



Research article

Antecedents of graduates' competence in the agro-food processing technical and vocational training system of Ethiopia as perceived by graduates and their trainers

Melaku Mengistu Gebremeskel*

Associate Professor of Educational Policy and Leadership, Bahir Dar University, College of Education and Behavioral Sciences, Department of Educational Planning and Management, Ethiopia

ARTICLE INFO

Keywords:

agro-Food processing
Graduate competence
Trainer competence
Institutional capability
Employability
AFP

ABSTRACT

The purpose of this study was to scrutinize the interdependence among training quality, graduate demographic characteristics, and graduate competence and employability in the agro-food processing sub-sector of the TVET system in Ethiopia. To that effect, the commitment and competence of graduates and trainers, the quantitative and qualitative aspects of resource supplies, training and assessment practices including industry involvement or cooperative training, and the relationships with and influence of the human and material resources on graduate competence were examined. The descriptive survey design of the quantitative approach that involved 637 participants was employed. Data analyses through descriptive and inferential statistics revealed that colleges were challenged with trainer skill gaps, poor material resource supply, and poor cooperative training. It was also found that the human inputs (trainer competence, trainer commitment, and trainee characteristics) significantly predicted the core competence of graduates whereas material resources had a very weak predictive power. In addition, an inverse relationship between employment status and all forms of graduates' competence was found. Accordingly, it is plausible to conclude that poor institutional capacity that denied to pay necessary attention for the input and process of the training delivery has obstructed the competence of graduates.

1. Introduction background of the study

Technical and vocational education and training (TVET) is the acquisition of knowledge and skills in an occupation to enhance the competence, employability, productivity, and socio-economic well-being of people thereby fostering organizational and national development [1]. Besides playing a pivotal role in human resource development, it contributes highly to meeting the human power needs of the market [2–4]. Consequently, the production of a skilled and adaptable labor force that effectively meets the requirements of the labor market and society at large is highly essential [5,6]. Since its role in the growth and development of society is an established fact, according to UNESCO [7], TVET is considered as an engine for social well-being, economic growth, and development. Accordingly, TVET has been considered a vital policy agenda of nations all over the world [7,8] because countries with a competent labor force responded to the challenges and opportunities of globalization and development more effectively and promptly than those

* Corresponding author.

E-mail address: mmelaku25@gmail.com.

<https://doi.org/10.1016/j.heliyon.2023.e16569>

Received 22 November 2022; Received in revised form 17 May 2023; Accepted 19 May 2023

Available online 25 May 2023

2405-8440/© 2023 The Author. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

without [9].

In light of this, it is mandatory to equip trainees with the required competencies by providing quality training on occupations demanded by the market [6]. To that effect, according to Gasskov, TVET institutions are highly responsible to supply necessary inputs and apply an appropriate training methodology to equip trainees with the competencies required in the market.

Regarding the pivotal roles that resource supply plays, AU [8, p. 23], for instance, declares that “inadequate instructor training, obsolete training equipment, and lack of instructional materials” are the major factors that debilitated the quality and effectiveness of TVET in Africa. If competence is sought in TVET, Amedorme & Fiagbe [3], AU [8] and Melaku [10] suggest, a supply of competent and dedicated teachers, appropriate workshops facilitated with adequate machinery, equipment, and consumables, and time for practical exercises for trainees need to meet the standards. In line with this, different sources of literature [e.g., 10–13] complement that the competence and commitment of trainers, the quality and quantity of material resources and technology employed, partnership with stakeholders, the concern and aspiration of students, the occupational standard, the curriculum, the assessment (monitoring and evaluation) scheme as well as leadership plays major roles in determining trainee competence.

With respect to raining methodology, contemporary sources of literature [9,14–20] claim that in the TVET system, competency-based education and training (CBET) matters highly. According to these sources, CBET is an approach where the quality of training provided is measured by the competence achieved than by the quantity and quality of inputs supplied or by the type and magnitude of courses taken and the theoretical knowledge acquired by the trainee [15,21,22]. According to these sources, CBET focuses on the performance of trainees (the outcome) in accordance with qualification standards set by the workplace. It takes workplace and individual issues into consideration in which a student is given the chance to master a competence at his/her own pace within a reasonable time to fit the labor market demand [13,20,22]. Hence, CBET stimulates the development and integration of knowledge, skills, and attitudes as well as bridging the economic demands with the individual learning needs of trainees.

According to Bauer and Gessler [23], Kyobe [22], and Lannert [24], CBET becomes more fruitful when industry involvement is proactive for TVET. For Eichhorst et al. [25], Dustmann and Schonberg [26] and Horn [27] it refers to the participation of the industry right from planning to monitoring and evaluation of the TVET system, including the development of OSs, training delivery, and assessment of occupational competence. Consequently, the TVET-industry partnership highly determines graduate competence and the viability of TVET [22,23,28].

In the current context of Ethiopia, the partnership under discussion is framed as a cooperative training [29]. This refers to what is widely known as the dual TVET system, one of the three distinct models of TVET provision: the liberal market-based, the state-regulated bureaucratic model, and the dual model [22,25,26]. Besides the strong public-private collaboration it creates in TVET financing, according to these sources, the dual approach resolves different problems that are inherent in TVET: (a) it contributes to minimizing the mismatch between the supply and demand for TVET and the consequent unemployment problems among graduates; (b) enterprises and/or companies that provide training can timely adjust and adapt training curricula to the changing demands of the labor market; (c) by creating motivation and engagement in training among trainees, the approach is more beneficial in providing a suitable environment for both learning and working; (d) by paving the way for early contact with the enterprises and getting an opportunity of working experience, the approach enrolls graduates faster into the labor market, besides creating a better opportunity of understanding about the types of jobs and occupations that they prefer for their future career. Consistently, Alet and Bonnal [30], Eichhorst et al. [25], and Horn [27] complement as the dual TVET model improves the quality and relevance of TVET despite there being arguments that refute its benefits including Melaku [31] who found out that it is difficult to execute the strategy in the context of Ethiopia and a futile exercise, if any.

To analyze and understand the proper operation of, TVET colleges (TVETCs) as organizations, organizational theories today

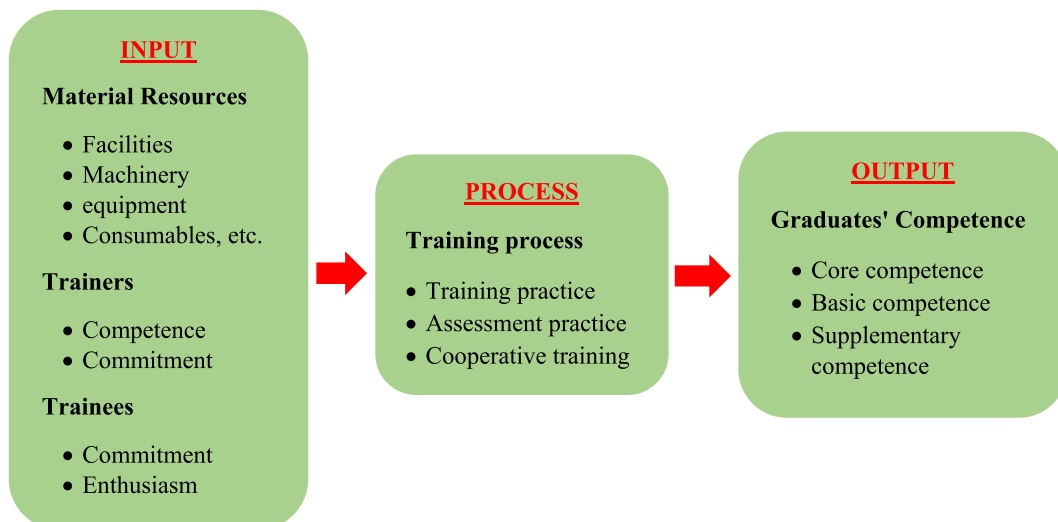


Fig. 1. The conceptual framework of the study.

emphasize the importance of the environment in which organizations are situated and a systems thinking. In this respect, Cameron and Green [32] and Muller-Christ [33] argue that an analysis of any organizational system in an environment without emphasizing the way its parts interact and function is insufficient since the organizational phenomenon is better understood only when the interrelationships are understood [34,35]. Mele and Colurcio [36] also supplement that the interaction of the different components or parts of a system (the input, process and output) determines the achievement of the goal. These authors go on to write that it is the proper organization and interaction of these components of a system that determine the fitness of the output to the purpose. That in turn requires, according to these authors, the ability to identify and manage the functioning and relationships of the components, closely monitoring the information flow and communication channels as well as rationalizing and harmonizing performance improvement patterns to match the quality and relevance of the output supplied with the requirements of the environment, aligning the cultivation and supply of competent graduate to the market in the context of this study.

