REVIEWED JOURNAL® of Education Practice [ISSN 2663-127X]

Vol. 4, Iss. 1 (2023), pp 56 – 70, July 5, 2023. www.reviewedjournals.com, ©Reviewed Journals

INSTITUTIONAL ENGINEERING TECHNICAL VOCATIONAL EDUCATION AND TRAINING PRACTICES AND IMPLICATIONS FOR ALIGNMENT WITH INDUSTRY SKILLS REQUIREMENTS IN SELECTED CENTRAL KENYA COUNTIES

[1] Daniel Kirogo Wahungu, [2] Dr. Violet Wawire PhD & [2] Dr. Francis Kirimi PhD

[1] Student, Department of Educational Foundations, Kenyatta University, Kenya
[2] Lecturers, Department of Educational Foundations, Kenyatta University, Kenya

Accepted: June 25, 2023

ABSTRACT

The purpose of this study was to scrutinize institutional engineering Technical Vocational Education and Training practices and implications for alignment with industry skills requirements in selected Central Kenya counties. There are concerns that engineering TVET training practices are not aligned to the industry and this mismatch has implications for the supply of skills to the labour market and youth unemployment. The study based its theoretical explanations on the Human Capital theory whose basic tenet is that education and training are investments that make individuals more productive and more employable, thus economic efficiency. Literature review in this study isolated several gaps including the need for soft skills alongside the technical competencies, the need for the industry to take the initiative for collaboration in order to cut on the cost of retraining and reorienting staff since they are the consumers of the skilled labour from TVET institutions. To realize the objective of the study, a descriptive survey using both qualitative and quantitative methods was utilized. The study utilized 489 participants comprising 339 trainers, 3 Directors (TVET, KAM and LIWA), 24 representatives of industries working with TVET, 64 TVET engineering trainees and 59 TVET engineering trainees who have graduated. The Study mainly utilized questionnaires, interview guide and Focus Group Discussions. For the purpose of triangulation, a document analysis and direct observation were used. A pilot study was conducted on the research instruments in order to increase validity and reliability. Collected qualitative data was scored manually then organized and analysed systematically as per thematic areas in a narrative form as well as tabular form. Quantitative data was analysed using the Statistical Package for the Social Sciences. The collected data was thematically analyzed as per the study objectives. The findings of the study indicated that despite the renewed efforts to revamp TVET education in Kenya and developing countries in general, there is a significant gap between the skills required by the industry and the training offered in engineering courses in TVET institutions and which has partly contributed to the rising unemployment among the youth in the country. Based on the study findings, the study presented a number of policy recommendations including adoption of Collaborative Training Model.

Key Words: *TVET Engineering Practices, Skills Gaps, Industry Requirements, Industry Alignment, Employability*

CITATION: Wahungu, D. K., Wawire, V., & Kirimi, F. (2023), Institutional engineering technical vocational education and training practices and implications for alignment with industry skills requirements in selected Central Kenya counties. *Reviewed Journal of Education Practice*, 4 (1), 56 – 70.

INTRODUCTION

Technical Vocational Education and Training (TVET) is playing a major role in informing the policy direction regarding skills for employability. Studies show that since the beginning of this millennium, a fresh awareness of the critical role that TVET can play in economic growth, reducing youth unemployment and national development has dawned among policymakers. The potential of TVET to initiate development and bring about meaningful transformations in our society is now being extensively recognized. The European Union (EU) has now acknowledged it as the "engine for economic development and international competitiveness" (Arbizu, et al., 2019). The goal of the TVET sub-sector is to deliver relevant skills and competencies in strategic disciplines for spurring industrial and economic development (Afet, 2015). TVET offers a pathway to the youth across all social segments and the opportunities to develop their competencies and enhance employability.

Focus by governments on technical education has been documented in research for several decades now. The main premise has been couched on its perceived ability to offer skills that reduce youth unemployment. A study by Foster (1965) on Vocational School Fallacy was among the early literature that began to look at the relevance of technical education to the acquisition of skills for employability and the possible challenges. Other studies began to critically examine the position that TVET is a panacea to alleviating unemployment among the youth and establishing connectivity to the labour market (Blaug, 1973; Oketch, 2007). So, there is a long-standing view that TVET has the potential to provide relevant skills that can reduce youth unemployment. From several empirical surveys across the globe, UNESCO concluded that TVET has the capacity to equip young people with the essential skills necessary for the world of work and more importantly for self-employment. TVET is also well placed to facilitate responsiveness to the ever-changing skill demands and emerging technologies (UNESCO, 2017).

However, studies have cited the challenge of a mismatch between the skills sought by the industry and those supplied by TVET. The work environment all over the world is experiencing a rapid transformation. The major ones are globalization and technological advancements catalysed by the Fourth Industrial Revolution (4IR) (Schwab, 2016). These transformations have brought about unprecedented and significant changes in labour dynamics all over the world. It is these kinds of disruptions that call upon educators to reflect seriously on the kind of skills that are offered in our TVET training institutions and the relevance of this training to the future of work.

Although the concern in the skills gap is for institutional TVET programmes in general, there are increased concerns for engineering programmes in particular, therefore, the focus of this study. In a survey on The Global Skills Shortage by Society for Human Resource Management (2019), respondents felt that the skills gap included technicians in production, operations, maintenance technicians, operators of special machinery, skilled trades including electricians, carpenters, welders, bricklayers, plasterers, plumbers, masons and many more (Stewart & Brown, 2019). These skills gaps are areas that are supposed to be trained in TVET institutions and they mainly point at engineering courses. Therefore, while looking at the institutional Technical Vocational Education and Training practices, the study took up a case of diploma in engineering courses.

Statement of the Problem

Despite the massive investment in TVET by the government to alleviate youth unemployment, TVET graduates still lack the skills required by the market. The budget allocation to TVETs rose from 6 billion shillings in 2017/2018 to 16 billion shillings in the 2018/2019 financial year. Nevertheless, Kenya's Economic Survey 2019 data reveals that about 38.9 % of the youth are unemployed. In the face of this glaring unemployment, a skills mismatch survey carried out by the Federation of Kenya Employers (FKE) in 2018 revealed that many corporate bodies are establishing academies to retrain fresh graduates so as to make them suitable for the roles they are appointed to. They identified some of the following skills gaps in Kenya: Heavy

and Light Machinery Operating, Electrical (Installation), Electrical Wiring, Electronics (Instrumentation), Mechanical Technology and Maintenance, Editing and Graphic Design, Pipefitting and Plumbing, Carpentry, Industrial Painting and Brushing, Welding and Construction (Masonry and Concrete Works). These are hands-on sector-specific technical skills that are trained under engineering courses in TVET and thus the focus of the study will be on engineering programmes.

