Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Influence of Technical and Vocational Education and Training on Skills Gap in the Masonry Workforce in Karamoja Sub-Region, Eastern Uganda: A Cross-Sectional Study

Hellen Grace Akite
Ogalai Vocational Training Institute, P.O. Box 10, Amuria, Uganda.
Sunday Mark Oyet
sundaymarkoyet@gmail.com
St. John Bosco Teacher Training Institution, Nyondo. P.O. Box 920, Mbale, Uganda.
John Simiyu
University of Eldoret

Research Article

Keywords: Technical and Vocational Education and Training, Skills gap, Masonry workforce, Construction industry, Moroto District, Uganda

Posted Date: October 30th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11131631/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

This study examined the influence of Technical and Vocational Education and Training (TVET) on the skills gap among masonry workers in Karamoja Sub-region, Eastern Uganda. Despite ongoing TVET efforts, the masonry workforce continues to exhibit notable skill deficiencies, suggesting a mismatch between training and industry demands. The study aimed to: (i) assess TVET's influence on skill levels, (ii) identify specific skills gaps, and (iii) examine factors affecting training effectiveness. A cross-sectional design was used, with a sample of 109 selected through multi-stage sampling. Quantitative data were collected through questionnaires and analyzed using descriptive statistics, whereas qualitative data were collected through and interviews and analyzed using qualitative content analysis. Findings show that TVET positively influenced masonry skills, with respondents reporting improvements in handling complex tasks (3.50 ± 1.209), work performance (3.46 ± 1.253), quality of work (3.46 ± 1.083), confidence (3.41 ± 1.197), and application of new techniques (3.29 ± 1.191). However, significant skills gaps remained in advanced masonry techniques, site management, architectural drawing interpretation, and modern construction practices. Key inadequacies included limited practical exposure (3.30 ± 1.136), mismatch between taught skills and job requirements (3.24 ± 1.226), and incomplete coverage of essential techniques (3.41 ± 1.268). Training was further constrained by limited resources (3.50 ± 1.172), unqualified trainers (3.58 ± 1.251), short program durations (3.47 ± 1.262), insufficient materials and equipment (3.55 ± 1.142), lack of refresher courses (3.59 ± 1.159), environmental factors (3.40 ± 1.196), and inadequate feedback integration (3.49 ± 1.153). The study concludes that although TVET improves basic skills and work quality, it remains insufficient to close the industry-required skills gap. Systemic reforms are necessary to align TVET with industry demands, including extending training duration, integrating advanced practical modules, strengthening TVET-industry partnerships, upgrading training resources, and establishing continuous professional development.

Introduction

The construction sector serves as a fundamental driver of economic growth and regional development globally, significantly contributing to infrastructure expansion and job creation [1]. The industry's growth is propelled by factors such as rapid urbanization, population increases, and large-scale infrastructure projects aimed at meeting the demands of emerging economies [2, 3]. In monetary terms, the global construction industry generates approximately ten trillion United States dollars (US$10) annually and is projected to maintain its role as a key contributor to economic development in the foreseeable future [4]. In developing countries, particularly in Africa, building construction accounts for over 70% of total construction expenditure, underscoring its critical role in shaping national economies [5]. In Uganda, the construction sector contributes over 12% to the Gross Domestic Product (GDP) and has experienced steady growth over the past two decades [6]. This expansion has been largely driven by an increasing reliance on building sites for employment, as civil engineering projects remain predominantly mechanized [7]. However, despite its economic significance, Uganda's construction industry continues to grapple with low productivity, which remains a major concern for developing nations [8]. A primary factor contributing to low productivity in Uganda's construction sector is the mismatch between the skills

required by the industry and the competencies possessed by the workforce. This gap has been exacerbated by rapid technological advancements associated with the Fourth Industrial Revolution, which have led to transformative changes in construction practices. Emerging technologies such as Building Information Modeling (BIM), automation, artificial intelligence, data analytics, and human-machine communication are increasingly being adopted to enhance project performance by reducing costs, improving quality, and optimizing timelines [9, 10]. However, these advancements highlight significant deficiencies in the workforce's technical competencies, creating challenges for industry adaptation [1].

Technology education plays a crucial role in equipping construction workers with the necessary skills to meet industry demands. Studies have shown that formal educational training programs significantly impact workforce competency, particularly in developing technological proficiency and project management skills [11, 12]. Despite this, construction education and training in Uganda remain insufficient in addressing the industry's evolving skill demands. There is a notable gap between the technical skills imparted through vocational education and those required by employers, particularly in areas such as digital construction techniques, cyber security, data analytics, and automation [1, 13]. The Ugandan government, through the Uganda Skills Development Project (USDP), has introduced reforms aimed at strengthening TVET through competency-based curricula, improved assessment, and greater industry relevance [14]. However, the sector continues to face quality assurance challenges that affect its professionalism and effectiveness [15]. Negative social perceptions also remain a concern, as TVET is sometimes viewed by parents and communities as a second-choice pathway, reducing its attractiveness to prospective learners [16]. These challenges are further compounded by inadequate funding, limited access to modern training equipment, and low instructor motivation, which constrain the ability of training institutions to provide high-quality, market-relevant skills training [17]. Even more concerning, existing research has largely focused on the implications of technological advancements and skill gaps in the construction industry at a macro level. For instance, studies by Alaghbari et al. [8] and Osunsanmi et al. [9] emphasize the impact of digital transformation on construction efficiency but do not specifically examine how education and training programs influence workforce competency. Furthermore, previous studies have not adequately addressed the skills gap within Uganda's construction industry, particularly among masonry workforce in underdeveloped regions such as Karamoja.

Moroto, Napak and Nakapiripirit districts, located in Eastern Uganda, face unique challenges related to masonry workforce skills development due to limited access to quality educational training, insufficient technological resources, and inadequate infrastructure [18]. Additionally, many construction workers lack essential technical skills, modern tools, and industry-specific knowledge necessary for executing construction projects effectively [19]. This deficiency has contributed to substandard work, project delays, increased operational costs, and reduced competitiveness of the masonry workforce. Moreover, the rapid advancement of construction technologies, changing building standards, and the complexity of modern projects require a workforce that is adaptable and well-trained [20, 21]. However, existing TVET programs may not be adequately aligned with industry needs, leading to a workforce that struggles to

meet market expectations. This misalignment results in a reliance on foreign expertise, increased costs for on-the-job training, and overall inefficiencies in project execution [22]. Therefore, addressing the above gaps is critical to aligning workforce capabilities with industry needs and ensuring sustainable development in the region. Given the urgent need for a well-trained workforce to sustain the growth of the construction industry, this study sought to assess the influence of TVET on the skills of masonry workforce in Moroto, Napak and Nakapiripirit districts, identify the specific skill gaps, and examine the factors influencing the effectiveness of TVET programs in addressing these gaps. The findings of this study provide evidence-based recommendations to enhance training programs, bridge the skills gap, and improve workforce productivity and efficiency in Uganda's construction sector.

Methods

Aim and research design

The purpose of this study was to investigate the influence of Technical and Vocational Education and Training on skills gap in the masonry workforce in Moroto, Napak and Nakapiripirit districts, Eastern Uganda. The study adopted a descriptive cross-sectional survey design, utilizing both qualitative and quantitative methods of data collection. This design was appropriate as it enabled the researcher to collect data from a sample population at a specific point in time to understand their preferences, practices, and interests [23]. The cross-sectional design allowed for the simultaneous collection of data on multiple variables, enabling the examination of relationships between TVET and skills gap indicators at a single point in time.