As described by Mele et al. [37] accordingly, TVETC managers should be familiar with the concept of systems thinking so that they can design an integrated holistic plan, for instance, to guarantee their graduates employable competences in the market. This in turn demands linking the supply of necessary human and nonhuman resources, delivering quality training by understanding market scenarios in order to equip graduates with the required competences and realize the demands of both individual graduates and the market. By enabling managers to take their TVETCs and the labor market as a unitary whole, for instance, the understanding and proper practice of systems theory can effectively contribute to ensure the equipment of trainees with necessary competences by closely following up the interactions among the necessary components of the training delivery system. Cheng [34] and Ng et al. [35] corroborate that the adaptive and proactive behavior of the systems model explains the conceptual foundation to explore relationship studies such as the one under explanation. The systems theory that emphasizes graduate competence as a function of input-process-output interdependence is, therefore, a good framework that mirrors this study more explicitly and clearly (see Fig. 1). The framework demonstrates the various factors required in maintaining TVET quality, all of which lie at the heart of graduate competence.

1.1. Problem statement

The government of Ethiopia expects the agro-industrial sector to play an important role in the development endeavors of the country: job creation, foreign exchange earnings, and enterprise development [38]. By enhancing industrialization – raising the share of the industrial sector to 27% of the GDP, and the GDP share of the manufacturing sub-sector to 18% by 2025 – the government aspires to bring about accelerated structural transformation in the economy by providing particular emphasis on the agro-industry sector [39]. This attempt is envisaged to enhance opportunities that change the huge potential of the sector for job creation and absorption of the workforce in the labor market. Different assessment reports [such as 40–42], nonetheless, inform that the agro-industry sector in the country accounted for only around 5% of the GDP on average. Those sources, in addition, disapprove that Ethiopia's agro-industry exports are currently almost limited to primary and unprocessed products while market conditions for exports of processed food are favorable by citing that the global export of processed food products is growing at approximately 10% annually. Consequently, the country has prioritized the development of Integrated Agro-Industrial Parks (IAIPs) as its key national development strategy which is expected to drive the structural transformation of the economy, reduce rural poverty, and foster investment in the agro-food processing (AFP) and allied sectors.

The effectiveness of IAIPs is, obviously, a function of a competent labor force, particularly middle-level professionals produced by the TVET sector [43]. On this basis, the government has provided due emphasis to the AFP sector of the TVET system [38,43]. Accordingly, the government has developed a TVET strategy that attempts to deliver competent and self-reliant citizens who can play pivotal roles in the overall socio-economic development of the country and realize sustainable poverty reduction goals [43]. This calls for producing competent graduates of agro-processing professionals from TVETCs.

In the past two decades and a half, however, the entire TVET system has been criticized for lacking to meet its goals, despite the meager achievements registered [10,31,43]. MoSHE criticizes the system for failing to produce employable graduates who can meet their employment needs as well as the expectations of the market for competent graduates. Most of the TVET graduates including the AFP sector, on the other hand, widely complain and blame the government for subjecting them to unemployment and problems of livelihood after lots of individual and public resources are invested to train them. In contrast, evidence on the ground shows that the IAIPs are demanding a high number of skilled labor forces from the TVETCs. This implies that there is a contradictory situation where there are a large amount of unemployed AFP graduates in the market, on the one hand, and high demand for AFP professionals by IAIPs, unlike other sectors where job opportunities are scarce, on the other. In aggregate, the AFP sector of the TVET system is not playing its role both in bridging youth transitions from school to work and in spearheading AFP toward the anticipated goals. This situation often mystified me and elicited my interest to examine the antecedents that subjected AFP graduates to problems of unemployment while there is a market demand for the profession. In light of this, the purpose of the study was to examine the competence of the last five years' AFP graduates from different TVETCs of Ethiopia and the factors associated with their competence based on the perception of graduates and their trainers. The following research questions guided the study:

- i. What is the level of graduates' competence as measured by the antecedents assessed?
- ii. Is there a significant relationship between each antecedent (trainer competence and commitment, quantity and quality of resource supply, trainee characteristics, training and assessment practices, cooperative training) and graduates' competence?
- iii. To what extent does each antecedent (trainer competence and commitment, quantity and quality of resource supply, trainee characteristics, training and assessment practices, cooperative training) explain graduates' competence?

1.2. Definition of key terms

- **Core competence:** this comprises specific skills and knowledge required by a given occupation.
- **Basic competence:** this refers to the skills and knowledge that everyone needs to accomplish a given work activity.
- **Supplementary competence:** this encompasses skill and knowledge needed by all people working in a particular company or enterprise.

1.3. Limitations of the study

The finding of this study needs to be understood in light of some limitations despite the researcher has made concerted efforts to meet the objectives of the study. To begin with, although an attempt was made to reach out to as many graduates as planned in the occupation in focus, there were different challenges faced to reach them all as desired. Due to the poor database system by the study colleges, it was found very difficult to trace and identify the address of graduates selected to participate in the study. In addition, there were colleges in the study sample who reported TVET graduates other than AFP as if they are AFP graduates. That is why only data from 577 participants were found useable after collecting data from 875 graduates. The removal of those participants may have its own effect on the outcomes of the study. Similarly, the number of graduates involved in the study from Level I, Levels V and from 2017/2018 academic year were only 1(0.2%), 7(1.2%), and 2 (0.3%) respectively. This also informs lack of generalizability of the findings regarding the two levels and the year mentioned.

2. Methods

2.1. Research design

This study collected survey data from a wide range of participants at a specific time. It employed the cross-sectional survey design of the quantitative research approach. According to Creswell [44], that is because the study attempted to examine and understand the national trend of the competence of AFP graduates based on a randomly drawn sample to describe individual opinions and behaviors of the population. In addition, Creswell suggests a survey study is useful for examining or evaluating education and training programs and for providing information on the status and fate of the programs.

2.2. Population and sampling

The study gathered information from graduates and their trainers of TVETCs focusing in the occupations under investigation. Four regional states, namely Amhara, Oromia, Southern Nations, Nationalities, and Peoples (SNNP), and Sidama were selected among 11 through a lottery method. Among these regional states, Bure and Tillili TVETCs from Amhara, Batu and Arsi-Negele from Oromia, Aleta Wondo from Sidama, and Dilla from SNNP regional states were selected using the same method. The sample size of study participants was determined by using Daniel and Cross's [45] statistical formula because this formula addresses sample size concerns regarding population proportion and for population size not clearly identified:

$$n = D \frac{Z^2 P(1 - P)}{e^2}$$

Where n = the sample size; D = design effect, which assumed the value of 2 in this study; Z = the abscissa of the normal curve that cuts off an area α at the tails ($1 - \alpha$ equals the desired confidence level, e.g., 95%).

The sampling method employed to draw sample TVETCs and participants in this study is a multistage cluster sampling technique accompanied by a simple random sampling method. That is because different sources of literature such as Aberson [46], Cohen et al. [47], and Creswell [44] advise it rather than extracting participants through a mere probability sampling technique from such a hierarchically structured population environment that may nest some segments of the population unnecessarily and affect the relevance of the conclusion to be drawn. Hence, the multistage cluster sampling technique, which enables the recruitment of participants from different levels of sites and draws respondents from each site, is an appropriate method in such situations.

The sample size using this formula was found to be 384.16, which becomes 384 after rounding off. However, the formula is valid only for simple random or systematic sampling methods. Hence, since this study implemented a two-stage sampling technique, the sample size obtained through a simple random sampling technique was multiplied by D , the design effect that multiplies n and provides a correction for the loss of sampling efficiency resulting from the use of simple random sampling. In this study, the design effect was two: first, the selection of regional states, and then the selection of zonal administrations where participants (graduates) were dispersed. Thus, the actual sample size becomes 2×384 (or 768). In order to respond to the challenges arising from nonconformities such as unreturned questionnaires, incomplete questionnaires after return (e.g., missed out items, two ticks put in a row of choices instead of only one, etc.), the sample size was made to increase by a non-response insurance factor [44,48]. That factor was 10% in this study. Accordingly, the study involved 845 graduates filling out questionnaires. Once the total sample size had been identified, the proportional distribution of both participant groups among each state and TVETC was determined based on the proportionate-to-size sampling method by using the formula by Bethlehem [49]. Due to its manageable size, according to Cohen et al. [47] and Gay et al. [50], in addition, all 76 trainers were involved in the study through a comprehensive sampling technique.