In spite of the above depiction of increased interest in TVET engineering courses and the indicated mismatch, there is no evidence to show major efforts to address gaps in the training practices. The African Union Continental Education Strategy for Africa 2016-2025 acknowledges that there is little current information on TVET including research on policy and systems and the relationship between TVET and the labour market. If the challenge remains unaddressed, there will be implications for the attainment of specific SDGs and Vision 2030. The overarching objective of the Sustainable Goal Number 4, Target Number 4 seeks to significantly increase the number of trainees with skills for employability. On its part, Vision 2030 identifies TVET as an essential vehicle for socio-economic and technological transformation. Therefore, it is important that TVET meets the requirements of the industry for the successful attainment of Vision 2030 and SDGs.

Objective of the Study

The study examined the employers' perceptions on existing skills gaps in the engineering TVET graduates in relation to alignment with industry skills requirements in selected Central Kenya Counties.

Significance of the Study

At a time when Kenya is making massive investments in TVET, a study on institutional engineering Technical Vocational Education and Training practices and implications for alignment with industry skills requirements in selected Central Kenya counties, could advise educational policymakers and stakeholders on employers' perceptions on existing skills gaps, TVET curriculum, infrastructural needs and matching of skills with training.

Theoretical Framework

The study based its theoretical explanations on the Human Capital theory. The theory has its foundation from the works of early scholars like Adam Smith (1960s), Schultz (1961) and Becker (1993). The basic tenet of the theory is that education should be looked at or evaluated based on economic efficiency. The central premise of the theory is one that suggests that education and training are investments that make individuals more productive and more employable, thus economic efficiency. In the case of this study, the efficiency of technical education should be measured against the way it matches with the world of work.

The theory is suitable for the study because it describes the relationship between TVET training practices and the implications for alignment with industry skills requirements which is the main thrust of this study. The effectiveness of TVET training, in this case, being economically viable in so far as it aligns with the requirements of the workplace by giving the youth skills that are useful for both formal and self-employment.

Conceptual Framework

The entire TVET practice is informed and guided at the national policy level by the TVET Act of 2013 so as to guarantee the quality, standards and relevance of the training. With reference to the employers' perceptions on existing skills gaps in the engineering TVET graduates, the study looked into TVET Trainers' perceptions of engineering TVET trainees' employability, the skills that the industry is looking for among TVET engineering graduates, the reasons for the skills gaps among TVET engineering graduates in relation to industry skills requirements and the response of the industry. However, the study recognizes that the training environment has a role towards guaranteeing quality training. Stakeholders' participation, economic policy, CBET, governance and management of TVET, attitude towards TVET and gender dynamics provide the environment within which policy is formulated.

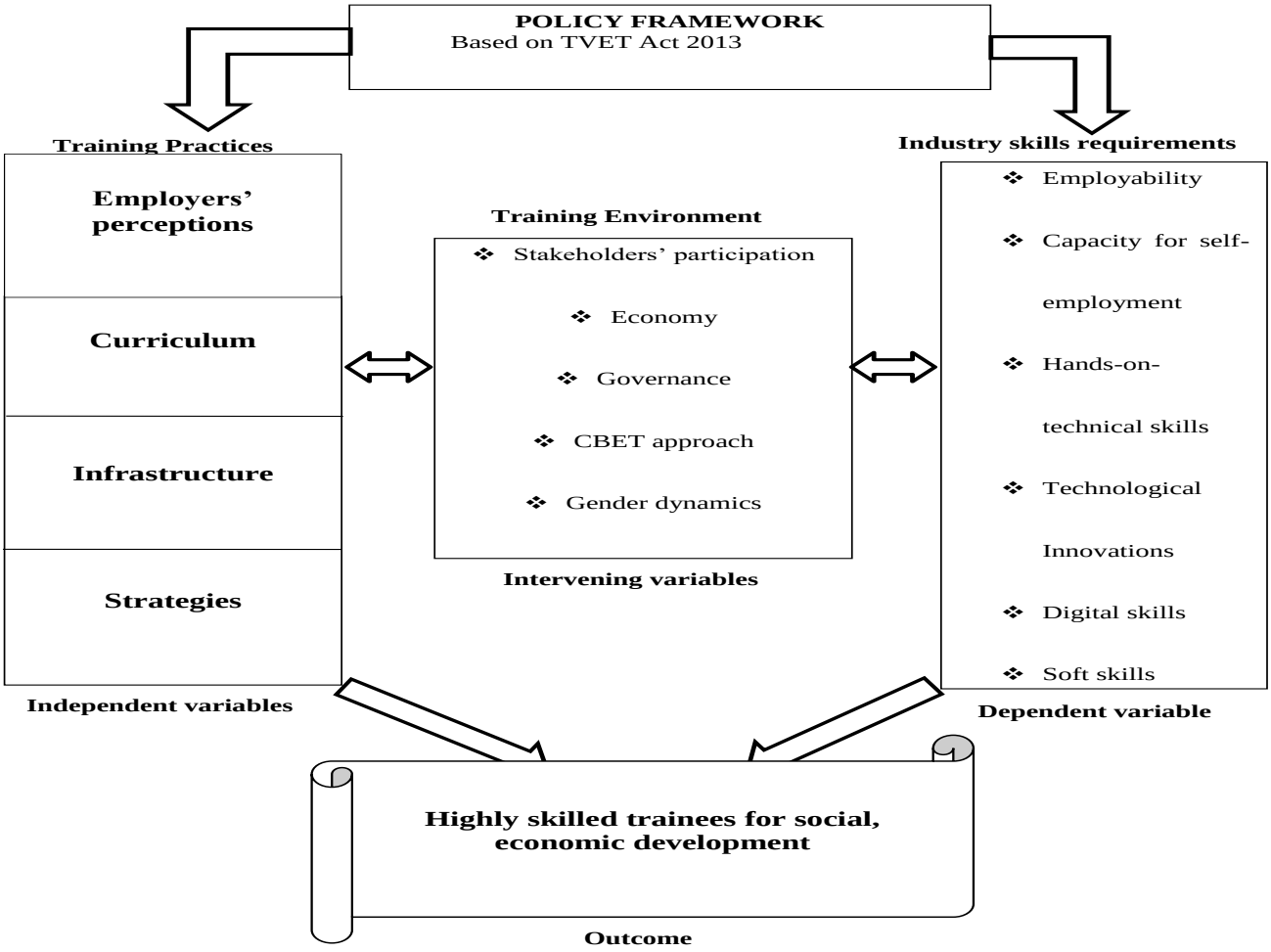

Figure 1: Training practices and implications for alignment with industry skill requirements