Study area

The study was conducted in Moroto, Napak, and Nakapiripirit Districts in the Karamoja Sub-region of northeastern Uganda (Fig. 1). Moroto District lies between latitudes 1°53' and 3°05' N and longitudes 33°38' and 34°56' E, with an elevation of about 1,356–1,524 metres above sea level [24, 25]. The districts have a largely semi-arid landscape, with mountainous areas including Mount Moroto [26, 27]. The three districts are dominated by the Karimojong, a Nilotic ethnic group with a semi-nomadic pastoral lifestyle centered on cattle herding. According to the 2024 Uganda Bureau of Statistics (UBOS) Census, Moroto District had a population of 103,639, while Napak and Nakapiripirit had populations of 211,830 and 111,681, respectively [28]. Napak District is located at approximately 2°12' N and 34°18' E, at about 1,500 metres above sea level, while Nakapiripirit is located at approximately 1°55' N and 34°40' E, at about 1,300 metres above sea level [28]. The study sites were Moroto Technical Institute in Ngoleriet Sub-County, Napak District; St. Daniel Comboni Polytechnic-Naoi in Moroto Municipality, Moroto District; and Nakapiripirit Technical Institute in Nakapiripirit Town Council, Nakapiripirit District. These districts were selected due to their predominantly informal construction workforce, where many builders acquired skills on the job without formal training [29]. This informality often led to technical deficiencies and non-compliance with industry standards. The district's limited access to formal educational opportunities

further exacerbated these challenges, making it an ideal location for examining how educational training could address the skills gap in the construction sector.

Characteristics of participants

The target population comprised masons, instructors for building and construction courses, and heads of TVET institutions. Masons were selected for their hands-on construction experience and understanding of the effects of formal training. Instructors ensured that students acquired the skills and knowledge required to meet industry demands, while heads of TVET institutions offered valuable perspectives on the alignment between training programs and industry needs. Only respondents with formal technical training or professional certification were included in the study. Masons without formal training, workers outside the specified categories, professionals from non-registered construction sites, and inactive or retired professionals were excluded.

Sample size determination

The sample size was determined using Krejcie and Morgan's (1970) table [30], yielding a total of one hundred nine (109) respondents from a population of one hundred thirty eight (138). The sample sizes for each group were determined based on proportional allocation and comprised of heads of three (3) TVET institutions, fourteen (14) instructors, and ninety two (92) masons.

Sampling procedures

The current study utilized a multistage sampling procedure to select the respondents. In the first stage, Moroto, Napak and Nakapiripirit districts were purposively selected. In the second stage, one TVET institution was purposively selected from each district, namely Moroto Technical Institute in Ngoleriet Sub-county, Napak District; St. Daniel Comboni Polytechnic–Naoi in Moroto Municipality, Moroto District; and Nakapiripirit Technical Institute in Nakapiripirit Town Council, Nakapiripirit District. In the third stage, the heads of the three institutions and 14 instructors were purposively selected from the respective institutions. In the fourth stage, registered construction sites within the study areas were identified and purposively selected based on the inclusion criteria, particularly formal registration. Finally, eligible TVET-trained masons working at the selected construction sites were purposively selected based on their roles and experience in the construction industry. The masons comprised of 31 from Napak, 31 from Moroto, and 30 from Nakapiripirit, giving a total sample of 92 respondents. This approach ensured that the study included participants with relevant TVET training and practical experience in masonry.

Data collection instruments

The study used a structured questionnaire with closed-ended questions for masonry workers and face-to-face interviews for key informants. Two research assistants were selected and trained on research

ethics to assist in data collection. Recruitment was based on their previous research experience and proficiency in local dialects and English.

The structured questionnaire was administered to masons who had attended formal education in TVET institutions. The questionnaire featured closed-ended questions with a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree) to evaluate the impact of educational training on skill, the relationship between skills gaps and training quality, and factors affecting training effectiveness. The Likert scale was selected for its ability to capture respondent feedback efficiently, and structured questionnaires were cost-effective, easy to administer, and ensured respondent confidentiality [31, 32].

A structured interview guide was used to collect qualitative data from thirteen (13) key informants, who comprised of ten (10) building and construction instructors and three (3) heads of TVET institutions. This method facilitated face-to-face interaction, enabling the researcher to gather in-depth insights and additional information not captured through the questionnaire [33]. The interviews focused on understanding the impact of educational training on the masonry workforce's skill levels, identifying specific skill gaps, and examining factors affecting the effectiveness of training.

Validity and reliability

Validity refers to the extent to which an instrument accurately measures the concept or phenomenon it is intended to assess [34]. To ensure that the instruments were appropriate for the intended purpose, face validity was first established through review by the researcher's supervisors and colleagues. Their feedback led to adjustments in wording, sequencing, and clarity of questions to better align them with the study objectives. Content validity was then assessed through expert judgment. A panel of six experts in Education, Vocational Training, and Construction Workforce evaluated each item for relevance and clarity, using a 4-point rating scale (1 = Not relevant, 2 = Somewhat relevant, 3 = Quite relevant, 4 = Highly relevant). Items rated 3 or 4 were considered "relevant."

The Content Validity Index (CVI) was computed using the formula:

$$\text{CVI} = \frac{\text{Number of items rated relevant by all judges}}{\text{Total number of items in the instrument}}$$

For this questionnaire, 37 items out of 43 were rated as relevant by all six experts, yielding a CVI of 0.86. According to Amin [23] and Krishnan & Ramasamy [35], a CVI of 0.70 or higher is considered acceptable. The obtained CVI of 0.86 demonstrates a high level of content validity, confirming that the questionnaire items were relevant, comprehensive, and well-aligned with the study's objectives.

The reliability of the data collection instruments was established through a pilot study conducted in Kotido District, involving 18 respondents (representing 5% of the total sample size). The pilot study was

designed to test the consistency of the instruments, identify potential weaknesses, and ensure that the items would yield stable and consistent results during the main study. Respondents completed the questionnaires, and their responses were analyzed for internal consistency using Cronbach's Alpha in SPSS (version 20). Cronbach's Alpha is a widely used statistic for determining the internal consistency of a research instrument. Values range from 0 to 1, with values of 0.70 and above considered acceptable for research purposes [23, 36]. The obtained Cronbach's Alpha coefficient of 0.82 indicates good internal consistency, suggesting that the items in the questionnaire reliably measured the intended constructs. To further ensure reliability during the main study, all field assistants were thoroughly trained on data collection procedures and protocols, including administering the questionnaire in a standardized manner and maintaining consistency in recording responses. Strict supervision was also provided throughout the data collection process to minimize errors and ensure uniformity.

Data collection procedures

The questionnaire was designed to gather information in line with the research questions. The tool was developed and then administered to the respondents. The objectives and purpose of the study were explained to the respondents prior to completion. Additionally, participants who agreed to participate in the study were required to sign a consent form. Study assistants assigned each respondent a code to conceal their identity.

For the interviews, before each interview, the researcher obtained consent from the respondents to record the conversation. The interviews were guided by open-ended questions designed to encourage participants to share their thoughts and experiences related to the study objectives. The researcher probed for clarification and further details as needed. One research assistant assisted by recording the interviews using an electronic device, and the conversations were transcribed verbatim for analysis. Each interview lasted approximately 45 to 60 minutes. This approach ensured that the study captured rich, detailed responses that directly addressed the research objectives.