2.3. Data gathering tools

This study depended on primary sources of data. Self-prepared questionnaires (for graduates and their trainers) set on the basis of the research questions and the literature reviewed were employed. With the exception of a few demographic data, the items in both questionnaires were close-ended in their form, which employed two types of attitude scales (Likert and rating scales). The scales had scores ranging between 1 and 5 because they are easier to use and rarely difficult to complete [47,50]. Before conducting analyses, in fact, the validity, and reliability of the tools were tested. To gauge the validity of the items, determining the rejection or retention of items, Lawshe's [51] content validity check model that helps to see how far each item is pertinent to measure the variables specified was employed. The content validity ratio (CVR) was calculated using Lawshe's formula portrayed here under:

$$VCR = \frac{n_e - N_2}{N_2}$$

Where n_e is the number of panelists indicating "essential" and N is the total number of panelists.

On this basis, the draft questionnaires were distributed to eight trainers (served as panellists) who were recruited among AFP trainers of Bahir Dar Polytechnique College to rate each item of the trainers' questionnaire. Ten AFP graduates from the same college were also selected and served as panellists to gauge the validity of the graduates' questionnaire. The items of both questionnaires were rated on a two-point scale, 1 = not essential and 2 = essential. Then, in aggregate, about seven items with poor validity were removed and 14 others were modified by taking Lawshe's assumptions into consideration.

Alike validity, a scale reliability test was conducted on each variable. Accordingly, a thorough screening of item consistency has been conducted. In reporting the results of the data analysis, items that focus on a specific variable were clustered together and composite scores have been preferred to item-by-item reporting of the responses. In this respect, item-total correlations have been manipulated to measure a given variable [52]. As depicted in Table 1, all three groups of instruments were found reliable because all the values of alpha coefficients are within the acceptable ranges (e.g., 46, 44, 52, 48).

2.4. Methods of data analysis

In this study, both descriptive and inferential statistics were employed to analyze the data. Before analysis was operationalized, of course, data were checked for whether they met the required assumptions. Besides applying random sampling, accordingly, the tests of outliers, normality, homoscedasticity, and multicollinearity confirmed the possibility of applying parametric tests on the basis of methodological parameters set by scholars in the field [e.g., 46, 52, 48]. Hence, the study employed descriptive statistics (such as the mean, standard deviation, one-sample *t*-test, and cross-tabulation) and inferential statistics (independent samples *t*-test coupled with Cohen's delta, Pearson product-moment correlation coefficient, point-biserial correlation coefficient, ANOVA, and regression) to make more meaningful and sound generalizations [48,53,54]. Version 17 of STATA statistical software was applied to analyze the quantitative data. SPSS version 26 was also employed for data screening and for univariate and bivariate data analyses. As usual, significance tests were examined at an alpha 0.05 significance level or 95% confidence interval.

3. Results and discussion

Before analysis took place, the data garnered were cleaned. Consequently, data collected from 298 graduates had been removed due to their non-conformity. Among the survey instruments distributed, accordingly, a total of 637 (577 from employed and unemployed graduates and 60 from trainers) or 75% were found acceptable. This is nearly 83% of the actual sample size necessary and 75.4% of the sample size with 10% contingency. The size of the return rate in terms of both proportions did not prevent from pursuing the analysis because, as a rule of thumb [44,47,50], as low as 50% response rate is tolerable for survey studies to generalize about the population from which samples have been recruited.

3.1. Demographic data and its implications

Table 2 demonstrates that 294 (51.0%) of the graduates involved in the study were females. Since participants were drawn through a random sampling technique, the figure implies that females have probably a greater involvement in the sector than their male counterparts. As far as their level of qualification is concerned, a greater proportion (55.6%) of them was level III whereas the smallest ones were level I. This informs that the lower-level qualification of this sector is not the preference of trainees. Graduates' profile was also assessed from the viewpoint of employment status, and the majority of them (76.6%) are unemployed, implying that the sub-sector under scrutiny is subjected to a severe unemployment problem.

Table 3 refers to the demographic characteristics of trainers. Among the trainers involved in the study, the overwhelming majority

Table 1
Scale reliability.

Variable	Number of items	Coefficient Alpha	
		Graduates (N = 577)	Trainers (N = 60)
Trainer competence	9	0.8808	0.8380
Trainer commitment and concern	13	0.9295	0.9230
Quantity of resources	6	0.7931	0.6505
Quality of resources	6	0.8197	0.7810
Trainee characteristics	8	0.8473	0.8562
Training practice	12	0.8182	
Assessment practice	11	0.8450	
Cooperative training	11	0.9823	
Core competence of graduates	7	0.7889	0.8486
Basic competence of graduates	5	0.7700	0.7518
Supplementary competence of graduates	8	0.7891	0.8243

Table 2
Demographic characteristics of graduated respondents (N = 577).

variables	#	%	Variables	#	%		
Sex	Male	283	49.0	Employment Status	Employed	135	23.4
	Female	294	51.0		Unemployed	442	76.6
Level of qualification	Level I	1	0.2	Year of graduation	2017/18	2	0.3
	Level II	62	10.7		2018/19	55	9.5
	Level III	321	55.6		2019/20	79	13.7
	Level IV	185	32.1		2020/21	432	74.9
	Level V	7	1.2		2021	9	1.6
	Missing data	1	0.2		2017/18	2	0.3

Table 3
Demographic characteristics of trainer respondents (N = 60).

Variables	Frequency	Percent	Variables	Frequency	Percent		
Sex	Male	49	81.7	Service Years	1–5 years	28	46.6
	Female	11	18.3		6–10 years	26	43.4
Qualification Level	Level A	7	11.7		11–15 years	5	8.3
	Level B	48	80.0		16–20 years	1	1.7
	Level C	5	8.3				

(81.7% and 80%) were male in their sex and B-level in their level of qualification, respectively. This informs the need for endeavoring toward sex equity and upgrading trainer qualification levels in the sub-sector. Since it is only 11.7% of trainers have acquired level-A¹ in their occupation and training methodology, the profiles of trainers in the current sub-sector are not good enough to equip trainees with competitive competencies and qualification levels in higher-level OSs. Similarly, most trainers seem to have insufficient service years for delivering training on the occupational levels described in Table 2 because service year is one requirement of certifying trainers at different qualification levels. The service year is directly associated with the qualification level of trainers, or the former is an input for upgrading the latter. Consequently, the data inform those trainers lack to meet the minimum requirements of the Federal TVET Agency [55] and MoE [56,57] with respect to trainer profile.

A cross tabulation of demographic data informed us with other essential findings. With respect to this, Table 4 exhibits the association of graduates' qualification levels with their sex and employment opportunity. In this regard, while the number of females who graduated in the AFP sub-sector falls when we go up in the qualification level, males' participation in contrast goes up in line with the hierarchy. Hence, the high proportion of female participation observed in Table 2 lacks consistency when we go up in the level of qualification, which implies that females are disadvantaged by being limited to lower qualification levels. With respect to employment opportunity, on the other hand, there is a mixed trend when it is viewed in terms of qualification levels, given that the general employment opportunity by itself is very low. That is, levels II and V have better employment opportunities than levels III and IV, whereby level V is the best employable qualification level.

A longitudinal examination of the recent five years' data regarding enrolment and employment rates of AFP graduates exhibited

¹ In the Ethiopian TVET system the qualification levels of trainers are divided into three qualification levels. Level-A qualification requires a trainer to acquire a Level V national certificate of occupational and training methodology competencies whereas Level-B and Level-C qualification levels require Level IV and Level III national certificates of occupational and training methodology competencies respectively. While an A-Level trainer provides training from levels I–V, levels IV and III provide training in levels I–IV and levels I–III only consecutively [57].

Table 4
Sex and employment status of graduates in terms of their qualification level.

