation was voluntary, and confidentiality of responses was ensured.

6.1 Author's contribution

Balija Luyombya led the study's conceptualization, design, data collection, analysis, and manuscript preparation. Kisoza Lwekeza James supervised the research, guided methodology, and reviewed the manuscript. Malongo Richard Simalike Mlozi supervised, validated findings, and revised the manuscript. Valery Sonola assisted with data analysis, validation, and visualization. All authors reviewed and approved the final manuscript.

6.2 Declaration of Conflict of interest

The authors declare that there are no conflicts of interest related to this study

6.3 Funding statement

This study received no external funding and was conducted independently by the author.

6.4 Acknowledgement

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Appendix 1: CIPP Items and their percentage responses assessed for tutors and students

Table 3: Tutors' evaluation of availability and utilization of CBET Curriculum inputs

Item	Not at all Available	Slightly Availabl	Moderatel Available	Very Available	Extremel Available	Weighte response	Rating %	Mea score
Teaching and learning materials relevant to the courses offered	8	3	6	11	12	96	60.0	3.40
Students' outreach &excursion programmes	0	1	2	9	28	144	90.0	4.80
Established contact(s) with livestock keepers for practical exercises	3	3	5	13	16	116	72.5	3.87
Qualified teaching/instructors' staff for practical instruction	9	1	4	14	12	99	61.9	3.30
Employment of various assessment methods such as assignments, role plays, and case studies	8	4	7	10	11	92	57.5	3.07
Qualified and competent laboratory technicians	9	6	6	9	10	85	53.1	2.83
Up-to-date study materials in the library	14	3	4	11	8	76	47.5	2.53
Classrooms, chairs, and tables in th institute	13	6	5	7	9	73	45.6	2.43
Lecture theatres and practical demonstration sites	13	4	12	4	7	68	42.5	2.27
Adequacy of laboratories, animal farm & structures, workshops, and livestock	16	5	3	10	6	65	40.6	2.17
The extent of resource availability i relation to the number of staff and learners	15	6	8	4	7	62	38.8	2.07
Sufficiency of library resources	20	3	4	4	9	59	36.9	1.97
Qualified and effectiveness of the institute's librarian	19	5	4	8	4	53	33.1	1.77
Computers and internet facilities for both staff and students	19	8	5	2	6	48	30.0	1.60
Equipment and vehicles for training, field excursions, and outreach programs	22	7	8	2	1	33	20.6	1.38

Mean	STD	SE	95% CI	t, df	P value
48.71	17.74	4.58	38.88-58.53	0.28, 14	0.781

Source: Field Data, 2024.

Table 4: Students' evaluation on availability and utilization of CBET curriculum inputs

Item	Not at all Available/Utilized	sparlingly Available/Utilized	Moderately Available/Utilized	fairly Available/Utilized	aamply Available/ Utilized	Weighted response	Rating %	Mean score
Availability of up-to-date study materials in the library	0	0	0	0	138	552	100	5.00
Qualifications of teaching staff for practical instruction	0	0	0	0	138	552	100	5.00
Qualifications and competence of the laboratory technicians	0	0	0	11	127	541	98.0	4.92
Qualifications and effectiveness of the institute's librarian	0	13	0	0	125	513	92.9	4.91
Sufficiency of library resources	17	0	0	8	113	476	86.2	4.47
Availability of lecture theatres and practical sites	22	0	0	10	106	454	82.2	4.38
Availability and adequacy of laboratories, workshops, and livestock	27	12	0	0	99	408	73.9	3.52
The extent of resource availability in relation to the number of staff and learners	33	0	0	29	76	391	70.8	3.65
Availability of equipment and vehicles for training, field excursions, and outreach programs	52	0	0	0	86	344	62.3	3.38
Established contact(s) with livestock keepers for practical exercises	54	0	5	19	60	307	55.6	3.52
Availability of teaching and learning materials relevant to the courses offered	64	11	6	4	53	247	44.7	2.66
Availability of students' outreach programs	69	11	0	0	58	243	44.0	2.65
Employment of various assessment methods such as assignments, role plays, and case studies	51	35	2	4	46	235	42.6	2.61
Availability of classrooms, chairs, and tables in the institute	96	0	10	32	0	116	21.0	2.36
Availability of computers for students	97	16	14	11	0	77	13.9	2.26