Figure 1 illustrated how the independent variable which is the employers' perceptions on existing skills gaps in the engineering TVET trainees interface with the dependent variable which is highly skilled trainees for social and economic development. The expected outcome is TVET graduates who have acquired knowledge, values, attitudes and employable skills such as soft skills, work ethics, digital skills, technological innovations and hand-on-skills that will increase the likelihood of employability and self-employment.

LITERATURE REVIEW

The employers' perceptions on existing skills gaps in the engineering TVET graduates in relation to alignment with industry skills requirements in Kenya

At the global level, there is a concern on the mismatch between TVET engineering skills and the requirements of the world of work in both developed and developing countries. The fact is that the training offered to the TVET engineering students falls short of the industry expectations (Ondiek et al., 2018; Blom, 2016; Malale & Gomba, 2016). Studies in the UK illustrated a perception by the employers that indicates that the skills gaps in TVET engineering courses have persisted since the 1990s. In a survey conducted in 1999 and 2001, the findings showed that the occupations most affected by skills gaps were the lower-skill technical and vocational ones like machine operators, metal fabrication, mechanical and vehicles engineering, electrical, electronic and instrument engineering, building and construction (Hogarth, et al., 2001). Two decades later, a survey indicated that 73% of employers felt that there are large gaps in the skills of technicians and skilled

craft level engineers. Another 60% felt that the skills gap were the biggest anticipated barrier to attainment of their business objectives (The Institution of Engineering and Technology, 2019).

Another study identifies existing skills gaps in the engineering TVET graduates in the current frameworks for digital skills including a handful of key areas of skills and competencies, namely information and data literacy, digital communication and collaboration, digital content creation, digital safety, digital identity and awareness of digital rights at different levels of proficiency. Digital skills also include non-technical so called '21st Century Skills', which can be grouped under cognitive, intrapersonal and interpersonal domain (Kispeter, 2018). In fact, a report by Burning Technologies (2019) based on analysis of advertisements of vacant positions in the UK revealed that digital skills are almost a mandatory requirement for all skills level: 75% requirement for low-skilled jobs, 78% for middle-skilled jobs and 80% for high skilled jobs.

Similarly, an empirical study in South Africa conducted among engineering students from TVET revealed that majority at 69.91% believed that the employers undervalued their qualifications. In actual fact, an analysis of the job advertisements in the newspapers revealed that the employers scarcely mention TVET qualifications which is a demonstration that they do not seem to have regard for this qualification. The researchers assert that the growing number of unemployed graduates is an indicator of the employers' devaluation of TVET qualifications (Sibiya, Nyembezi and Bogopa, 2021).

Most of the studies appear to focus on skills gaps in technical hands-on skills but recent studies mark a study gap in the need for soft skills among engineering TVET students. Studies in Malaysia reveal that engineering TVET students were found lacking in soft skills such as human relations skills, communication skills and cognitive skills that the prospective employers are looking for. The employers in the industry have expectations and are looking for specific skills required from the engineering TVET job applicants that match the skills required to perform on their job but found that most of the trainees were insufficient (Kenayathulla et al., 2019).

A survey conducted by the World Bank in Kenya on Skills Towards Employment and Productivity (STEP, 2018) indicated that 60% of the employers were giving preference to soft skills over technical skills. The employers identified a broad set of cognitive skills like reading, writing and numeracy; transferrable socio-emotion skills like ability to supervise others, working with teams, ability to make presentations, autonomy; high-order skills like problem solving, ability to learn, unlearn and relearn; personality traits like emotional stability, decision making, flexibility, openness and resilience. These are the soft skills. Additionally, the survey noted that the world of work was increasing becoming automated and this had not only changed the number of skills required but also affected the labour conditions. The TVET engineering graduates were specifically found lacking in technical skills relating to their work like operating machinery. The employers thus perceived TVET graduates as lacking both soft skills and practical experience required to work in the industry.

The studies discussed herein indicate that the employers' perceptions reveal a disjuncture between the skills possessed by the engineering TVET graduates and the industry skills requirements. The output from the TVET institutions in the areas of engineering does not seem to satisfy the needs of the industry. These skills gaps in TVET engineering trainees render them unprepared for the world of work. The skills gaps are actually responsible in part for the rising unemployment among the TVET graduates.

METHODOLOGY

Research Design

The study employed a descriptive survey design utilizing both qualitative and quantitative approaches. According to Creswell (2014), descriptive survey design is a kind of investigation that portrays the situation under scrutiny as exactly as it is.

Location of the study

The study focused on Central Kenya region since presently it carries 27 % of the total number of TVET institutions across the five administrative regions. The choice was thus made to enhance representativeness. The region covers a wide geographical area cutting across eight counties: Meru, Tharaka, Embu, Kirinyaga, Murang'a, Nyeri, Nyandarua and parts of Laikipia.

Target population and Sampling techniques

The sample techniques and sizes were as follows:

Table 1: Target population and sampling technique

Categories	Sampling Technique	Reasons
TVET Institutions	Stratified random sampling	Increase statistical precision
TVET Trainers	Simple random sampling	To minimize bias
Director TVET/KAM/LIWA	Purposive	There is only 1 in the Region
Representatives of industry	Stratified random sampling	Increase statistical precision
TVET Trainees	Purposive	To select respondents who will provide in-depth and detailed information on the area
TVET Trainees who graduated	Stratified random sampling	Increase statistical precision

Sample size of the study

Table 2: Target population and sample size

Respondents	Target Population	Sample Size	% Sample
TVET institutions	23	8	35
TVET Trainers	1242	373	30
TVET Director	1	1	100
KAM Director	1	1	100
LIWA Director	1	1	100

Construction of research instruments

The researcher employed different instruments: Questionnaires, interviews and focus group discussions to collect data for this study in view of the informant's sampled and terrestrial range of the key respondents. The use of this combination is articulated by Mugenda and Mugenda (2013) who contend that in social science research, the most frequently utilized tools are questionnaires and interview schedules. The researcher also used content analysis and observation for triangulation.