Variables			Qualification level of graduates					Total
			Level I	Level II	Level III	Level IV	Level V	
Sex of participants	Male		1	28	149	99	5	282
	Female	#	0	34	172	86	2	294
		%	0	54.8	53.6	46.5	28.6	51.0
Total			1	62	321	185	7	576
Employment status of participants	Employed	#	0	18	73	38	6	135
		%	0	29.0	22.7	20.5	85.7	23.4
	Unemployed		1	44	248	147	1	441
Total			1	62	321	185	7	576

attention-seeking information (see Table 5). The findings inform that the proportion of female graduates in the sub-sector during those years demonstrated no clear pattern despite its sudden drop by 2021. In contrast to the steadily growing number of graduates from year to year, employment opportunities consistently declined at the same pace. It is worth noting that this finding coincides with different sources of literature [e.g., 58,17,59] on the one hand and diverges from the intention of MoE [60] on the other that sought AFP to effectively contribute for the livelihood and the socio-economic well-being of society in general and those of graduates in particular. In line with some other commendable experiences [such as 3,4,61,62], the current finding shall alert TVETCs and the TVET system of the country, in general, to take the issue of occupational employability and utility into consideration in their strategic and operational plans and implementations.

3.2. Resource supply

Table 6 demonstrates the magnitude and quality of both human and nonhuman resource supplies by TVETCs for delivering training. As can be understood from the mean scores in the table both the quantity and quality of all forms of material resources supplied by the colleges did not satisfy their customers, particularly of the trainers. Although the scores are a little bit higher than average, the competence and commitment of trainers is not that good enough. This finding aligns with the concerns of AU [8] regarding TVET in Africa, which is supplemented by Amedorme and Fiagbe [3], Ayonmike et al. [12], and Igberaharha [13], that attributed the poor competence and employment opportunity of graduates to the deployment of less competent trainers, outdated equipment and machinery as well as scarcity of instructional materials or consumables. Above all it confirms the findings by Melaku [10] that revealed the quality of the entire TVET system in Ethiopia being affected by resource scarcity with a consequent defect of equipping trainees with the necessary competencies.

3.3. Graduates' level of competence

In this study, graduate competence was examined by disaggregating competence into three major components: core, basic, and supplementary competencies. Among the three components of competence, graduates perceived that the supplementary ($M = 3.44$) and basic ($M = 3.30$) competencies are the highest and lowest competencies they acquired consecutively (see Table 7). Alike the graduates, trainers perceived that these two competencies are the highest and the lowest competencies that graduates have possessed. For the trainers, the basic competence of graduates ($M = 2.87$) is below average (see Table 7).

The t -test for independent samples unveiled (see Table 8) a strong mean difference between graduates and trainers ($t = 4.545$, $d = 0.558$; $t = 6.232$, $d = 0.857$ and $t = 6.571$, $d = 0.930$, for core, basic, and supplementary competencies respectively). Positive t -values and strong d -values demonstrate that students' perception of their competence is significantly higher than their trainers weigh them. This difference is due to the differences between the two in the acquaintance of level of competence. Trainers gauge the competence of their graduates relative to the standards set based on market requirements whereas graduates just compare their current competencies with their level of competencies before joining the TVET system. Their claim is also a reflection of the argument by Coleman [63] and

Table 5
Employment status and sex of graduates in year of graduation.

Variables			Years of graduation					Total
			2017/18	2018/19	2019/20	2020/21	2021	
Sex of the respondent	Male		1	29	38	210	5	283
	Female	#	1	26	41	222	4	294
		%	50.0	47.3	51.9	51.4	44.4	50.9
Total			2	55	79	432	9	577
Employment status	Employed	#	2	34	22	74	3	135
		%	100	61.8	27.8	17.1	33.3	23.4
	Unemployed		0	21	57	358	6	442
Total			2	55	79	432	9	577

Table 6
Composite mean scores of resource supply.

Resource Category	Variable	Supply size			
		Graduates (n = 577)		Trainers (n = 60)	
		Mean	Std. Dev	Mean	Std. Dev
Material resource	Quantity of profession-specific resources	2.40	0.528	2.11	0.474
	Quality of profession-specific resources	3.03	0.705	2.82	0.753
	Quantity of common resources	2.52	0.585	2.03	0.452
	Quality of common resources	3.07	0.712	2.76	0.700
	Quantity of basic resources	2.24	0.575	1.67	0.434
	Quality of basic resources	3.27	0.785	2.57	0.735
Human resource	Trainer competence	3.60	0.787	3.05	0.796
	Trainer commitment	3.12	0.831	3.03	0.808

Table 7
Composite mean scores of graduates' competence.

Components of Competence				
Participants	Statistics	Core Competence	Basic Competence	Supplementary Competencies
Graduates (n = 577)	Mean	3.54	3.30	3.44
	Std. Dev	3.08	2.42	3.43
Trainers (n = 60)	Mean	3.26	2.87	3.02
	Std. Dev	3.92	2.54	3.81

Table 8
Independent Samples *t*-test between Graduates and Trainers for Graduates' Competence.

Variables in competence dimensions		Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)	Mean Difference	Cohen's d
		F	Sig.					
PSC	Equal variances assumed	6.828	.009	4.545	635	.000	1.95350	.558
BC	Equal variances not assumed	.148	.700	6.232	70.929	.000	2.10994	.857
SC	Equal variances not assumed	.733	.392	6.571	69.298	.000	3.36886	.930

Shepperd et al. [64] which stipulate that self-serving or attribution bias manifested as a tendency of attributing success to the self and failure to external causes by individuals to distort reality in order to protect their ego. Otherwise, in view of the above sources, the claim by graduates for getting equipped with the necessary competence in a situation where TVET institutions are under severe problems of resource scarcity and trainer competence is not only groundless but also self-deceptive.

Mean score differences regarding the competencies of graduates were also compared and contrasted between employed and unemployed as well as male and female graduates. Irrespective of employment status and sex of graduates, as illustrated by Table 9, the mean scores regarding the perceptions of graduates about their own core competence are below average whereas the mean scores about their basic and supplementary competencies are above average for both graduate categories. In fact, the mean scores of employed graduates in all three forms of competency exceed the mean scores of the unemployed. This implies that employed graduates do have higher self-efficacy than their unemployed counterparts. With respect to sex, however, the mean scores demonstrated in the table inform that males' perception of their core and basic competencies is higher than those of their female counterparts whereas the reverse is true regarding their supplementary competencies.

Moreover, the mean scores of each group were computed by using an independent samples *t*-test to measure whether there was a significant mean difference in each case. The test result, shown in Table 10, revealed that there was a weak mean score difference between males and females regarding all the components of graduates' competence. With respect to the comparison between employed and unemployed graduates, it is only on the core competence of graduates that there are weak mean differences whereas

Table 9
Mean scores of graduates' competence based on their employment status and sex.

Dimensions of Competence	Employment status of graduates				Sex of graduates			
	Employed (N = 135)		Unemployed (N = 442)		Male (N = 283)		Female (N = 294)	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Core competence	2.63	5.41860	2.39	5.97398	2.53	5.9445	2.37	5.7809
Basic competence	3.54	2.38982	3.52	2.19497	3.57	2.2232	3.48	2.2408
Supplementary competence	3.44	3.32698	3.37	3.47724	3.42	3.3506	3.35	3.5221

there are no significant differences regarding the other two competence dimensions. This implies that female graduates have a little lower self-efficacy than their male counterparts, employed and unemployed graduates do not have that significant difference in their self-efficacy.

In general, all the findings from different participant groups in one way or another corroborate with earlier study findings (e.g., 58, 17, 59) that echoed graduates were subjected to unemployment because they were equipped with irrelevant occupations and poor competencies, likely due to lack of resource supply for the training delivery and the consequent poor training process.

3.4. The relationship between the antecedents and graduates' competencies

The central objective of this study was to determine the influences of IVs (demographic characteristics, trainers' competence, trainers' commitment, trainees' characteristics, resources supply, training practice, assessment procedures, and CT) on graduates' competencies. In order to have a clear picture of the competence level of graduates within each component of competence (core competence, basic competence, and supplementary competencies), data was recorded with the help of the data transformation process. To that effect, the composite score of each component set to measure the subscale was computed as per the rating scale (i.e., each item on a 5-point scale). Then the aggregate score of all items for each subscale was established. Accordingly, except for the demographic variables, each scale was aggregated to find an overall score for each of the variables under investigation.