Mean	STD	SE	95% CI	t, df	P value
65.87	28.24	7.291	50.24-81.51	2.177,14	0.0471

Table 5: Tutors' evaluation on employed CBET curriculum process elements

Item	Always	Mostly	Partially	Minimal	Never	Weight score	Applied Rating %	Mean score
Teaching and learning methods								
Hands-on practical skills traini	30	5	2	1	2	140	87.5	4.38
Direct instruction method	27	2	3	4	4	124	77.5	4.10
Enterprise activities	26	3	4	3	4	124	77.5	4.08
Competency-Based Assessmen	19	6	5	4	6	108	67.5	3.70
Project-Based Learning	16	8	6	4	6	104	65.0	3.60
Collaborative/Cooperative learning	18	6	5	4	7	104	65.0	3.60
Field trips/ visits and On-the-jo activities	16	9	4	5	6	104	65.0	3.60
Simulations	13	10	6	6	5	100	62.5	3.50
Problem-Based Learning	15	7	6	7	5	100	62.5	3.53
Multidisciplinary approach	11	12	6	4	7	96	60.0	3.43
Mentorship	15	0	5	10	10	80	50.0	3.00
Reflective Journals:	5	3	7	4	20	47	30.1	2.53
Scaffolding	5	3	4	7	21	44	27.5	2.45
Industry Guest Speakers	2	4	7	6	21	40	25.0	2.33
Assessment methods								
Skills Demonstrations	33	6	1	0	0	152	95.0	4.80
Group Projects	34	5	0	1	0	152	95.0	4.80
Practical Examinations	29	8	1	2	0	144	90.0	4.60
Formative Assessment	23	8	5	2	2	128	80.0	4.10
Summative Assessment	18	11	5	5	1	120	75.0	3.95
Performance Assessments	14	10	9	4	3	108	67.5	3.70
Observation and Feedback	11	15	8	3	3	108	67.5	3.70
Case Studies	12	10	8	6	4	100	62.5	3.53
Oral Examinations	9	15	5	5	6	96	60.0	3.43
Self-Assessment	8	13	5	7	7	88	55.0	3.28
Authentic Assessment	6	8	7	10	9	72	45.0	3.00
Product assessment	4	8	6	12	10	64	40.0	2.83
Peer Assessment	5	4	8	12	11	60	37.5	2.75
Rating scale and rubric	1	9	8	9	13	56	35.0	2.58
Portfolios	0	10	5	8	17	48	30.0	2.40

	Assessment methods	
59.51	Mean	62.33
18.68	STD	21.87
4.824	SE	5.646
49.17-69.86	95% CI	50.22-74.4
1.972,14	t, df	2.185,14
0.0687	P value	0.0464

Source: Field Data, 2024.

Table 6: Students' evaluation on tutors employed CBET curriculum process elements