Piloting the Research Instruments

The research instruments were piloted in a TVET institution that was not among those sampled for the study.

Validity of Research Instruments

In this study, the focus was on face validity and content validity. Content validity refers to whether an instrument provides adequate coverage of a topic. The research combed through the research instruments against the objectives of the study to confirm that each area of the objectives was adequately covered. Face validity refers to the likelihood that the question would be misunderstood or misinterpreted. This helped to iron out any ambiguity. The pilot study helped to enhance the face validity of the instruments.

Reliability of Research Instruments

The instruments' reliability was established by carrying out test- re-test method, which is administering the same instrument twice to the same group of subjects. The relevant instruments to be analysed for this purpose were administered to respondents selected from one TVET institution which was not included in the study sample.

Logistical and Ethical Considerations

The researcher began by obtaining written authority from the school of education, Kenyatta University for research, which in turn enhanced the acquisition of a research permit from NACOSTI. The researcher also took into consideration the changing landscape of conducting research during COVID 19 pandemic. The procedure of collecting data was adhered to and the researcher maintained conventional ethical standards of ensuring that the participants do so out of informed consent and guaranteeing confidentiality.

Data Analysis

The research entailed both qualitative and quantitative data. Qualitative data was first transcribed in narrative form by the researcher. The analysis of this data considered the inferences that were made from the opinions of the respondents. Then analysis was made and presented thematically in a narrative form and where possible in tabular form. In analyzing quantitative data, the study leveraged both google sheets and SPSS. The google forms survey was collated, stored in a spreadsheet, then downloaded in CSV format and analyzed using SPSS.

FINDINGS, INTERPRETATION AND DISCUSSION

General and Demographic Information

Table 3: A summary of the survey respondents and the response rate of the instruments

Sampled Group	Instrument	Number of Respondents	Participated	Response Rate
Trainers	Questionnaire	373	339	91%
Representatives of industry	Questionnaire	24	24	100%
Director KAM	Interview	1	1	100%
Director LIWA	Interview	1	1	100%
Director TVET	Interview	1	1	100%
Trainees	Focus Group Discussion	64	64	100%
Trainees who Graduated	Focus Group Discussion	64	59	92%

Examining the employers' perceptions on existing skills gaps in the engineering TVET graduates in relation to alignment with industry skills requirements

The study acknowledged that the most important outcome of any skill training is successful job performance, whether in self or wage employment. In view of this, the study sought to find out the industry skills requirements related to engineering TVET courses in order to tease out the gaps in the training practices. In order to have a good foundational argument, the study began by looking at the experiences in the training institutions before moving to the employers and students who had graduated. The institutional practices enabled the researcher to trace the skills gap right from the institution to the workplace. This way, the views of the trainers and trainees in the TVET institution were put side by side with those of the employers and trainees who had graduated.

Examining TVET Trainers' perceptions of engineering TVET trainees' employability

The TVET Trainers were asked how they would rate their engineering TVET trainees in specified areas of competence by the end of their TVET training.