Statistical analysis

All raw data were first entered into a Microsoft Excel worksheet for preliminary exploration and data cleaning before transferring them into Statistical Package for Social Scientists (SPSS) version 20 to generate descriptive statistics. Quantitative data were analysed using descriptive statistics in the form of frequencies, percentages, mean, standard deviations, and tables. The mean scores were interpreted using a five-point Likert scale interpretation framework where scores of 4.1–5.0 indicated very high agreement, 3.1–4.0 indicated high agreement, 2.1–3.0 indicated moderate agreement, 1.1–2.0 indicated low agreement, and 0.0–1.0 indicated very low agreement.

Qualitative data from key informant interviews were analyzed using qualitative content analysis based on their level of recurrence within the collected data and in line with the key research questions. The data were first transcribed from the tapes recorded during the individual dialogues/discussions. Thereafter, the transcribed data were categorized according to emerging themes from each question in the

interview guide and discussions. All data sources were triangulated during the analysis to increase data validity.

Results

Demographic characteristics of respondents

As indicated in Table 1 below, the study involved 92 masonry respondents, with the majority being male (84.8%) and a smaller proportion female (15.2%). The age distribution showed that most respondents were aged 26–36 years (32.6%), followed by 18–25 years (29.3%), 36–45 years (18.5%), 46–55 years (14.1%), and 56 years and above (5.4%). Regarding educational attainment, most respondents held a certificate (29.3%) or diploma (20.7%), while 23.9% had completed secondary education, 16.3% primary, 5.4% a bachelor's degree, and 4.3% had no formal education. Work experience was largely between 6–10 years (43.5%), followed by 1–5 years (29.3%), 11–15 years (16.3%), and 16 years and above (10.9%). In terms of employment type, nearly half of the respondents were casual labourers (48.9%), 35.9% were permanent employees, and 15.2% were self-employed. Regarding training, 62.0% had received some form of training, while 38.0% had not. Training frequency varied, with 38.0% never trained, 25.0% rarely trained, 17.4% occasionally trained, 12.0% frequently trained, and 7.6% always trained. The findings indicate that the masonry workforce in the study area is predominantly young to middle-aged, male, moderately educated, and engaged mostly in casual labor, with varied levels of training experience.

Table 1
Demographic characteristics of respondents

Demographic characteristics	Category	Frequency (n)	Percentage (%)
Gender of respondents	Male	78	84.8
	Female	14	15.2
	Total	**92**	**100**
Age range of respondents	18–25	27	29.3
	26–36	30	32.6
	36–45	17	18.5
	46–55	13	14.1
	56 and above	5	5.4
	Total	**92**	**100**
Level of education of respondents	No formal education	4	4.3
	Primary	15	16.3
	Secondary	22	23.9
	Certificate	27	29.3
	Diploma	19	20.7
	Bachelors' Degree	5	5.4
	Total	**92**	**100**
Years of experience	1–5 years	27	29.3
	6–10 years	40	43.5
	11–15 years	15	16.3
	16 and above	10	10.9
	Total	**92**	**100**
Type of employment	Casual labourer	45	48.9
	Permanent employee	33	35.9
	Self-employed	14	15.2
	Total	**92**	**100**
Training received	No	35	38
	Yes	57	62

Demographic characteristics	Category	Frequency (n)	Percentage (%)
	Total	**92**	**100**
Training frequency	Never	35	38
	Rarely	23	25
	Occasionally	16	17.4
	Frequently	11	12
	Always	7	7.6
	Total	**92**	**100**

Impact of TVET on skill levels of the masonry workforce

The results from Table 2 below indicated that educational training positively influenced the masonry skills and performance of respondents. For instance, the ability to handle complex masonry tasks recorded the highest mean score (3.50 ± 1.209), with 21.7% of respondents strongly agreeing and 34.8% agreeing. Work performance (3.46 ± 1.253) and quality of masonry work (3.46 ± 1.083) were also highly rated, with 22.8% and 15.2% strongly agreeing and 31.5% and 37.0% agreeing, respectively. Confidence in performing masonry tasks scored 3.41 ± 1.197, with 17.4% strongly agreeing and 34.8% agreeing, while the ability to apply new techniques in daily work had a mean of 3.29 ± 1.191, with 15.2% strongly agreeing and 31.5% agreeing. Reduction of errors (3.37 ± 1.136) and increased work speed (3.46 ± 1.123) were reflected with 14.1%–18.5% strongly agreeing and 30.4%–32.6% agreeing. Similarly, the relevance of the training to masonry work (3.37 ± 1.146) and overall improvement in masonry skills (3.37 ± 1.136) were reported with 14.1% strongly agreeing and 38.0% agreeing.

Table 2
Respondents' perceptions of the effect of TVET on masonry skills

Statements	SA n (%)	A n (%)	N n (%)	D n (%)	SD n (%)	Mean ± SD
Technical Vocational Educational and Training has improved my overall masonry skills.	13 (14.1%)	35 (38.0%)	25 (27.2%)	11 (12.0%)	8 (8.7%)	3.37 ± 1.136
I am more confident in performing masonry tasks after completing technical vocational education and training.	16 (17.4%)	32 (34.8%)	30 (32.6%)	2 (2.2%)	12 (13.0%)	3.41 ± 1.197
The technical vocational education and training I received has contributed to better work performance.	21 (22.8%)	29 (31.5%)	23 (25.0%)	9 (9.8%)	10 (10.9%)	3.46 ± 1.253
I can now apply new techniques learned during technical vocational education and training in my daily work.	14 (15.2%)	29 (31.5%)	30 (32.6%)	8 (8.7%)	11 (12.0%)	3.29 ± 1.191
Technical vocational education and training has improved the quality of my masonry work.	14 (15.2%)	34 (37.0%)	32 (34.8%)	4 (4.3%)	8 (8.7%)	3.46 ± 1.083
The technical vocational education and training programs I have attended are relevant to my masonry work.	13 (14.1%)	35 (38.0%)	26 (28.3%)	9 (9.8%)	9 (9.8%)	3.37 ± 1.146
The skills acquired from technical vocational education and training has helped me work faster.	17 (18.5%)	30 (32.6%)	30 (32.6%)	8 (8.7%)	7 (7.6%)	3.46 ± 1.123
I feel that technical vocational education and training has reduced errors in my masonry work.	13 (14.1%)	34 (37.0%)	28 (30.4%)	8 (8.7%)	9 (9.8%)	3.37 ± 1.136
I am able to handle complex masonry tasks better after technical vocational education and training	20 (21.7%)	32 (34.8%)	23 (25.0%)	8 (8.7%)	9 (9.8%)	3.50 ± 1.209
The quality of my work has improved since I began attending technical vocational education and training sessions.	17 (18.5%)	32 (34.8%)	25 (27.2%)	10 (10.9%)	8 (8.7%)	3.43 ± 1.170

SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree, SD= Standard Deviation. Mean ± SD is calculated using the numeric coding (1 = SD, 2 = D, 3 = N, 4 = A, 5 = SA).

The above quantitative findings were consistent with the views of the instructors. They emphasized that training programs improve basic skills but highlighted limitations in advanced competencies.

Instructor 1 remarked: *"Technical vocational education and training improves basic skills but not advanced techniques. Trainees can handle simple bricklaying and basic structural work, yet they struggle with complex tasks like multi-story constructions and precision detailing, which limits their overall competency on real projects."*

Similarly, Instructor 8 stated: *"Good impact on foundational skills; advanced skills still lacking. Trainees gain confidence in basic masonry but are not fully prepared for more demanding site activities."*

Instructor 2 noted: *"Training builds foundation but does not fully prepare trainees for real site challenges. While they understand theory and basic techniques, they often need supervision and corrective guidance when confronted with site-specific problems."*

Instructor 3 added: *"Programs moderately improve skills; trainees still need guidance. They are confident with small-scale tasks but cannot independently manage large projects or make judgment calls when unexpected issues arise."*

The heads of TVET institutions further corroborated these findings.