Method	Always used	Mostly used	Partially used	Minimally used	Not used at all	Weighted response	Rating usage%	Mean score
Teaching and learning methods								
Hands-On Practical skills Training	138	0	0	0	0	552	100	5.00
Direct instruction method	138	0	0	0	0	552	100	5.00
Enterprise activities	110	20	8	0	0	516	93.5	4.74
Case studies and real scenari	108	26	2	2	0	516	93.5	4.74
Competency-Based Assessment	103	31	3	1	0	512	92.8	4.72
Project-Based Learning	100	32	6	0	0	508	92.0	4.68
Collaborative/Cooperative learning	97	37	2	1	1	504	91.3	4.65
Field trips/ visits and On-the-job activities	101	26	7	4	0	500	90.6	4.62
Simulations	96	34	4	2	2	496	89.9	4.58
Problem-Based Learning	81	37	5	7	8	452	81.9	4.33
Multidisciplinary approach	79	36	10	8	5	452	81.9	4.28
Mentorship	84	25	14	9	6	448	81.2	4.28
Reflective Journals:	74	33	19	11	1	444	80.4	4.23
Scaffolding	72	35	20	7	4	440	79.7	4.22
Industry Guest Speakers	39	26	24	26	23	308	55.8	3.10
Assessment methods								
Skills Demonstrations	138	0	0	0	0	552	100	5.00
Group Projects	138	0	0	0	0	552	100	5.00
Practical Examinations	138	0	0	0	0	552	100	5.00
Formative Assessment	138	0	0	0	0	552	100	5.00
Summative Assessment	138	0	0	0	0	552	100	5.00
Performance Assessments	116	13	5	3	1	516	93.5	4.78
Observation and Feedback	98	37	0	1	2	504	91.3	4.75
Case Studies	92	45	0	1	0	504	91.3	4.74
Oral Examinations	87	38	7	4	2	480	87.0	4.66
Self-Assessment	82	42	5	4	5	468	84.8	4.61
Authentic Assessment	77	45	8	5	3	464	84.1	4.58
Product assessment	71	52	11	2	2	464	84.1	4.51
Peer Assessment	73	51	6	3	5	460	83.3	4.50
Rating scale and rubric	65	49	12	5	7	436	79.0	4.41
Portfolios	7	10	12	34	75	116	21.0	2.23

Statistics summary

Teaching and learning methods		**Assessment methods**	
Mean	86.97	Mean	86.63
STD	10.94	STD	19.6
SE	2.826	SE	5.06
95% CI	80.91-93.03	95% CI	75.77-97.48
t, df	13.08, 14	t, df	7.23,14
P value	P<0.0001	P value	P<0.0001

Source: Field Data, 2024.

Table 7: Tutors' evaluation of industrial partnership effectiveness in CBET curriculum

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Weighted response	Rating %	Mean score
Facilitate the development of skills and competencies required by labour market	1	2	4	10	23	132	82.5	4.26
Improving employability outcomes	2	1	5	10	22	129	80.6	4.23
Offer students access to real-world work experience	3	2	6	12	17	118	73.8	3.94
Enhancing curriculum relevance	4	4	6	8	18	112	70.0	3.83
Aligns with effective pedagogical approaches	5	5	3	8	19	111	69.4	3.80
Building professional networks	8	3	5	9	15	100	62.5	3.57
Complement Tutors to deliver effective practical instruction	7	4	5	10	14	100	62.5	3.54

Mean	STD	SE	95% CI	t, df	P value
71.61	7.934	2.999	64.28-78.95	7.208,6	0.0004

Source: Field Data, 2024.

Table 8: Students evaluation of industrial partnership effectiveness in CBET curriculum

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Weighted response	Agree, %
Extent to which CBET aligns with effective pedagogical approaches	0	0	0	13	125	539	97.6
Extent to which CBET supports effective feedback and coaching for learners	0	0	0	43	95	509	92.2
How well does CBET integrates theoretical knowledge with practical competencies	0	0	54	52	32	392	71
Perception on the effectiveness of CBET in comparison to traditional education	21	0	29	30	58	380	68.8
Effectiveness of CBET assessment methods in evaluating learner competencies	0	0	60	56	22	376	68.1
Training in CBET positively impacted the ability to deliver effective instruction	18	15	56	32	17	291	52.7
Satisfaction with the CBET curriculum and its ability to develop competencies	24	11	54	36	13	279	50.5

Mean	STD	SEM	95% CI	t, df	P value
71.56	17.9	6.767	55-88.12	3.186,6	0.0189

Table 9: Tutors' assessments of effectiveness of CBET curriculum implementation

Attribute	**Minimum %**	**Maximum %**	**Mean %**	**Mean Effective Index (Normalized)**
Context	56.9	88.1	74.20	0.7420
Product	49.4	82.5	71.61	0.7161
Industrial partnerships	62.5	82.5	71.61	0.7161
Process	42.5	80.6	53.93	0.5393
Input	20.6	90.0	48.71	0.4871
Overall Effective Delivery Index	-	-	62.63	0.6263