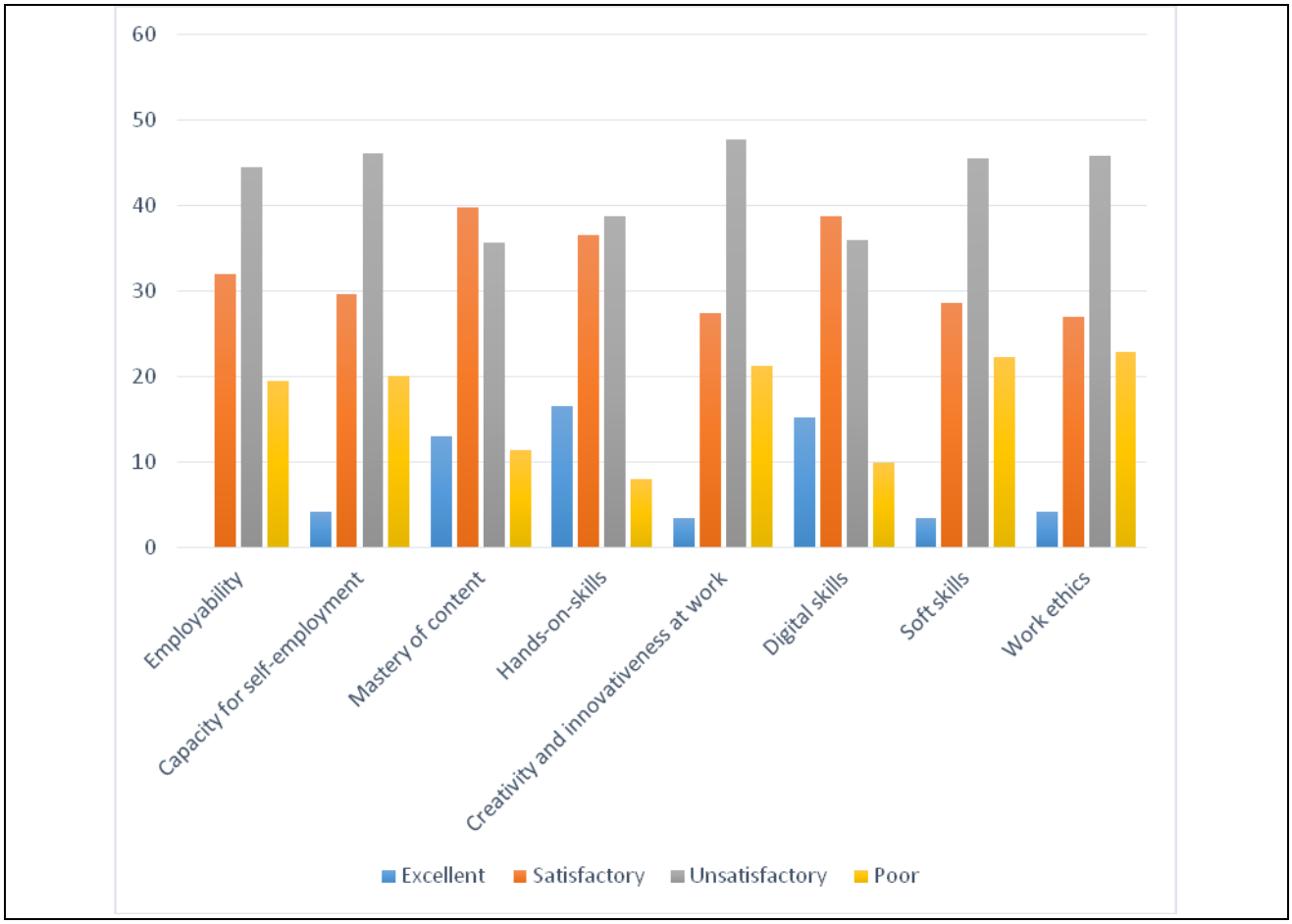

Figure 2: Rating of engineering trainees in specified areas competence

The rating was informed by indicators of effective TVET training as guided by UNESCO (2018) and The Council of the European Union (2019) which in a nutshell, identified employability, capacity for self-employment, mastery of content, hands-on-skills, creativity and innovativeness at work, digital skills, soft skills and work ethics as standard gauges of functioning TVET training. The overall picture from analysis of Google online questionnaires for TVET trainers was that the rating of unsatisfactory was the highest for all the skill areas meaning that the training was primarily unsatisfactory. More specifically, there were three main findings from this data. First, the rating index of poor for employability, creativity and innovativeness at work, soft skills and work ethics was at about 20% and above. The implied meaning was that the trainers felt that the TVET graduates are not well prepared for employment, they lack the capacity for self-employment, have not gained creativity and innovativeness for work and have not developed the corporate soft skills and work ethics. Secondly, mastery of content and digital skills had a relatively high satisfactory rating of 38.6% (131) and 37.8% (128) respectively. Similarly, they also had a comparatively higher rating for excellent that rests at 13.9% (47) and 16.2% (55). The trainers rating for the hands-on skills competence was at par with that mastery of content and digital skills at 35.7% (121) for satisfactory and 17.1% (58) for excellent. The trainees were given a higher rating for hands-on skills.

These findings confirmed that though the TVET engineering students were proficient in digital skills and were perceived to be better at hands-on skills than university students, there was a significant gap in soft skills among them. The TVET trainees confirmed these deficiencies in the Focus Group Discussions. They indicated that during their industrial attachment, they found that soft skills were a key requirement in the industry and many found that they fell short. They further argued that work ethics and corporate discipline should be factored into the curriculum. The sentiments were well summarized below:

As an automotive engineer, my industrial attachment was quite challenging. This was mainly because of the high expectations the supervisors have of you. I went for attachment in an automotive company called KVM that had very sophisticated machinery that I had not dealt with before. Automotive technology is changing, for instance, the car engines being used in the early 2000s are not the same being used right now, they have become better and more sophisticated. Therefore, you have to find ways to be more liquid; to keep up with the new technology, to blend in and to challenge yourself so that you can be capable of dealing with any situation at hand. I found that I could learn fast but there was the problem of discipline at work like time management, grooming, communication and relationship with colleagues. These were the real challenges.

(Male voice in Focus Group Discussion)

The implication of these findings from the TVET trainees was that even though TVET trainees had a challenge in the areas of competence of employability, capacity for self-employment and the ability for technological innovations, the major skills gap was in soft skills and work ethics. The thrust of the study demonstrated that the periphrases around inadequate skills and competencies revolved around the curriculum and the way it was delivered. The researcher felt that there were ramifications for both formal and self-employment for the TVET trainees.

Studies concur that soft skills are becoming increasingly core. An empirical study by Harvard University (2020) concluded that 80% of achievements in the career are determined by soft skills and only 20% by hard skills. The study cites serious skills gaps in a combination of people skills, communication skills, social skills, individual mannerisms, attitude, emotional intelligence and other career attributes that facilitate the graduates to perform well in the work place.

Identifying the skills that the industry is looking for among TVET engineering graduates in relation to industry skills requirements

The study set out to look into the skills requirements related to engineering TVET courses in order to find out the gaps in the training practices. The question was addressed to the selected representatives of industries working with TVET institutions as well as engineering students who had graduated from TVET institutions.

Accordingly, the selected representatives of industries working with TVET institutions were asked to rate the skills required from engineering students by companies in order of their importance for successful job performance. The industry understands the skills in terms of the competencies that are needed by their workforce for production processes or organizational needs. Based on the review of related literature, the following were found to be summative and representative of skills requirements for TVET engineering students: mastery of content in engineering solutions; job-specific technical skills; creativity and innovativeness at work; digital skills and technological skills; professional skills, work ethics and soft skills. However, the study acknowledged that different companies and human resource personnel tend to use of diverse terminologies and register to describe similar ranges of skills requirements.