As a result, the respondents' total score for core competence ranged from $n-5n$ (7–35), where n refers to the number of items used to measure the subscale. Similarly, the respondents' total scores for basic and supplementary competencies ranged from 4 to 20 and 6–30, respectively. While point-biserial correlation analyses were conducted to examine the relationship between components of graduate competencies and demographic variables, Pearson Product Momentum correlation was employed to examine the relationships between competence components and the three categories of IVs (human inputs, material inputs, and the training processes).

Finally, multiple regression analyses were carried out to determine the effects of the IVs (demographic characteristics, trainers' competence, trainers' commitment, trainees' characteristics, resources supply, training practice, assessment procedures, and CT) on the components of graduates' competence (core competence, basic competence, and supplementary competence). A linear multiple regression analysis was employed to screen out which variable among the IVs identified exerts a significant predictive power on the components of graduates' competence.

In this respect, the point bi-serial correlation analysis results (see Table 11) revealed that the core competence of graduates has a positive significant relationship with their sex and qualification level (i.e., $r = .099^*$, $p < .05$ and $r = 0.449^{***}$, $p < .001$ respectively) on the one hand, and a negative significant relationship ($r = -0.118^{**}$, $p < .01$) with their employment status, on the other. Similarly, graduates' basic competence has a positive significant relationship with sex ($r = 0.096^*$, $p < .05$) and level of qualification acquired ($r = 0.175^{***}$) but a non-significant negative relationship ($r = -0.024$, $p > .05$) with the employment status of graduates. Consistently, graduates' supplementary competence had a positive significant relationship with their sex and level of qualification acquired ($r = .090^*$, $p < .05$; $r = 0.343^{**}$, $p < .01$ consecutively) and a negative non-significant relationship with their employment status ($r = -0.077$; $p > .05$). In general, while the relationships of all the three competence dimensions of graduates with their sex and level of qualification have a positive and significant relationship, they have negative associations with employment status. The relationship between employment status and basic and supplementary competencies was not significant.

In light of the mean scores displayed in Table 9 above, the findings in Table 11 imply that better competence in the three dimensions of competence is directly associated with being male. Similarly, the level of qualification is directly associated with the level of competence of graduates. Nonetheless, surprisingly, inverse relationships have been found between each competence component and employment status. That is, employment status is inversely associated with all forms of graduates' competence.

As shown in Table 12, the results of the correlation analysis revealed that the core competence of graduates had significant positive relationships with trainer competence ($r = 0.23$, $p < .001$), trainer commitment ($r = 0.13$, $p < .01$), trainee characteristics ($r = 0.21$, $p < .001$), training practice ($r = 0.22$, $p < .001$), training assessment ($r = 0.42$, $p < .001$) and CT ($r = 0.97$, $p < .001$) on the one hand, and non-significant positive relationship with material resource supply ($r = 0.01$, $p > .05$ for quantity and $r = 0.04$, $p > .05$ for quality) on the other. The strongest relationship is exhibited between graduates' core competence and cooperative training. That is, graduates who were involved in cooperative training have acquired better core competence than those who had less involvement. In other words, the better the trainer's competence and commitment, trainee characteristics, training and assessment process, and CT, the better would be the core competence of the graduates. Both the quantitative and qualitative dimensions of resources, however, are not significantly related to graduates' core competence although the two have positive associations.

Table 10
Independent Samples *t*-test for Graduates' Competence Based on their Sex and Employment Status.

Competence Dimensions	Variable	t-test of Significance			Cohen's d
		t	df	Sig. (2-tailed)	
Core competence	Employment status	3.003	575	.003	0.040
	Sex	2.377	575	.018	0.027
Basic competence	Employment status	.570	575	.569	0.009
	Sex	2.310	575	.021	0.040
Supplementary competence	Employment status	1.850	575	.065	0.021
	Sex	2.166	575	.031	0.020

Table 11

Relationships between demographic characteristics and competences of graduates (N = 577).

Variables	1	2	3	4	5	6
1. Core competence	1.000	0.224**	0.491**	.099*	.449***	-.118**
2. Basic competence		1.000	0.765**	.096*	.175**	-.024
3. Supplementary competence			1.000	.090*	.343**	-.077
4. Sex				1.000	.068	.039
5. Level of Qualification					1.000	.002
6. Employment Status						1.000

***p < .001; **p < .01; *p < .05.

Table 12

Pearson correlation coefficients among IVs and competences of graduates (N = 577).

Variables	1	2	3	4	5	6	7	8	9	10	11
1.PSC	1.000	0.22***	.49***	.23***	.13**	.01	.04	.21***	0.22***	.42***	.97***
2.BC		1.000	.77***	.33***	.37***	.09	.02	.41***	.46**	.42**	.23**
3.SC			1.000	.34**	.36*	.07	.05	.42**	.42**	.44**	.48**
4.TCP				1.000	.76**	.02	.01	.55**	.52**	.45**	.22**
5.TCM					1.000	.02	.02	.59**	.54**	.42**	.12**
6.RQN						1.000	.77**	.05	.52**	.48**	.20**
7. RQL							1.000	.054	.01	.05	.03
8. TCHs								1.000	.52**	.48**	.20**
9.TP									1.000	.75**	.29**
10. TAs										1.000	.42**
11. CT											1.000

***p < .001; **p < .01; *p < .05.

PSC (Core Competence); BC (Basic Competence); SC (Supplementary Competence); TCP (Trainer Competence); TCM (Trainer Commitment); RQN (Resource Quantity); RQL (Resource Quality); TCHs (Trainee Characteristics); TP (Training Practice); TA (Training Assessment); CT (Cooperative Training).

Table 12 also depicted that graduates' basic competence has a significant positive relationship with competence and commitment of trainers ($r = .33, p < .001$ and $r = 0.37, P < .01$ respectively), the characteristics of trainees ($r = 0.41, P < .001$), training practice ($r = 0.46, P < .001$), training assessment ($r = 0.42, P < .001$) and CT ($r = 0.97, P < .001$) whereas it has a non-significant positive relationship with quantity ($r = 0.09, P > .05$) and quality ($r = 0.02, P > .05$) of resource supply. Regarding the supplementary competence of graduates, similarly, significant positive relationships were observed with the competence of trainers ($r = 0.34, p < .001$), the commitment of trainers ($r = 0.36, P < .01$), the characteristics of trainees ($r = 0.42, P < .001$), the training practice ($r = 0.42, P < .001$), training assessment ($r = 0.44, P < .001$) and CT ($r = 0.48, P < .001$). However, non-significant positive relationships were observed with both quantitative ($r = 0.07, P > .05$) and qualitative ($r = 0.05, P > .05$) aspects of resource supply. The quality and quantity of resource supply in TVETCs did not have significant relation with graduates' basic and supplementary competence more likely due to the fact that the practical training is delivered in companies through CT, despite poor it is, and hence it is the resource supply in such companies or enterprises that determines the competence of graduates.

All three dimensions of competencies exhibited the strongest association with CT and non-significant positive relationships with the quantity and quality of material resources' supply. The findings complement different sources of literature [e.g., 30, 26, 25, 27, 22] that advocate dual or cooperative training for enhancing competence and thereby employability of graduates. Moreover, the findings substantiated the concerns of Melaku [31] and MoSHE [43] that justified poor trainer competence, poor infrastructure, inadequate and outdated equipment, machinery and facility, and financial scarcity were the root causes of poor competence and less employability among TVET graduates. The absence of a significant relationship between the quantitative and qualitative dimensions of resource supply and the three forms of graduates' competencies implies that both trainers and graduates perceive that the role of material resource supply has a low contribution to graduate competence. This contrasts not only with the established facts of a wide range of literature [e.g., 11, 3, 8, 12, 13] that inform about the existence of a direct relationship between resource supply and trainee competence but also the fact that skills acquisition and trainee competence require resource supply for practical exercise besides the theoretical conceptualization of principles.

The strongest relationship was exhibited between graduates' core competence and CT which confirms the claim by many research reports [e.g., 30, 26, 25, 27, 22, 19, 28] about the utility of the dual approach for enhancing the core competence of graduates applies in the current study area too. Above all, the current finding coincided with the call by MoSHE [43] for strengthening the TVET-industry partnership to make it outcome-based and more relevant to the needs of the market and individual trainees.