Head 1 observed: *"Our training programs have significantly helped learners acquire foundational masonry skills such as proper mixing of mortar and laying straight walls, but we still see a gap when it comes to more advanced techniques like structural planning."*

Head 2 emphasized the constraints of short-duration programs: *"The training has been impactful, especially for beginners, but its short duration limits the extent to which learners can master complex construction skills."*

Head 3 confirmed deficiencies in advanced technical areas, noting: *"We have seen improvements in basic workmanship among trainees; however, advanced areas like reading technical drawings or interpreting measurements are still lacking."*

Skills gap in the masonry workforce

The results in Table 3 indicated that respondents perceived notable gaps between educational training and the actual skills needed in the masonry field. The belief that there are specific areas of masonry where training has been inadequate recorded the highest mean score (3.55 ± 1.062), with 45.7% of respondents agreeing and 15.2% strongly agreeing. The view that the lack of practical training contributes to the skills gap (3.54 ± 1.094) and that the existing skills gap affects the quality of work in masonry projects (3.49 ± 1.418) were also highly rated, with between 25.0%–35.9% agreeing and 19.6%–31.5% strongly agreeing. Respondents also agreed that the quality of educational training does not meet the needs of the construction industry in the study area (3.48 ± 1.104) and that filling the skills gap would improve the quality of masonry work (3.37 ± 0.991). Furthermore, there was recognition of a mismatch

between the skills taught and the actual demands of the job (3.24 ± 1.226) and that the training received did not cover all necessary masonry techniques (3.41 ± 1.268). The perception that current training programs do not fully address individual skills (3.37 ± 1.340) and that there is a noticeable gap between the skills taught and those needed in the field (3.42 ± 1.225) were also reflected, with between 19.6%–32.6% strongly agreeing and 25.0%–38.0% agreeing. Finally, the suggestion that training programs should be updated to address current skills gaps in masonry scored 3.32 ± 1.283, with 32.6% agreeing and 18.5% strongly agreeing.

Table 3
Perceptions on skills gaps in masonry training in Moroto, Napak and Nakapiripiriti districts

Statement	SA n (%)	A n (%)	N n (%)	D n (%)	SD n (%)	Mean ± SD
There is a noticeable gap between the skills taught in technical vocational education and training and the skills needed in the field.	17 (18.5%)	35 (38.0%)	20 (21.7%)	10 (10.9%)	10 (10.9%)	3.42 ± 1.225
The technical vocational education and training I received did not cover all the necessary masonry techniques.	21 (22.8%)	26 (28.3%)	26 (28.3%)	8 (8.7%)	11 (12.0%)	3.41 ± 1.268
I feel that my skills are not fully addressed by the current technical vocational education and training programs.	20 (21.7%)	30 (32.6%)	21 (22.8%)	6 (6.5%)	15 (16.3%)	3.37 ± 1.340
There are specific areas of masonry where technical vocational education and training has been inadequate.	14 (15.2%)	42 (45.7%)	24 (26.1%)	5 (5.4%)	7 (7.6%)	3.55 ± 1.062
The quality of the technical vocational education and training does not meet the needs of the construction industry in Moroto.	15 (16.3%)	36 (39.1%)	26 (28.3%)	8 (8.7%)	7 (7.6%)	3.48 ± 1.104
The existing skills gap affects the quality of work in masonry projects.	29 (31.5%)	23 (25.0%)	19 (20.7%)	6 (6.5%)	15 (16.3%)	3.49 ± 1.418
The lack of practical training contributes to the skills gap in the masonry workforce.	18 (19.6%)	33 (35.9%)	28 (30.4%)	7 (7.6%)	6 (6.5%)	3.54 ± 1.094
There is a significant mismatch between the skills taught and the actual demands of the job.	12 (13.0%)	33 (35.9%)	25 (27.2%)	9 (9.8%)	13 (14.1%)	3.24 ± 1.226
I believe that filling the skills gap would improve the quality of masonry work.	9 (9.8%)	36 (39.1%)	32 (34.8%)	10 (10.9%)	5 (5.4%)	3.37 ± 0.991
The technical vocational education and training program should be updated to address current skill gaps in the masonry field.	17 (18.5%)	30 (32.6%)	23 (25.0%)	9 (9.8%)	13 (14.1%)	3.32 ± 1.283

SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree, SD= Standard Deviation. Mean ± SD is calculated using the numeric coding (1 = SD, 2 = D, 3 = N, 4 = A, 5 = SA)

These findings are consistent with the views of the instructors. They emphasized that training programs, while providing foundational knowledge, still leave notable gaps in advanced masonry techniques, site management, and essential soft skills.

Instructor 1 remarked: *"Trainees struggle with advanced bricklaying and planning. They often fail to apply proper alignment and spacing techniques and have difficulty visualizing the sequence of construction tasks, resulting in delays and inconsistent quality."*

Similarly, Instructor 2 stated: *"Weak leveling, measurement, and site management skills are common among trainees. Many trainees cannot accurately calculate quantities or manage resources on-site, limiting their ability to work efficiently."*

Instructor 4 added: *"Trainees cannot work independently on larger projects. They struggle with coordinating tasks with others, following complex plans, and ensuring safety protocols."*

Instructor 7 noted: *"Mixing, structural masonry, and safety gaps exist. Lack of hands-on practice makes them prone to errors, particularly with advanced structural designs."*

The heads of TVET institutions further corroborated these observations.

Head 1 emphasized: *"Most trainees struggle with interpreting architectural drawings, which is a direct result of limited exposure during the training sessions."*

Head 2 highlighted the inadequacy of content depth: *"Advanced bricklaying techniques, such as handling corners, arches, or roofing structures, remain a major gap. This shows that our training content is still too shallow."*

Head 3 confirmed shortcomings in technical and applied skills: *"Skills such as accurate measurement, mixing ratios, and planning for durability are missing. The short-term training programs do not cover these aspects adequately."*

Factors affecting the effectiveness of TVET in addressing skills gap among the masonry workforce

The results from Table 4 revealed several factors affecting the effectiveness of educational training in addressing skills gaps among the masonry workforce in Moroto, Napak and Nakapiripiriti districts. Limited resources were perceived as a major constraint, recording a mean score of 3.50 ± 1.172, with 21.7% of respondents strongly agreeing and 33.7% agreeing. The lack of qualified trainers also affected training effectiveness (3.58 ± 1.251), with 27.2% strongly agreeing and 30.4% agreeing. Short training duration was noted as a limitation (3.47 ± 1.262), with 21.7% strongly agreeing and 34.8% agreeing, while insufficient practical applications in training programs scored 3.30 ± 1.136, with 9.8% strongly agreeing and 43.5% agreeing. Environmental factors were recognized as influential, with a mean of 3.40 ± 1.196, where 18.5% strongly agreed and 33.7% agreed. Access to materials and equipment was highlighted as

critical for learning quality (3.55 ± 1.142), with 22.8% strongly agreeing and 32.6% agreeing. Lack of follow-up or refresher courses had a mean of 3.59 ± 1.159, with 20.7% strongly agreeing and 41.3% agreeing, while the pace of training was considered too fast for adequate absorption of concepts (3.27 ± 1.149), with 12.0% strongly agreeing and 34.8% agreeing. Furthermore, the integration of feedback and evaluation mechanisms recorded a mean of 3.49 ± 1.153, with 17.4% strongly agreeing and 40.2% agreeing, and the need for training updates to match industry needs scored 3.40 ± 1.100, with 16.3% strongly agreeing and 33.7% agreeing.