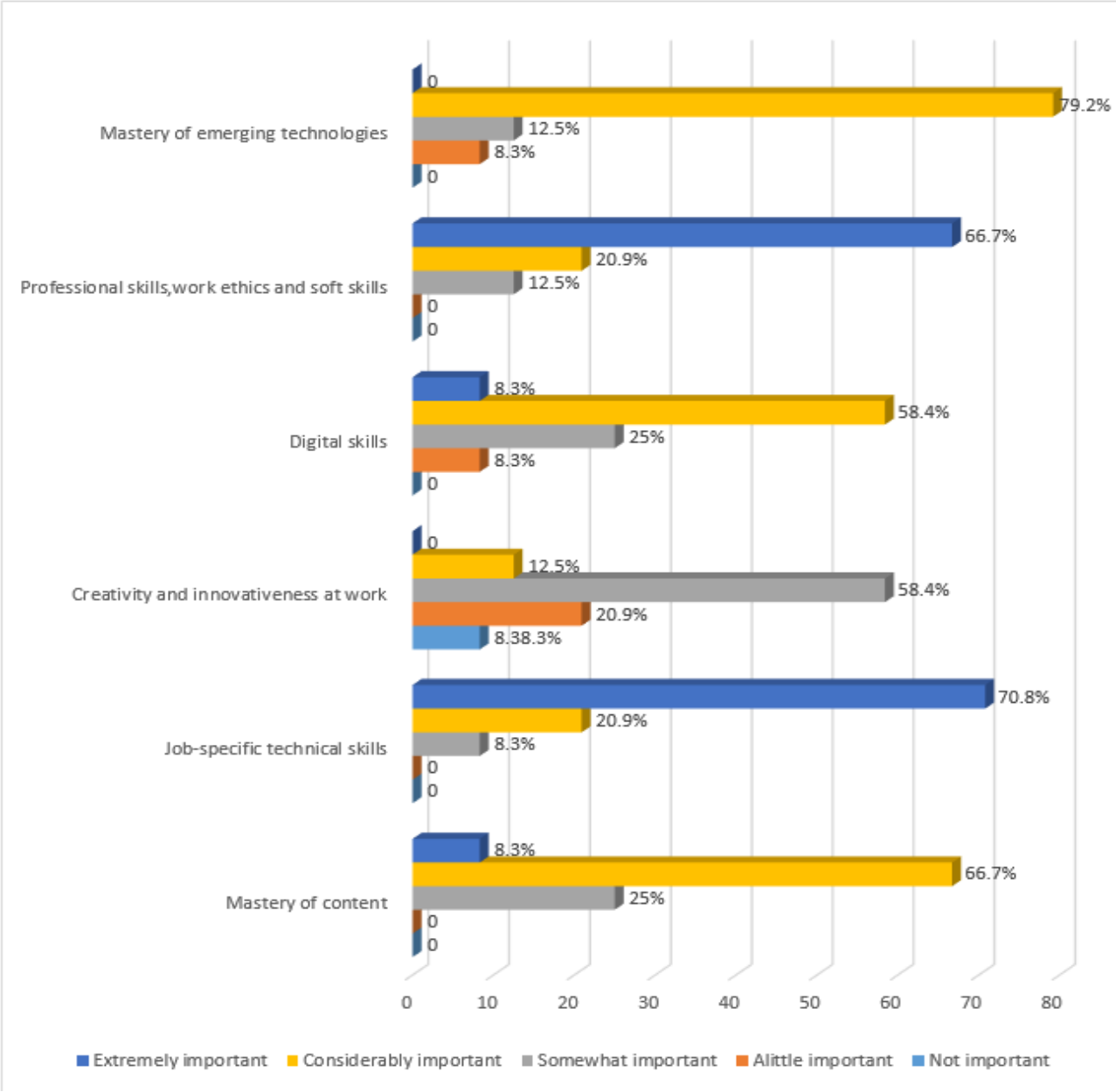

Figure 3: Rating of engineering trainees on skills required by industry for successful job performance

These responses from the selected representatives of industries working with TVET institutions reflected that the two most important skills for TVET engineering trainees in the workplace were job-specific technical skills and professional skills with a rating of 70.8% and 66.7% respectively for extremely important. Mastery of emerging technologies also had a relatively high rating of 79.2% for considerably important. The researcher viewed the job-specific technical skills as the expertise that the trainees acquire in their TVET training with regard to engineering work while the professional skills, work ethics and soft skills are the essential personal qualities that help the trainees fit well in the social work environment. Emerging technologies are essential given the fast-growing technological advancements and the TVET graduates are required to provide engineering solutions. The skills ranked second by the respondents were mastery of content in engineering solutions and digital skills rating at 66.7% and 58.4% respectively for considerably important. The two skills are closely aligned in that they are the day-to-day knowledge and abilities that facilitate the performance of engineering tasks in the workplace. Thirdly, creativity and innovativeness at work were perceived by the industry as somewhat important at 58.4%. The highlighted skills were perceived to be important for the

technical and professional effectiveness of TVET engineering graduates in performing their tasks in the industry.

Having established the expectations of the industry in terms of skills that were most important for the world of work, the study then proceeded to find out the perception of the representatives of the industry on how well the engineering TVET trainees were prepared for the workplace.