3.5. The effect of the competence antecedents on the competencies of graduates

The linear multiple regressions entered in four steps in Table 13 portrayed that all the IVs of the study accounted for 96.9% of the variance in graduates' core competence. In other words, those factors specified in the table determined 96.9% of the core competence

of the graduates. The result also exhibited that the sex of respondents was not found statistically significant in explaining graduate core competence. Moreover, the entry of human inputs (trainer competence, trainer commitment, and trainee characteristics) into the regression equation (model 2) improved the R² value from 0.220 to 0.269 and the entry of material inputs (quantity and quality of resource supply) and the training process (training practice, training assessment, and CT) into the regression model improved the shared variance significantly (see models 3 and 4). The R² change values indicate that the most important factors of the IVs were the human inputs and the training process. The quantity and quality of resource supply were, however, the weakest predictors of DVs. After controlling the demographic characteristics considered in this study, the joint contributions of the IVs related to human inputs (trainer competence, trainer commitment, trainee characteristics, training practice, training assessment, and CT) considered in the study were statistically significant (at p < .001) factors in predicting graduates' core competence.

The current finding has both consistent and inconsistent features with earlier research findings and principally established facts (Adams, 2011; Amedorme & Fiagbe, 2013; AU, 2007; Ayonmike et al., 2015; Igberaharha, 2021). In agreement with prior literature and facts, on the one hand, the human resource played a significant role in predicting graduates' competence whereas, in contrast to earlier literature, on the other hand, material resource supply lacked to attribute the core competence of graduates.

Individually, the regression analysis results indicated that the IVs entered into the model – CT (β = 0.994, p < .001), trainers' competence (β = 0.227, p < .001), trainers' commitment (β = 0.184, p < .01) and trainee characteristics (β = 0.152, p < .01) – were significant predictors of the core competence of graduates. That is, about 99.4%, 22.7%, 18.4%, and 15.2% of the core competence of graduates was determined by CT, the competence of trainers, the commitment of trainers, and characteristics of trainees respectively.

A strong influence of the training practice on the core competence of graduates implies that the attempt made to introduce CBET as a component of CT, a major training delivery approach in Ethiopia these days, was not realized in line with the suggestions made by different sources of literature [such as 14, 16, 22, 18, 19]. That is, in contrast to Barrick [14], Brockmann et al. [21], and Kyobe [22], the training process was not managed in line with the principles and requirements of CBET that provides graduates with the opportunity to acquire competencies at their own pace to fit labor market demands. Otherwise, the performance of graduates should have met the demands of the workplace to ultimately stimulate graduate competencies and bridge the individual learning needs of graduates with the economic demands of the market.

The standardized regression coefficients that emphasized the basic competence of graduates are described in Table 14. As can be seen in the table, the strongest influence on this variable has originated from the training practices. The IVs described in the table accounted for 31.5% of the variance in the basic competence of graduates. In other words, 31.5% of the basic competence of the graduates was influenced by the aggregate effect of the variables described in the table.

Both the quantity and quality dimensions of resource supply, however, did not exhibit significant effects on graduates' basic competence. Furthermore, among the human variables entered into the regression equation to gauge their predicting power over the basic competence of graduates, qualification level (β = 0.126, p < .001), and commitment (β = 0.155, p < .05) of trainers as well as the characteristics of trainees (β = 0.283, p < .01) significantly predicted the basic competence of graduates. Similar to the human inputs, the entry of training practice (β = 0.369, p < .001) into the regression model did a good job of predicting graduates' basic competence. This is meant that the qualification level of trainers, the commitment of trainers, characteristics of trainees, training practice, and assessment respectively determine 12.6%, 15.5%, 28.3%, and 36.9% of the basic competence of graduates. As a whole, after controlling for the demographic variables, the results of the multiple regression analysis demonstrated that 28.9% of the variance in graduates' basic competence was explained by the IVs (trainer competence, trainer commitment, trainee characteristics, training practice, training assessment, and CT). Besides, that level of qualification acquired emerged as a significant positive contributor to graduates' basic competence (β = 0.170, p < .01). That is 17% of the basic competence of graduates is the function of their qualification level.

The regression results in Table 15 indicated that all the IVs considered in this study accounted for 45.3% of the variance in

Table 13
Multiple regression analyses for core competence of graduates (N = 577).

IVs: Demographic characteristics, Human inputs, Material inputs and training process	Model 1 Standardized coefficients (beta)	Model 2 Standardized coefficients (beta)	Model 3 Standardized coefficients (beta)	Model 4 Standardized coefficients (beta)
Sex	.061	.050	.055	.003
Level of qualification	.445**	.423**	.400**	.014
Employment Status	.116**	.111**	.081	.017
Trainer competence			.188*	.011
Trainer commitment			.176*	.010
Trainee characteristics			.160*	.021
Quantity of resources supplied			.133	.022
Quality of resources supplied			.053	.012
Training practice				.012
Assessment practice				.010
Cooperative Training				.994**
R2	.220	.269	.247	.969
Adjusted R2	.216	.261	.227	.968
R2 Change		.049	-.022	.722**
F (ANOVA)	53.656**	34.813**	12.035**	828.471**

***p < .001; **p < .01; *p < .05.

Table 14
Multiple regressions analyses for basic competence of graduates (N = 577).

IVs: Demographic characteristics, Human inputs, Material inputs and training process	Model 1 Standardized coefficients (beta)	Model 2 Standardized coefficients (beta)	Model 3 Standardized coefficients (beta)	Model 4 Standardized coefficients (beta)
Sex	.082*	.051	.082	.045
Level of qualification	.170**	.126**	.045	.015
Employment Status	.021	.018	.014	.030
Trainer competence		.041	.140	.090
Trainer commitment		.155*	.163*	.079
Trainee characteristics		.283**	.221**	.110
Quantity of resources supplied			.038	.083
Quality of resources supplied			.049	.081
Training practice				.369**
Assessment practice				.029
Cooperative training				.064
R2	.038	.215	.230	.315
Adjusted R2	.033	.206	.209	.289
R2 Change		.177**	.015*	.085*
F (ANOVA)	7.555**	25.876**	10.939**	12.095**

***p < .001; **p < .01; *p < .05.

graduates' supplementary competence. The regression analysis results revealed that the entry of trainers' competence, trainers' commitment, and trainees' characteristics into the regression model was able to improve R2 from 0.127 to 0.294. Individually, trainees' characteristics ($\beta = 0.301$, $p < .01$) and trainer commitment ($\beta = 0.117$, $p < .05$) in model 2 and training practice ($\beta = 0.330$, $p < .01$) and CT ($\beta = 0.336$, $p < .01$) in model 4 were found statistically significant contributors in predicting graduates' supplementary competence. That means, individually, trainee characteristics, trainer commitment, training process, and CT determined 30.1%, 11.7%, 33.0%, and 33.6% of the supplementary competence of graduates consecutively.

The findings from the regression analyses regarding all three competence dimensions coupled with the findings displayed in Table 9 corroborate the concerns of MoSHE [43] that condemned in its strategy document the TVET system for lacking to meet its goals in general and address the demands of the labor market in supplying competent middle-level skilled personnel in particular. That is likely because the competence and commitment of trainers, the supply of material resources, the implementation of CT, and the enthusiasm and commitment of trainees for TVET in general and for their occupation in particular, were identified as the predictors of the three dimensions of graduates' competence by this study, were likely below the required standard and magnitude. In relation to this, in contrast to a wide range of literature [such as 9, 14, 23, 15, 21, 16, 22, 17, 18, 19, 20], the findings of the regression analyses imply that TVETCs cannot practice CBET properly, an approach where training quality is measured by the competence achieved or the performance of trainees than the type and magnitude of courses taken and the theoretical knowledge acquired by the trainee.