Table 4
Factors affecting the effectiveness of TVET on masonry skills gaps

Statement	SA n (%)	A n (%)	N n (%)	D n (%)	SD n (%)	Mean ± SD
Limited resources hinder the effectiveness of technical vocational education and training programs.	20 (21.7%)	31 (33.7%)	22 (23.9%)	13 (14.1%)	6 (6.5%)	3.50 ± 1.172
Technical vocational education and training is not regularly updated to match the changing needs of the industry.	15 (16.3%)	31 (33.7%)	27 (29.3%)	14 (15.2%)	5 (5.4%)	3.40 ± 1.100
There is a lack of qualified trainers to effectively conduct the courses.	25 (27.2%)	28 (30.4%)	24 (26.1%)	5 (5.4%)	10 (10.9%)	3.58 ± 1.251
The duration of the training sessions is too short to fully address the skills gap.	20 (21.7%)	32 (34.8%)	23 (25.0%)	5 (5.4%)	12 (13.0%)	3.47 ± 1.262
The technical vocational education and training programs do not have enough practical applications.	9 (9.8%)	40 (43.5%)	23 (25.0%)	10 (10.9%)	10 (10.9%)	3.30 ± 1.136
I believe that the environment in which training takes place affects its effectiveness.	17 (18.5%)	31 (33.7%)	25 (27.2%)	10 (10.9%)	9 (9.8%)	3.40 ± 1.196
Trainees' access to materials and equipment impacts the quality of their learning.	21 (22.8%)	30 (32.6%)	26 (28.3%)	9 (9.8%)	6 (6.5%)	3.55 ± 1.142
There is a lack of follow-up or refresher courses after initial training.	19 (20.7%)	38 (41.3%)	22 (23.9%)	4 (4.3%)	9 (9.8%)	3.59 ± 1.159
The pace of the technical vocational education and training program is too fast to absorb new concepts.	11 (12.0%)	32 (34.8%)	31 (33.7%)	7 (7.6%)	11 (12.0%)	3.27 ± 1.149
Feedback and evaluation mechanisms are not well integrated into the training process.	16 (17.4%)	37 (40.2%)	24 (26.1%)	6 (6.5%)	9 (9.8%)	3.49 ± 1.153

SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree, SD= Standard Deviation. Mean ± SD is calculated using the numeric coding (1 = SD, 2 = D, 3 = N, 4 = A, 5 = SA)

These quantitative findings were strongly supported by qualitative insights from both instructors and heads of TVET institutions as evidenced below.

Instructor 1 remarked: *"Short duration, limited tools, and unqualified trainers hinder trainees from mastering advanced skills. Courses focus on theory with minimal practical sessions, so trainees cannot internalize advanced techniques."*

Instructor 3 observed: *"Fast-paced sessions, lack of follow-up, and insufficient trainers reduce the impact of training programs. Trainees often forget newly taught techniques or fail to implement them correctly on-site due to inadequate reinforcement."*

Instructor 6 noted:

"Limited practical exposure and resource constraints negatively affect trainees' learning. Without access to sufficient bricks, cement, tools, or real site simulations, learners cannot gain confidence or competence."

Instructor 9 added: *"Limited follow-up, short sessions, and environmental challenges affect learning retention."*

Heads of TVET institutions further corroborated these observations.

Head 1 highlighted: *"The lack of adequate tools and materials limits our ability to conduct hands-on practical sessions, leaving trainees with more theoretical than practical knowledge."*

Head 2 stressed the role of trainer qualifications: *"Unqualified and undertrained instructors also affect the depth of content delivery, especially in technical masonry aspects."*

Head 3 confirmed the challenge posed by short training durations: *"The duration of the training is too short to adequately prepare learners, especially since many come in with no prior exposure to construction work."*

Discussion

Impact of TVET on the skill levels of the masonry workforce

The findings of this study (Table 2) clearly demonstrate that educational training plays a significant role in improving the masonry skills and work performance of trainees in Moroto, Napak and Nakapiripiriti districts. The quantitative results showed that trainees benefitted most in areas such as handling complex masonry tasks, improving work performance, and enhancing the quality of masonry output. This implies that training interventions were successful in imparting core technical skills that enabled learners to carry out their work with greater competence and confidence. Respondents also reported gains in speed, reduced errors, and confidence in task execution, reflecting the immediate benefits of structured training programs. These findings are important because they underscore the central role of TVET in bridging the skills gap in sub-regions such as Karamoja where access to higher technical institutions is limited. The observed improvements in speed, reduced errors, and confidence

demonstrate that even short-duration training interventions can deliver measurable outcomes. In many developing contexts, such incremental gains are significant because they enable semi-skilled workers to transition into the labor market and earn livelihoods. This is consistent with the argument by UNESCO [37] that TVET acts as a "ladder of opportunity," especially in rural and disadvantaged communities, by equipping learners with market-relevant skills. However, the moderate mean scores associated with applying new techniques and error reduction suggest that while training builds a solid foundation, it does not fully equip trainees with the advanced competencies required for independent problem-solving on construction sites. This gap has wider implications. In the construction industry, the ability to apply new techniques is critical for adapting to evolving building standards, safety requirements, and client expectations. Without these skills, workers risk stagnating at a low level of proficiency, unable to transition into supervisory or entrepreneurial roles.

These findings are consistent with earlier studies. For instance, Nkunya and Mwila [38] observed that while TVET in Tanzania improved employability, gaps remained in fieldwork opportunities and industry collaboration. The situation in the three study districts mirrors this challenge as trainees are well-prepared for basic masonry tasks but remained underprepared for site-specific complexities due to limited exposure to real-world construction environments. Similarly, Mengistu and Mahesh [39] found that Ethiopian construction students exhibited knowledge shortfalls in critical areas, largely due to weak internship coordination. The current findings reinforce this by showing that short training programs, without extended practical exposure, constrain the transfer of skills from the classroom to actual worksites.

The qualitative results complement the quantitative data by providing deeper insights into these limitations. Instructors repeatedly emphasized that although trainees acquire confidence in basic tasks such as simple bricklaying and mortar mixing, they struggle with advanced undertakings like multi-story construction, precision detailing, and structural planning. This finding corroborates with the observations of Fagbenle et al. [40] and Knezovich et al. [41], who highlighted the importance of continuous, industry-aligned training in enhancing the productivity and adaptability of construction workers. From this perspective, the findings suggest that while training programs are impactful, they remain too narrow in scope and duration to produce a fully versatile masonry workforce.

Skills gap in the masonry workforce and its relationship with the quality of TVET

The results of this study in Table 3 revealed that TVET in Moroto, Napak and Nakapiripiriti Districts, while valuable in building foundational masonry knowledge, is inadequate in addressing the comprehensive skill set demanded by the construction industry. Respondents strongly perceived a mismatch between the training content and the actual skills required on construction sites, particularly in advanced masonry techniques, architectural drawing interpretation, and site management. These perceptions were supported by instructors and TVET heads, who noted that trainees frequently struggle with precise alignment, accurate measurement, structural planning, and adherence to safety standards. This is in

agreement with Mahasneh and Thabet [42], who described the skills gap in construction as a persistent disparity between what employers require and what workers possess, spanning not only technical competencies but also managerial and soft skills [43, 44]. The study highlights the importance of updating curricula to incorporate both modern construction technologies and soft skills such as communication, teamwork, and problem-solving [43, 45].