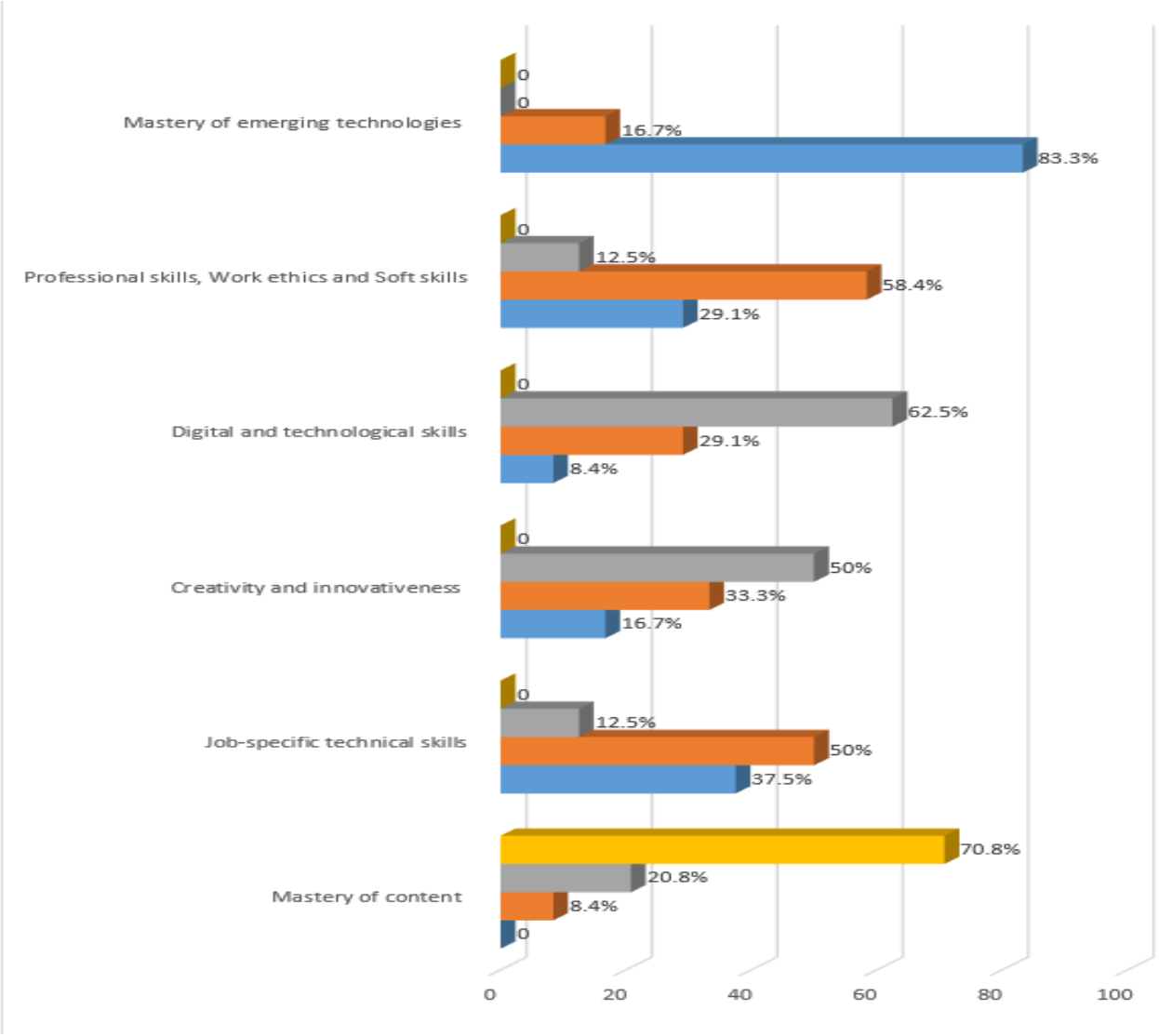

Figure 4: Rating of engineering trainees on skills required by industry for successful job performance

While the industry considered job-specific technical skills and professional skills as extremely important, the findings were that the TVET engineering trainees are perceived by the industry as having very little preparation at a rating of 50% and 58.4% respectively. More significantly, was the contrast between the expectation and reality for mastery of emerging technologies. While the rating for it was 79.2% for considerably important, there was an 83.3% rating of not prepared at all. The contrast is an indication that the TVET trainees were found wanting in the seemingly most critical areas of industry practice. These findings from the representatives of the industry indicated that while the industry perceives technical job-related skills, professional work ethics and soft skills as extremely important for the engineering TVET trainees to successfully perform in their work, they were found to have very little preparation in the same.

However, the study makes a positive observation of TVET engineering training in the area of mastery of content in engineering solutions where they were found to be very well prepared at 70.8%. The findings indicated that the trainees were found to be very well prepared in the mastery of content in engineering solutions and also somewhat prepared in creativity and innovativeness at work and also digital skills and technological skills. The findings were consistent with those of their trainers, elsewhere in this study, who also rated them at highly satisfactory on mastery of content.

The implications of the findings on the rating of the skills required of the engineering trainees by the industry for successful job performance and perceptions on how well they were prepared for the world of work indicated that they were well-grounded in the theoretical aspects of their training. However, there are skills gaps in the practical performance of the job, knowledge of emerging technologies and professional conduct and soft skills.

The study then looked into the specific skills that the industry was looking for in order to generate the real gaps in the engineering TVET training practices. The questionnaire responses from the KAM director provided a summative list of some of the skills gaps for the TVET engineering graduates including:

> *Broadly, there are skills gaps relating to engineering technology itself, professional and digital, skills relating to work itself and those relating to trainee characteristics. More specifically, the industry is experiencing skills gap in AutoCAD and ArchiCAD, CNC mechanical technicians, mechatronic technicians, artificial intelligence, Boiler operators, hydraulics, pneumatics, bar ruling, jall makers, moulding technicians, crane operators, vertical operators, gas welders, Leath machine operators, mono rams operators, automatic ruller machine operators, generator mechanics, denter purifiers, cutter bidder and industrial quality control engineers. In automotive engineering, the industry is looking for TVET engineering graduates with software engineering skills to program automated assembly lines. We also have soft skills, communication skills, emotional intelligence, teamwork, management and business skills.*
>
> (Female KAM Director)

In Nigeria, studies exemplified the skills gaps in the building sector. There are apparent deficiencies between skills produced in TVET institutions and the expectations and requirements of the building industry, a situation that prompted researchers to look into the issue. The study acknowledged skills gaps in craftsmen and artisan in building construction industry citing foundation skills, building drawing skills, ability to use machines for construction, ability to use hand tools for practical work, landscaping and site preparation skills, masonry skills, plumbing and other related building skills. There is a dwindling stock of competent skilled construction workers in spite of availability of unskilled and inefficient workers in the building sector (Judy & d'Amico, 2020).

The primacy of soft skills was underscored by one of the representatives of industry:

> *The adage in the industry is that we recruit for attitude but train for skills. In the industry, the attitude of graduate is more important than the technical skills they possess since we can train them in the technical skills but inculcating the desired soft skills can be a tall order with some of these TVET students. We go for soft skills first and hands on skills second.*
>
> (Male Representative of industries working with TVET)

The findings on soft skills highlight gaps in skills that enable TVET engineering graduates to navigate the world of work and relate well others. The indication was that the industry is emphasizing on soft skills since they complement the hands-on skills. The experience of the industry was such that even before the trainees can apply the technical skills relating to their work, there was a social environment that they need to master

and navigate first in order to deliver on their work. Therefore, the study established skills gaps both in hard and soft skills among the TVET engineering trainees.

Consequently, the study sought the direct perspective from the engineering TVET trainees who had graduated on their experiences upon entering the world of work and where they perceived they were best prepared and least prepared to perform their engineering work. In the automotive engineering field, a TVET engineering graduate narrated the skills gap in the area:

> *In the company, all work is designed for the assembly line. When you go to the assembly line, you realize that even some of the concepts are totally new. Your colleagues mention something and you have no idea what they are talking about. Then you realize that you do not have practical application of electrical equipment since you have been using manual ones. There is a lot to learn as if you were not well trained.*
>
> (Female TVET Engineering Graduate Respondent)

The views by the female TVET engineering respondent indicated a finding that some of the emerging technologies are not factored in the training such that the engineering TVET graduates find new concepts in the industry.

The findings of this study on skills gaps are collaborated in a survey on engineering technologists conducted in the UK by the Institute of Engineering and Technology on Skills and Demand in the Industry (2019), where 48% of companies reported gaps in the skills of their engineering apprentices or other young trainees while 73% of the companies had problems with trainees who had the requisite theoretical knowledge but lacked workplace skills.