4. Conclusion

The findings of this study are not generalizable to universities or higher education institutions. That is because TVET colleges and universities differ in their mission and context and participants were solely drawn from TVET colleges. That is, the former emphasizes on producing a middle-level labor force (levels I–V) whereas the latter focuses on producing graduates with higher-level qualifications, bachelor's degrees and above. In fact, the findings can be generalized to other fields of study (occupations other than AFP) in the TVET system of Ethiopia, including Polytechnic colleges, because structurally the TVET system incorporates both polytechnics and lower-level TVET qualifications. The current findings which disclosed the lack of supporting TVETCs with the necessary human and nonhuman resources and the reluctance of companies and enterprises to actively take part in cooperative training were the major bottlenecks in the efforts made to equip AFP trainees with employable competencies may therefore, inform about the entire TVET system. The existence of a formidable scarcity of infrastructure, workshops, machinery, consumable materials, and competent trainers, on the one hand, and very poor cooperative training, on the other, that handicapped the competencies of graduates is occupationally indiscriminate. This subjected most graduates to unemployment and livelihood problems although unemployment and competence, unusually, showed inverse relationships. Besides the scarcity of enterprises and/or companies that give employment opportunities for graduates, the lack of supplying finance, workplace, and market information by the government, and weak tenacity among graduates for self-employment are the daunting challenges faced by the employment opportunity of AFP graduates. The lack of employment opportunities among most AFP graduates after lots of investments and the opportunity costs are so painful and have far-reaching socio-economic consequences. Regarding the AFP sub-sector of TVET, accordingly, it will be logical to conclude that the TVET system lacked the institutional capacity to mobilize all stakeholders effectively, run the training process properly, equip trainees with the necessary competencies, and assure graduates with decent employment opportunities and livelihoods.

5. Implications of the study

The current findings informed that the human inputs considered in the study significantly predicted graduates' core competence whereas material resources had a very weak predicting power on the variable. This implies that CT and the professional and

Table 15
Multiple regressions analyses for supplementary competence of graduates (N = 577).

IVs: Demographic characteristics, Human inputs, Material inputs and training process	Model 1 Standardized coefficients (beta)	Model 2 Standardized coefficients (beta)	Model 3 Standardized coefficients (beta)	Model 4 Standardized coefficients (beta)
Sex	.062	.031	.062	.029
Level of qualification	.338**	.296**	.265**	.127*
Employment status	.075	.073*	.070	.057
Trainer competence		.043	.079	.009
Trainer commitment		.117*	.173*	.147*
Trainee characteristics		.301**	.254**	.125*
Quantity of resources supplied			.102	.094
Quality of resources supplied			.126	.133
Training practice				.330**
Assessment practice				.081
Cooperative training				.336**
R2	.127	.294	.318	.453
Adjusted R2	.123	.286	.299	.433
R2 Change		.167*	.019	.135*
F (ANOVA)	27.786**	39.329**	17.071**	21.797**

***p < .001; **p < .01; *p < .05.

methodological competence of trainers might have compensated the defects of resource supply in equipping graduates with the required competencies. Similarly, the inverse relationship between the employment status of graduates and all forms of their competencies implies that the severely complained unemployment problem among AFP graduates is due not only to their poor competence but also to factors other than their competence. So long as it is not supported with a more focused and exhaustive examination through triangulation of data both in terms of data sources and types, the contribution of human and material resources for graduates' competencies and the inverse relationship between competence and employment opportunity of graduates will remain mysterious.

Author contribution statement

Melaku Gebremeskel: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

The data that has been used is confidential.

Additional information

No additional information is available for this paper.

6. Recommendations

Paying adequate attention and practice the following may contribute highly to improve the competence and employability of TVET graduates in general and AFP graduates in particular:

- TVETCs have to improve the competence and commitment of their trainers and their material resource supply to equip graduates with the required competencies so long as the feasibility of CT is precarious.
- TVETCs need closely monitor the training and assessment practice to foster the overall competencies and employability of their graduates.
- TVETCs shall effectively introduce CBET to equip trainees with necessary competencies following everybody's pace of acquaintance.
- TVETCs must strengthen their relationship with IAIPs and other similar private enterprises to relieve resource scarcity problems and eventually equip trainees with the necessary competencies and eventually secure the employability of graduates.
- TVETCs should properly install the labor market information system and take the labor market demand and the inclination of trainees into consideration during the admission and placement of trainees to ultimately foster the passion of potential trainees and widen the employment opportunity of AFP graduates.
- The government shall devise mechanisms that encourage IAIPs and the private sector to get involved in CT.
- Local governments shall render necessary support for graduates to enhance their self-employment.
- The federal government has to make a rational choice and bold decision between two things: either commits itself to enforce legislations that introduce incentive mechanisms to attract the industry towards partnership in CT or abandon it completely and capacitate TVETCs with necessary human and material resources that equip graduates with employable competencies.

- The negative significant relationship between core competence and the employment status of graduates needs a deeper and more comprehensive investigation through a mixed research approach.

Declaration of competing interest

The authors declare no conflict of interest.