The evidence from the three study districts corroborates findings from Smith and Brown [46], who observed that TVET programs often emphasize theoretical instruction at the expense of practical modules, thereby producing graduates who are confident in classroom learning but unprepared for real-world challenges. Similarly, the current study found that lack of sufficient hands-on training contributed to errors, delays, and limited confidence among trainees when managing complex masonry tasks. Instructors repeatedly emphasized that trainees lack the capacity to visualize construction sequences, calculate quantities, or manage resources independently which skills are essential for efficient project delivery. These weaknesses are in agreement with observations by Khuzwayo et al. [47] in South Africa, where inadequate TVET and failure to adhere to building standards resulted in compromised structural integrity and poor workmanship.

Another critical dimension highlighted in this study is the absence of strong industry linkages. The heads of TVET institutions acknowledged that short training programs, outdated tools, and limited engagement with industry actors prevented learners from acquiring the advanced skills required in the job market. This finding is consistent with Akintoye and Oluwole [48], who argued that the disconnection between academic institutions and industry stakeholders exacerbates the skills gap. Similarly, Nkunya and Mwila [38] found that outdated teaching methods and lack of fieldwork opportunities undermined labor market readiness among TVET graduates in Tanzania. The situation in the three study districts emulates this challenge, as trainees graduate with basic skills but remain underprepared for industry-specific demands. The study also draws attention to the need for integrating safety and soft skills into training. Although this study did not directly focus on safety, the moderate ratings on error reduction and the instructors' comments regarding safety lapses suggest that current programs do not sufficiently prepare trainees for safe, independent practice. Anton et al. [49] and Kincl et al. [50, 51] emphasized the critical role of ergonomics and safety training in preparing masons for the workplace, showing that failure to integrate such training increases risks of injury and reduces productivity. In Moroto, Napak and Nakapiripiriti districts, the lack of consistent safety education may explain why trainees still rely heavily on supervision even after completing training programs. In addition, the study highlights the importance of updating curricula to incorporate both modern construction technologies and soft skills such as communication, teamwork, and problem-solving. Adepoju and Aigbavboa [1] found that the Nigerian construction industry faced significant skills shortages in Construction 4.0 areas like data analytics and human-machine communication, recommending curriculum redesign and continuous reskilling. Although Moroto, Napak and Nakapiripiriti's context is less advanced in terms of technological adoption, the principle remains relevant. Without dynamic, adaptive, and forward-looking curricula, training programs risk producing graduates who are obsolete before entering the workforce.

Factors affecting the effectiveness of TVET in addressing skills gap among the masonry workforce

The findings of this study revealed that several interrelated factors hinder the effectiveness of TVET in addressing skills gaps among the masonry workforce in Moroto, Napak and Nakapiripiriti districts. Limited resources, such as inadequate tools, construction materials, and teaching infrastructure, were identified as a major constraint. This finding aligns with Alinaitwe et al. [5], who reported that insufficient infrastructure and tools significantly limit the effectiveness of practical learning, thereby reducing skill acquisition among trainees in Uganda. Similarly, Nkunya and Mwila [38] highlighted that outdated teaching tools and inadequate fieldwork opportunities negatively affect graduates' employability in Tanzania, demonstrating that resource constraints are a widespread challenge in vocational training across the region. The study also indicated that the lack of qualified trainers adversely affects training quality. Respondents emphasized that under qualified instructors limit the depth of content delivery, particularly for advanced masonry techniques. This supports the findings of Mbati [52], who argued that weak human resource management practices, including insufficient trainer competency, undermine labor productivity in Nairobi's construction sector. Similarly, Khuzwayo et al. [53] observed that substandard instructor qualifications in South Africa contributed to gaps in technical skills and overall construction quality, reinforcing the need for skilled trainers to enhance the effectiveness of vocational programs.

Short training duration and fast-paced sessions emerged as additional limitations. Trainees reported difficulty internalizing advanced concepts and applying them on-site, a challenge that echoes the observations of Timothy, Peter and Wanjala [54], who found that brief TVET programs in Uganda fail to provide adequate practical exposure, limiting the development of critical masonry skills. Similarly, Akunda et al. [55] found that inadequate practical training opportunities and outdated curricula hinder the effective development of masonry skills in Ugandan TVET institutions. Furthermore, the absence of follow-up or refresher courses was highlighted as a factor contributing to poor retention of newly acquired skills, consistent with Akomah et al. [56], who emphasized that lack of ongoing professional development reduces skill application and diminishes workforce efficiency in Ghana's construction sector.

Practical application and hands-on learning were also found to be inadequate, with trainees unable to gain sufficient exposure to real-world construction tasks. This finding is consistent with Smith and Brown [46], who reported that vocational training in the United States adequately covers theoretical knowledge but often lacks realistic practical modules, leading to reduced on-site performance. Similarly, Hassan et al. [57] noted that weak linkages between TVET providers and industry in Malaysia resulted in a mismatch between skills taught and those required by employers, highlighting the critical role of practical, industry-aligned training in reducing skills gaps.

Environmental factors, such as poor learning conditions and limited access to materials, were found to further constrain skill development. This observation aligns with Lawani et al. [58] in Scotland, who identified environmental challenges, including physical strain and inadequate resources, as significant

barriers to effective training and retention of skills among masonry workers. The integration of feedback and evaluation mechanisms was also deemed insufficient, limiting trainees' ability to self-correct and adapt their skills. This is in consonance with the recommendations of Nkunya and Mwila [38] and Alinaitwe et al. [5], who emphasized the importance of structured assessment and continuous monitoring in improving the quality of vocational training outcomes.

Strengths and limitations of the study

The study had several strengths. For instance, the use of both quantitative and qualitative methods provided complementary information and enabled a broader understanding of the masonry skills gap. Additionally, involving different stakeholders, including masonry workers, instructors, and TVET institution heads, also provided diverse perspectives on training and workforce competencies. However, the study had some limitations. For example, informally trained masons were not included, which may have excluded an important section of the masonry workforce. In addition, the cross-sectional design limited the ability to draw conclusions about cause and effect, while the study's focus on a single district limited the extent to which the findings could be generalized to other settings.

Conclusions

The study found that TVET in Moroto, Napak and Nakapiripiriti districts provided masonry trainees with important foundational skills and improved their confidence and workmanship. However, significant gaps remained in advanced technical skills, independent problem-solving, and the ability to adapt skills to real construction settings. These gaps were mainly linked to limited opportunities for practical training, inadequate resources and equipment, insufficient trainer competence, limited coverage of some essential skills, and weak connections between TVET institutions and the construction industry. Strengthening practice-based training, expanding practical exposure and mentorship, improving trainer competence, and establishing stronger partnerships with industry could therefore enhance the effectiveness of TVET and better prepare masonry trainees for the demands of the construction industry.