The reasons for the skills gaps among TVET engineering graduates in relation to industry skills requirements and the response of the industry

Having established the skills gaps among engineering TVET trainees, the study went a step further to look at the reasons for the skills gap and response of the industry. The study sought the views of selected representatives of industries working with TVET institutions who indicated that skills gaps emerge from factors beyond an individual company or even country. Changes in technology in one part of the world or country quickly diffuses and triggers corresponding technological changes elsewhere. The process is complex and requires continuous upgrading of skills. When there is no link between the industry and academia, the skills gaps are exacerbated.

The director of the organization Linking Industry With Academia weighed in on the reasons for these skills gaps:

> *There is a gap between what is being taught in the current TVET curriculum and what is happening in industries. Most of the companies have introduced modern fully automated production lines in order to enhance their production, output and quality of their products. These companies are looking to recoup their heavy investment by ensuring greater efficiency and eventually the cost of production and raise their profit margins. They are in business. So we expect the TVET trainees to match this kind of high expectations. However, skills gaps lead to failure to achieve and maintain quality standards in the company, increased operational costs in retraining staff and challenges in timely delivery of the company objectives.*
>
> (Male LIWA Director)

The response from the LIWA director reverberated the cross-cutting findings from both respondents and a review of literature that technological advances were driving the skills needs in the industry while TVET institutions had fallen short. The LIWA director noted that there was a training gap between the TVET

institution and the industry. The summary of reasons for the skills gap included the introduction of new technology and new working practices; theoretical training related to the occupation; lack of practical use of computers and modern technology; personal traits of the trainee; inadequate course content in TVET institutions; and inadequate training infrastructure in TVET institutions.

CONCLUSIONS AND RECOMMENDATIONS

The study concluded that despite the renewed efforts to foreground TVET education in Kenya and developing countries in general, there is a significant gap between the skills required by the industry and the training offered in engineering courses in TVET institutions and which has partly contributed to the rising unemployment among the youth in the country. The ultimate goal of TVET training is providing technical training that meets the quality and practical-oriented labour market requirements.

However, TVET institutions continue to operate a conveyor belt production of engineering technicians to join the labour market. Unfortunately, the technology in the industry is fast evolving and therefore unable to absorb the trainees both for formal employment and self-employment. The study established that TVET training faces the challenge of major skills gaps in engineering courses due to unsatisfactory consultations between the curriculum developers and the industry, trainers who lack the requisite industrial experience and exposure plus obsolete and underutilized training infrastructure.

The findings of this study firmly recommended the institutionalization of the Collaborative Training Programme in TVET. These findings clearly highlighted some of the skills required in the current world of work and provides a point of reference for alignment efforts. The study recognizes that to do so, the country requires the full participation of industry. The government should provide incentives to industries for partnering with TVET institutions. Such incentives would include tax concessions. However, there may not be enough companies to take up the trainees. This gap is to be taken up by the SMEs.

Recommendations for further research

Bearing on the conclusions of this study, the research made the following recommendations for further study. The study could form a baseline for a full-scale study on skills gaps beyond engineering courses to encompass TVET training in general.

The emerging concept of Competency Based Education and Training (CBET) and its implications for skills match for TVET trainees in Kenya.

REFERENCES

Afeti, G., (2018). Education and Youth Development: Africa Policy Review Journal 2017/18 Royal Academy of Engineering Study, 2012

Arbizu, A. D., Shahab, Y., Chengang, Y., & Haider, M. J., (2019). Entrepreneurial self-efficacy and intention: do entrepreneurial creativity and education matter? *International Journal of Entrepreneurial Behaviour & Research*.

Blaug, M., & Ufficio internazionale del lavoro, (1973). Education and the employment problem in developing countries (pp. 9-9). Geneva: International Labour Office.

Blom, R. (2016). Towards a vocational pedagogy for South African TVET Educators. Occasional paper, Education Policy Consortium, 1-13.

Creswell, J., (2014). Mixed methods research. University on Nebraska. Lincoln, USA: Sage Publishers.

Hogarth, T., Shury, J., Vivian, D., & Wilson, R. (2001). Employers Skill Survey 2001: Statistical Report. DfES Publication (September 2001, Ref. SKT 40).

Institution of Engineering and Technology (IET). (2019). IET Skills and Demand in Industry 2019 Survey.

Judy, R. W., & d'Amico, C. (2020). Workforce 2020: Work and workers in the 21st century. Hudson Institute, Herman Kahn, Indianapolis.

Kenayathulla, H. B., Ahmad, N. A., & Idris, A. R. (2019). Gaps between competence and importance of employability skills: evidence from Malaysia. Higher Education Evaluation and Development.

Kispeter, E. (2018). What digital skills do adults need to succeed in the workplace now and in the next 10 years? Digital Skills and Inclusion Research Working Group Evidence Brief, Warwick Institute for Employment Research.

Malale, M. M., & Gomba, G. K. (2016). Stakeholders 'perceptions about Technical and Vocational Education and Training colleges in South Africa: A literature towards excellence in educational practices.

Mugenda, A., and Mugenda, O., (2013). Research methods: Quantitative and qualitative approaches. Nairobi: ACTS Press.

Oketch, M. O., (2007). To vocationalise or not to vocationalise? Perspectives on current trends and issues in technical and vocational education and training (TVET) in Africa. International Journal of Educational Development, 27(2), 220-234.

Ondieki et al., (2019) Integration of Soft Skills into the TVET Curriculum in Kenya. Journal of Multidisciplinary Engineering Science and Technology (JMEST) ISSN: 2458-9403 Vol. 6 Issue 9, September - 2019 www.jmest.org JMESTN42353117 10704

Schwab, K., & Samans, R., (2016). The future of jobs: Employment, skills and workforce strategy for the fourth industrial revolution. In *World Economic Forum* (pp. 1-32).

Sibiya, A. T., Nyembezi, N., & Bogopa, D. (2021). TVET engineering students' perceptions of the value of their qualification and the prospects of employment. Journal of Vocational, Adult and Continuing Education and Training, 4(1), 16-16.

Stewart, G. L., & Brown, K. G., (2019). Human resource management. John Wiley & Sons.

UNESCO-UNEVOC, (2017). Greening technical and vocational education and training – a practical guide for institutions.