References

- [1] Ministry of Education, National Technical and Vocational Education and Training (TVET) Strategy: Building Ethiopia, EMPDE, 2008.
- [2] G. Afeti, Technical and Vocational Education and Training for Industrialization, Africa Research and Resource Forum, 2014.
- [3] S.K. Amedorme, Y.A.K. Fiagbe, Challenges facing technical and vocational education in Ghana, *Int. J. Sci. Technol. Res.* 2 (6) (2013) 253–255.
- [4] K. King, R. Palmer, Planning for Technical and Vocational Skills Development, UNESCO: International Institute for Educational Planning, Paris, 2010.
- [5] A.V. Adams, The Role of Youth Skills Development in the Transition to Work: A Global Review, The World Bank, New York, 2007.
- [6] V. Gasskov (Ed.), Vocational Education and Training Institutions: A Management Handbook and CD – ROM, ILO Publication, Geneva, 2007.
- [7] UNESCO, Transforming Technical and Vocational Education and Training: Building Skills for Work and Life (Main Working Document), 2012.
- [8] African Union, Strategy to Revitalize Technical and Vocational Education and Training (TVET) in Africa (Final Draft). Meeting of the Bureau of the Conference of Ministers of Education of the African Union – COMEDAF II+, 2007. Addis Ababa.
- [9] M. Aring, ASEAN Economic Community 2015: Enhancing Competitiveness and Employability through Skill Development, International Labor Organization, 2015.
- [10] M. Melaku, The practice of quality assurance in the TVET system of the state of Amhara as perceived by major stakeholders, *Bahir Dar J. Educ.* 19 (1) (2019) 80–104.
- [11] A.V. Adams, The Role of Skills Development in Overcoming Social Disadvantage (Background Paper Prepared for the Education for All Global Monitoring Report 2012), UNESCO Publication, 2011.
- [12] C.S. Ayonmike, P.C. Okwelle, B.C. Okeke, Towards quality technical vocational education and training (TVET) programs in Nigeria: challenges and improvement strategies, *J. Educ. Learn.* 4 (1) (2015) 25–34.
- [13] C.O. Igberaharha, Improving the quality of technical vocational education and training (TVET) for sustainable growth and development of Nigeria, *J. Educat. e-Learn. Res.* 8 (1) (2021) 109–115.
- [14] K. Barrick, Competence-based education in the USA, in: M. Mulder (Ed.), *Competence-based Vocational and Professional Education. Bridging the Worlds of Work and Education*, Springer, 2017, pp. 255–272.
- [15] H. Biemans, R. Wesselink, J. Gulikers, S. Schaafsma, J. Versteegen, M. Mulder, Towards competence-based VET: dealing with the pitfalls, *J. Vocat. Educ. Train.* 61 (3) (2009) 267–286.
- [16] L.P. Hauuanga, Competency-based education and training for the training of trainers in Vocational Education in Namibia: a curriculum evaluation, in: E. Friedhelm, H. Gesine, L. Bernd (Eds.), *Vocational Education and Training in Sub-saharan Africa: Current Situation and Development*, W. Bertelsmann Verlag GmbH & Co. KG, 2017, pp. 311–315.
- [17] P. Lolwana, Technical and vocational education and training in Sub-Saharan Africa: the missing middle in post-school education, in: E. Friedhelm, H. Gesine, L. Bernd (Eds.), *Vocational Education and Training in Sub-saharan Africa: Current Situation and Development*, W. Bertelsmann Verlag GmbH & Co. KG, 2017, pp. 11–24.
- [18] C. Mayombe, *Vocational Education and Training in Sub-saharan Africa: Evidence-Informed Practice for Unemployed and Disadvantaged Youth*, Palgrave Macmillan, 2021.
- [19] M. Mulder, Foundations of competence-based vocational education and training, in: M. Simon, M. Martin, p. Joy, S. Rebecca (Eds.), *Handbook of Vocational Education and Training: Developments in the Changing World of Work (1167-1192)*, Springer, 2018.
- [20] A.G. Watts, Career guidance and orientation, in: UNEVOC (Ed.), *Revisiting Global Trends in TVET: Reflections on Theory and Practice*, 2013, pp. 239–276.
- [21] M. Brockmann, L. Clarke, P. Mehaut, C. Winch, Competence-based vocational education and training (VET): the cases of England and France in a European perspective, *Vocat. Learn.* 1 (2008) 227–244.
- [22] E. Kyobe, The concept of competence-based assessment in vocational education and training, in: E. Friedhelm, H. Gesine, L. Bernd (Eds.), *Vocational Education and Training in Sub-saharan Africa: Current Situation and Development*, W. Bertelsmann Verlag GmbH & Co, 2017, pp. 257–263.
- [23] W. Bauer, M. Gessler, Dual vocational education and training systems in Europe: lessons learned from Austria, Germany, and Switzerland, in: E. Friedhelm, H. Gesine, L. Bernd (Eds.), *Vocational Education and Training in Sub-saharan Africa: Current Situation and Development*, W. Bertelsmann Verlag GmbH & Co. KG, 2017, pp. 48–66.
- [24] J. Lannert, Building up partnership: the Hungarian experience, in: D. Atchoarena (Ed.), *Getting the Stakeholders Involved: Partnership at Work in Three Countries from Asia, Africa, and Eastern Europe*, 1999, pp. 57–102. Paris, Retrieved from, www.unesdoc.unesco.org/iiep.
- [25] W. Eichhorst, N. Rodríguez-Planas, R. Schmid, K.F. Zimmermann, A Roadmap to Vocational Education and Training Systems Around the World. Discussion Paper, No. 7110, 2012.
- [26] C. Dustmann, U. Schönberg, What makes firm-based vocational training schemes successful? The role of commitment, *Am. Econ. J. Appl. Econ.* 4 (2) (2012) 36–61.
- [27] D. Horn, School-based Vocational or Workplace-Based Apprenticeship Training? Evidence on the School-To-Work Transition of Hungarian Apprentices, *EUI Working Papers*, 2013. MWP 2013/10.
- [28] J.I. Oviawe, Revamping technical vocational education and training through public-private partnerships for skill development, *Makerere J. High. Educ.* 10 (1) (2018) 73–91.
- [29] Ministry of Education, *Cooperative and In-Company Training Handbook*, 2010. Ethiopia.
- [30] E. Alet, L. Bonnal, Vocational Schooling and Educational Success: Comparing Apprenticeship to Full-Time Vocational High School, *Toulouse School of Economics*, 2011.
- [31] M. Melaku, The cooperative training delusion in Ethiopia: college-industry partnership discrepancy in the TVET system of the regional state of Amhara, *Ethiop. J. Educ.* 37 (1) (2017) 97–134.
- [32] E. Cameron, M. Green, *Making Sense of Change Management: A Complete Guide to the Models, Tools & Techniques of Organizational Change*, second ed., Kogan Page, 2009.
- [33] G. Muller-Christ, *Sustainable Management: Coping with the Dilemmas of Resource-Oriented Management*, Springer, 2011.
- [34] Y.C. Cheng, *New Paradigm for Re-engineering Education: Globalization, Localization, and Individualization*, Springer, 2005.
- [35] I.C.L. Ng, R. Maull, N. Yip, Outcome-based contracts as a driver for systems thinking and Service-Dominant Logic in Service Science: evidence from the defense industry, *Eur. Manag. J.* 27 (6) (2009) 377–387.
- [36] C. Mele, M. Colurcio, The evolving path of TQM: towards business excellence and stakeholder value, *Int. J. Qual. Reliab. Manag.* 23 (5) (2006) 464–489.
- [37] C. Mele, J. Pels, F. Polese, A brief review of systems theories and their managerial applications, *Serv. Sci.* 2 (1/2) (2010) 126–135.
- [38] S. Yamada, C.S. Otchia, Y. Shimazu, K. Taniguchi, N. Fekadu, Bridging the supply-demand gaps of the industrial workforce: findings from a skill assessment of garment workers in Ethiopia, in: *Interim Report of SKY, Skills, and Knowledge for Youths*, 2018.
- [39] Ministry of Industry, *Ethiopian Industrial Development Strategic Plan (2013-2025)*, 2020. Addis Ababa.

- [40] B. Alebel, G. Mulu, A. Girum, A. Berihu, in: *A Study on Industrial Park Development: Issues, Practices, and Lessons for Ethiopia*. Research Report 29, Ethiopian Development Research Institute, Addis Ababa, Ethiopia, 2017.
- [41] W.A. Ermias, *Regulating industrial Parks development in Ethiopia: a critical analysis*, Beijing Law Rev. 10 (2019) 23–60.
- [42] X. Zhang, T. Dejene, C. Zou, Z. Wang, J. Zhao, A.G. Eneyew, J. Dhavle, *Industrial Park Development in Ethiopia: Case Study Report*, UNIDO, 2018.
- [43] Ministry of Science and Higher Education, *Ethiopian technical and vocational education and training policy and strategy*, Addis Ababa (2020) 1–68.
- [44] J.W. Creswell, *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*, Pearson Education, 2014.
- [45] W.W. Daniel, C.L. Cross, *Biostatistics: A Foundation for Analysis in the Health Sciences*, seventh ed., John Wiley & Sons, 2013.
- [46] C.L. Abersson, *Applied Power Analysis for the Behavioral Sciences*, second ed., Taylor & Francis, 2019.
- [47] C. Cohen, L. Manion, K. Morrison, *Research Methods in Education*, sixth ed., Taylor and Francis group, 2018.
- [48] B.G. Tabachnick, L.S. Fidell, *Using Multivariate Statistics*, sixth ed., Pearson Education, Inc, 2013.
- [49] J. Bethlehem, *Applied Survey Methods: A Statistical Perspective*, John Wiley & Sons, Inc, 2009.
- [50] L.R. Gay, G.E. Mills, P. Airasian, *Educational Research: Competencies for Analysis and Applications*, tenth ed., Pearson Education Ltd, Boston, 2012.
- [51] C.H. Lawshe, *A quantitative approach to content validity*, Person. Psychol. 28 (4) (1975) 563–575.
- [52] J. Larson-Hall, *A Guide to Doing Statistics in Second Language Research Using SPSS*, Routledge, 2010.
- [53] P.C. Cozby, S.C. Bates, *Methods in Behavioral Research*, McGraw-Hill, New York, 2012.
- [54] A. Field, *Discovering Statistics Using SPSS*, 3rd ed., SAGE Publication, 2009.
- [55] Federal Democratic Republic of Ethiopia TVET Agency, *Updated National Manual for the Promotion, Recruitment, and Placement of TVET Leaders, Trainers, and Instructors*, May 2018. Addis Ababa.
- [56] Ministry of Education, *TVET Trainers' Career Structure, Qualification Requirements, and Promotion Implementation Manual (Volume II)*, 2010. Ethiopia.
- [57] Ministry of Education, *TVET Leaders' and Trainers' Qualifications Framework (TLTQF)*. Addis Ababa, Ethiopia, 2010.
- [58] A. Desta, *The integration of technical and vocational education and training to sustainable development education: a review of African case studies*, Int. J. Manag. Sci. Bus. Res. 1 (3) (2012) 1–14.
- [59] S.S. Manabete, B. Umar, *Technical and vocational education and training for job creation in Nigeria*, Int. J. Bus. Administrat. Stud. 4 (1) (2018) 21–30.
- [60] Ministry of Education, *Labor Market Information System for TVET Providers (Manual)*, 2010. Addis Ababa, Ethiopia.
- [61] P. Krishnan, I. Shaorshadze, *Technical and Vocational Education and Training in Ethiopia*, International Growth Center (IGC), London School of Economics and Political Sciences, 2013.
- [62] UNESCO, *Enhancing Relevance in TVET: Review of Progress in the Asia-Pacific since 2012*, UNESCO Bangkok Office, 2016.
- [63] M.D. Coleman, *Emotion and the self-serving bias*, Curr. Psychol. 30 (2011) 345–354.
- [64] J. Shepperd, W. Malone, K. Sweeny, *Exploring the causes of self-serving bias*, Soc. Personal. Psychol. Compass 2/2 (2008) 895–908.