Abbreviations

BIM
Building Information Modelling
CBET
Competency-Based Education and Training
CVI
Content Validity Index
GDP
Gross Domestic Product
HRM
Human Resource Management
ICF

Insulated Concrete Forms
ILO
International Labour Organization
MoES
Ministry of Education and Sports
SAVE
Safety Awareness and Voice Evaluation
SPSS
Statistical Package for Social Scientists
SSC
Sector Skills Council
TVET
Technical and Vocational Education and Training
UBOS
Uganda Bureau of Statistics
UNESCO
United Nations Educational, Scientific and Cultural Organisation
USDP
Uganda Skills Development Project
UVTAB
Uganda Vocational Qualifications and Training Board
WBL
Work-Based Learning

Declarations

Ethical approval and consent to participate

The study was conducted in accordance with the ethical principles outlined in the 2013 revision of the Declaration of Helsinki. Ethical clearance was obtained from the Uganda Christian University Research Ethics Committee (Application No. UCUREC-2025-1751). The study also obtained the necessary research permit from the University of Eldoret prior to data collection. Permission was also sought from the Chief Administration Officers (CAO's) of Moroto, Napak and Nakapiripiriti districts to conduct the study in the selected Sub-Counties/Town Councils/Municipality. Sub-County/Town Council/Municipality leadership was briefed on the objectives of the study to prevent misconceptions and ensure cooperation. Participation was voluntary, and informed consent was obtained from all respondents, ensuring they were fully aware of the research procedures and any potential risks. Additionally, confidentiality and anonymity were maintained by using codes instead of personal identifiers during data collection.

Consent for publication

Not applicable. This manuscript does not contain any identifiable personal information from participants, including images or videos, in any form.

Clinical trial number

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Contribution

HGA: Conceptualized the study, designed the methodology, collected data, performed statistical analysis, and drafted the manuscript. SMO: Conceptualized the study, designed the methodology, performed statistical analysis, and drafted the manuscript. JS supervised the research, provided critical feedback on the methodology, reviewed the manuscript, and contributed to the interpretation of findings and approved the final manuscript.

Acknowledgement

The authors wish to express their sincere gratitude to the heads of TVET institutions, instructors, and masonry workers in Moroto, Napak and Nakapiripiriti districts who participated in this study and generously shared their experiences and insights. The authors also thank the research assistants for their dedication and professionalism during data collection.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author sundaymarkoyet@gmail.com on reasonable request.

References

1. Adepoju OO, Aigbavboa CO. Assessing knowledge and skills gap for construction 4.0 in a developing economy. J Public Affairs. 2021;21(3):e2264.
2. Gu C, Urbanization. Processes and driving forces. Sci China Earth Sci. 2019;62:1351–60.
3. Shi G, Shan J, Ding L, Ye P, Li Y, Jiang N. Urban road network expansion and its driving variables: A case study of Nanjing City. Int J Environ Res Public Health. 2019;16(13):2318.
4. Barbosa F, Woetzel J, Mischke J. Reinventing construction: A route of higher productivity. McKinsey Global Institute; 2017.
5. Alinaitwe HM, Mwakali JA, Hansson B. Factors affecting the productivity of building craftsmen—studies of Uganda. J Civil Eng Manage. 2007;13(3):169–76.
6. Uganda Bureau of Statistics. Statistical abstract. Government of Uganda; 2005.
7. Kikwasi GJ. Causes and effects of delays and disruptions in construction projects in Tanzania. J Constr Eng Manag. 2013;139(8):1234–42.
8. Alaghbari W, Al-Sakkaf AA, Sultan B. Factors affecting construction labour productivity in Yemen. Int J Constr Manage. 2019;19(1):79–91.
9. Osunsanmi TO, Aigbavboa C, Oke A. Construction 4.0: The future of the construction industry in South Africa. Int J Civil Environ Eng. 2018;12(3):206–21.
10. Maskuriy R, Selamat A, Maresova P, Ondrej K, Oladipo OD. Industry 4.0 for the construction industry: Review of management perspective. Economies. 2019;7(3):68.
11. Mullin PT, Williams AN. Using skills gap analysis in construction management to stimulate a demand led model of curriculum. In: Conference Proceedings W089-Special Track 18th CIB World Building Congress. 2010; pp. 65–79.
12. Mukooli HM. The role of vocational training in the industrial development in Uganda [Master's dissertation]. Makerere University; 2022.
13. Osei-Asibey D. Skills mismatch in the construction industry: The role of TVET. J Constr Educ. 2022;15(3):145–62.
14. Ministry of Education and Sports. Uganda. Uganda Skills Development Project (USDP). Government of Uganda; 2016.
15. Mutebi J, Ferej A. Regulatory frameworks in Uganda's TVET sector: A systematic review. J Vocat Educ Train. 2023;75(3):445–63.
16. Agole P, Ochieng R, Kerre B. The adaptability of engineering graduates to Ugandan labour market. Open Access Libr J. 2024;11(10):1–16.
17. Erimirwa MP. Performance of technical and vocational training system towards skill development in Uganda [Doctoral dissertation]. Makerere University; 2023.
18. UNESCO. Global education monitoring report: Inclusion and education. UNESCO Publishing; 2020.
19. Shinyekwa I, Kiiza J, Hisali E, Obwona M. The evolution of industry in Uganda. Manufacturing Transformation. 2016; (9).

20. Dharani K. Study on labours productivity management in construction industry. Int J Latest Trends Eng Technol. 2015;6(1):278–84.
21. Yap JBH, Chow IN, Shavarebi K. Criticality of construction industry problems in developing countries: Analyzing Malaysian projects. J Manag Eng. 2019;35(5):04019020.
22. McGuinness S, Ortiz L. Skill gaps in the construction industry: A European perspective. Int J Manpow. 2016;37(6):1024–45.
23. Amin ME. Social science research: Conception, methodology and analysis. Makerere University Printery; 2005.
24. Nalule A. Social management of rangelands and settlements in Karamoja. Uganda Land Alliance; 2010.
25. Nakalembe C, Dempewolf J, Justice C. Agricultural land use change in Karamoja region, Uganda. Land Use Policy. 2017;62:2–12.
26. Akwango DA, Obaa BB, Turyahabwe N, Baguma Y, Egeru A. Agro-pastoral choice of coping strategies and response to drought in the semi-arid areas of Uganda. J Agric Sci. 2016; (1):281–91.
27. Mubiru DN. Climate change and adaptation options in Karamoja. Vol. 1. 2010.
28. Uganda Bureau of Statistics. Uganda National Household Survey 2023/24. Kampala, Uganda: UBOS; 2025.
29. Sladoje M, Randolph G, Khan L. Transforming secondary urban areas for job creation. World Bank Policy Research Working Paper. 2020; 8921.
30. Krejcie R, Morgan S. Sample size determination. Bus Res Methods. 1970;4(5):34–6.
31. McGuirk PM, O'Neill P. Using questionnaires in qualitative human geography. 2016.
32. Patten ML. Questionnaire research: A practical guide. 4th ed. Routledge; 2016.
33. Kallio H, Pietilä AM, Johnson M, Kangasniemi M. Systematic methodological review: A guide to conducting a semi-structured interview study. Scand J Caring Sci. 2016;30(4):681–92.
34. Barnes J. Validity in research. 2011.
35. Krishnan A, Ramasamy R. Accessing the construct and content validity of uncertainty business using SEM approach - An exploratory study of manufacturing firms. Global J Manage Bus Res. 2011;11(12 Version 10):01–7.
36. Trochim WM. Introduction to validity. Research Methods Knowledge Base; 2006.
37. UNESCO. UNESCO strategy for TVET 2016–2021. UNESCO Publishing; 2018.
38. Nkunya HR, Mwila PM. Bridging the gap between TVET skills and labor market demands: An analysis of the influence of training outcomes in Dar Es Salaam, Tanzania. Int J Res Innov Social Sci. 2024;8(12):703–9.
39. Mengistu DG, Mahesh G. Construction education in Ethiopia: Knowledge and skills level attained and effectiveness of internship program. Higher Education, Skills and Work-Based Learning. 2019; 9(3):510–524.

40. Fagbenle OI, Lawal P, Omuh IO. The influence of training on bricklayers' productivity in Nigeria. J Constr Eng Manag. 2012;138(7):853–60.
41. Knezovich J, Moyer S, McPhee J, Le Toile R. Experience, productivity, and musculoskeletal injury among masonry workers. J Constr Eng Manag. 2023;143(6):04017045.
42. Mahasneh J, Thabet W. Skills gap in the construction industry. J Constr Eng Manag. 2015;141(8):04015025.
43. Adepoju O, Aigbavboa C, Nwulu N, Onyia M, Adepoju O. Reskilling for construction 4.0. Springer International Publishing; 2022. pp. 197–219.
44. Olusola O. Skills gap in the Nigerian construction industry. J Constr Project Manage Innov. 2019;9(2):2112–25.
45. Warrner J. Soft skills in the construction industry. J Constr Educ. 2018;12(4):225–39.
46. Smith J, Brown M. Effectiveness of vocational training programs in the midwestern United States. J Constr Educ Res. 2015;11(3):142–58.
47. Khuzwayo BP, Walker M, Graham B. Deficiencies in formal mason training in South Africa: Gaps in technical instruction impacting the quality of masonry construction. J Constr Educ Res. 2024;12(2):45–62.
48. Akintoye A, Oluwole A. Skill deficiency in the Nigerian construction industry: A case study of the masonry sector. J Constr Eng Manag. 2010;136(10):1162–70.
49. Anton D, Bray M, Hess JA, Weeks DL, Kincl LD, Vaughan A. Prevalence of work-related musculoskeletal pain in masonry apprentices. Ergonomics. 2020;63(9):1194–202.
50. Kincl LD, Anton D, Hess JA, Weeks DL. Safety voice for ergonomics (SAVE) project: Protocol for a workplace cluster-randomized controlled trial to reduce musculoskeletal disorders in masonry apprentices. BMC Public Health. 2016;16:1–9.
51. Kincl LD, Hess JA, Weeks DL, Vaughan A, Anton D. Efficacy of text messaging apprentices to reinforce ergonomics and safety voice training. J Saf Res. 2020;74:35–43.
52. Mbati DW. The effect of human resource management practices on masonry labour productivity in the Kenyan construction industry [Doctoral dissertation]. University of Nairobi; 2019.
53. Khuzwayo BP, Walker M, Graham B. Improving South African masonry construction industry. Afr J Inter/Multidisciplinary Stud. 2023;5(1):1–11.
54. Timothy A, Peter O, Wanjala B. Factors affecting skills development amongst trainees of building and civil engineering in technical and vocational institutions in Uganda. IOSR J Res Method Educ. 2024;14(5):58–74.
55. Akunda T, Ouma P, Kerre L, Wanjala B. An exploration of the factors affecting skills development amongst trainees of building and civil engineering in technical and vocational institutions in Uganda. J Res Method Educ (IOSR-JRME). 2024;14(5):58–74.
56. Akomah BB, Ahinaquah LK, Mustapha Z. Skilled labour shortage in the building construction industry within the central region. Baltic J Real Estate Econ Constr Manage. 2023;8(1):83–92.

57. Hassan PF, Noor MSM, Mohammad H. Challenges in education and training to develop Malaysian construction workforce. Int J Sustainable Constr Eng Technol. 2021;12(2):53–69.
58. Lawani K, McKenzie-Govan S, Hare B, Sherratt F, Cameron I. Skill shortage of bricklayers in Scotland. J Eng Des Technol. 2022;20(1):321–38.

Figures

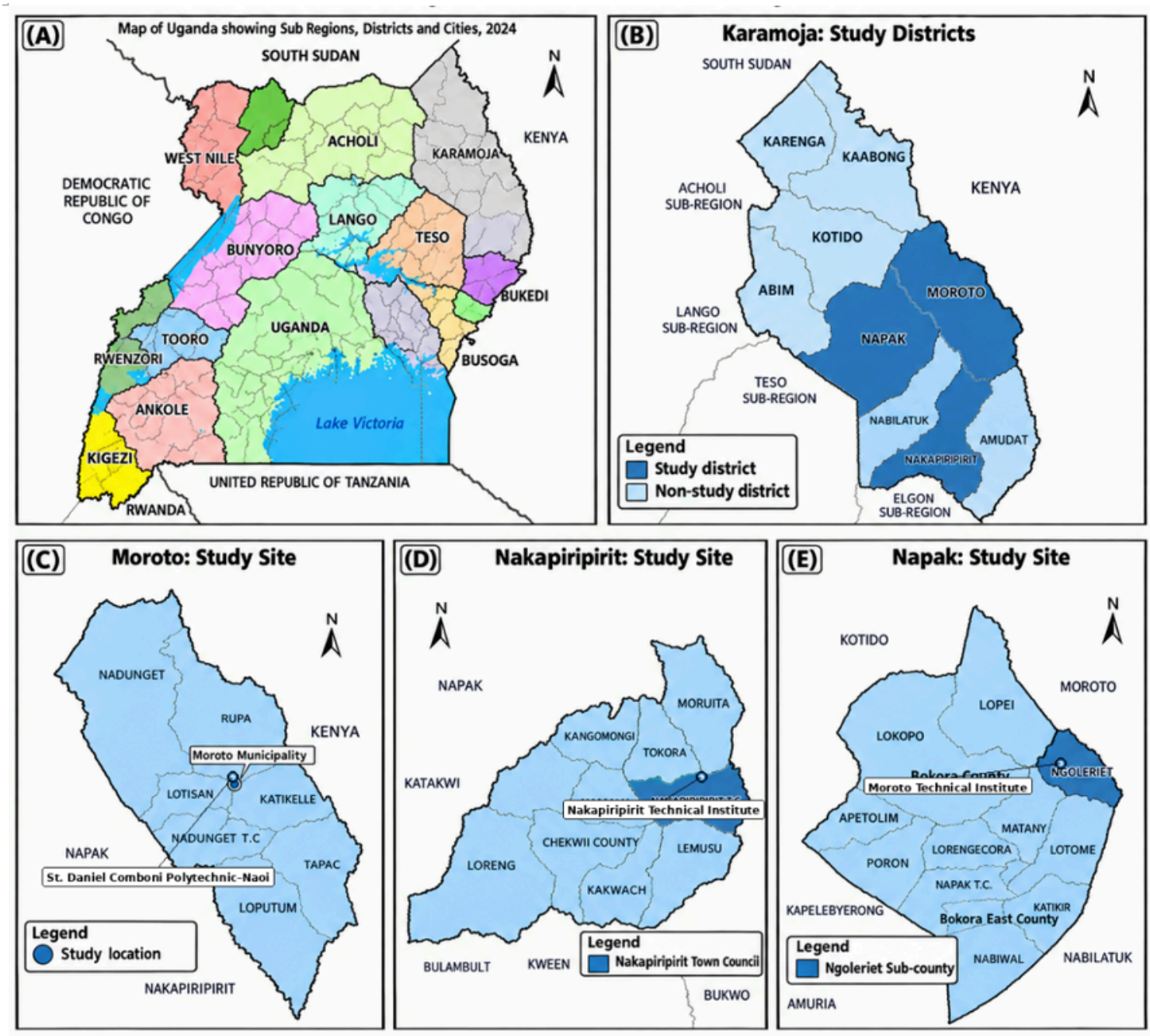


Figure 1

A map showing the study districts, Sub-Counties and Town Councils