

**INFLUENCE OF PUBLIC-PRIVATE PARTNERSHIP ON DEVELOPMENT
OF INDUSTRIAL SKILLS IN ENGINEERING TRAINING IN PUBLIC
TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING
INSTITUTIONS IN NAIROBI COUNTY**

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**A THESIS SUBMITTED TO THE SCHOOL OF EDUCATION IN PARTIAL
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2025

DECLARATION

Declaration by the Student

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Declaration by the Supervisors

This thesis has been submitted to us and approved by us as the university supervisors.



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DEDICATION

This thesis is dedicated to my late father Kikwai Arap Ngeny who instilled in me the value of hard work and perseverance. His spirit and memory have been my guiding light.

ABSTRACT

Dynamic trends in the engineering industry have continued to call for quality training to enhance the industrial skills of engineering graduates to meet the challenges of the 21st century industry. However, there is a growing skills gap which is a multi-faceted problem when highly skilled engineers are in short supply and high demand. This lauds the essence of public-private partnership in pooling resources, knowledge and experiences to build industrial skills amongst engineering trainees efficiently. Thus the study was guided by the following specific objectives; to determine the influence of partnering in engineering internships on industrial skills development in engineering training, to examine the influence of partnering in infrastructure development on industrial skills development in engineering training, to analyse the influence of partnering in capacity building of trainers on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County. This study was guided by Cognitive Learning Theory which was proposed by Jean Piaget in 1930. The study adopted a descriptive research design. The target population was 334 HoDs, course tutors and electrical engineering trainers. The study used Slovin's formula to calculate the sample size which is 182. The respondents were selected using a multistage sampling process. Data was collected by use of a questionnaire which was piloted for testing reliability and validity. Data was analyzed by use of descriptive and inferential statistics using Statistical Package for Social Sciences (SPSS) version 26.0 package and presented using tables. From the findings, the coefficient of determination (R square) of 0.318 indicated that the model explained only 31.8% of the variation or change in industrial skills development in engineering training. Engineering internship ($t = 2.867, P < .05$), infrastructure ($t = 3.779, P < .05$) and Capacity building ($t = 5.459, P < .05$). The study findings indicate that the engineering internship, infrastructure, and Capacity building significantly influence industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County. Therefore, TVET institutions should consider strengthening engineering internship, infrastructure, and Capacity building using a policy framework to enhance their potential industrial skills development in engineering training. The findings of the study are of significance to TVET and the stakeholders in improving the industrial skills development engineering trainees in TVET through public-private partnerships.

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LIST OF ABBREVIATIONS AND ACRONYMS

AI	Artificial Intelligence
CLT	Cognitive Learning Theory
CMC	Cooper Motor Corporation
CPD	Continuous Professional Development
EFA	Education For All
ETIP	Engineering and Technology Internship Program
FDSE	Free Day Secondary School Education.
FPE	Free Primary Education
GIZ	Gesellschaft für Internationale Zusammenarbeit
HoDs	Heads of Departments
LPPP	Locality-Public-Private Partnership
NSDP	National Skills Development Policy
PPP	Public-Private Partnership
STEM	Science, Technology, Engineering, and Mathematics
VET	Vocational Education and Training
EE	Electrical Engineering

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter provides the background, a description of problem statement, the study objectives, the research questions, the justification of the study, the scope of the study, the theoretical framework, the conceptual framework, and the operational definition of terms.

1.2 Background of the Study

Dynamic trends in the engineering industry have continued to call for quality training to increase the industrial skills of engineering graduates towards sustained solutions of the 21st-century industry. However, a growing skill gap, a multi-faceted problem, remains when highly skilled engineers are in low supply when the demand is high (Awonuga, 2020). This variation is set to slow down both innovation in the sector and economic growth as a whole. Therefore, training the Electrical Engineering trainees in TVET must enhance their global competence, problem-solving, critical thinking, and technology literacy. This corresponds to the expectation that TVET is expected to promote skills acquisition through competency-based training. However, the impact of TVET training on the acquisition of technical skills is still under debate (Shi & Mukdarut, 2022). This eulogizes the essence of Public-Private Partnership (PPP) in pooling resources, knowledge and experiences to build industrial skills amongst electrical engineering trainees efficiently. Accordingly, Reinsch and Caporal (2020) note that academic-industrial collaboration is essential in bridging the gap in industry growth and productivity.

Industrial skills development in engineering training exposes the trainees to a broad range of practical skills, problem-solving and production skills and allow skilled workers to find new opportunities for technical self-actualization (McGunagle & Zizka, 2020). Focusing on the goals of technical education, engineering training combined with production promotes the capacity of trainees to apply the skills to produce goods, and the supply of services becomes particularly significant. PPPs can improve the relevance and quality of skills training. However, most TVET institutions responsible for providing the much-needed skills in today's economy are still very traditional which promises to stunt in entire engineering training (Tom & Norton, 2017).

Public-Private Partnerships make sense and work well for the development of industrial skills in engineering training. The teaching approach by trainers should equip the trainees with skills compatible with the dynamic demands of the energy and power industries which are a cog in the wheels of a prosperous society (Srivastava, Awojobi, & Amann, 2020). Besides many industries, companies are investing in artificial intelligence (AI) and other technology which threaten to leave the most vulnerable trainees exposed to automation and worsen an existing skills gap. Partnerships between private companies and governments provide advantages to both parties. Private-sector technology and innovation, for example, can help improve the operational efficiency of providing public services (Brock, 2022).

The essence of PPPs in vocational and higher education is that it involves results that neither colleges nor companies could ever hope to achieve alone (Moerman, 2021). PPP describes a range of possible relationships among public and private entities in the context of infrastructure and other services. A strong PPP allocates the tasks,

obligations, and risks among the public and private partners in an optimal way. In TVET, PPPs are important for the development of high-quality vocational education and training, because they foster regular communication between employers and TVET providers. Therefore, TVET must be driven by the demand for skills, primarily from Enterprise and self-employment (Tom & Norton, 2021). In this regard, Dialogic and Ecorys (2020) note that evaluating partnerships in vocational education can strengthen the relationship between education and the labour market.

PPP initiatives to improve TVET have been widely used in numerous countries for many decades. In this regard, a multi-sectorial approach has to be embraced in improving skills development for the workforce in addressing contemporary global challenges. Also, 60% of sectors believe the match between the education program and companies' performance has improved (Moerman, 2021). The Dutch government developed several initiatives to realize regional public-private partnerships in vocational and higher education (Ministry of Education, 2017; Ministry of Economic Affairs, 2018) and within the private sector alone to stimulate cooperation to bridge the skills gap.

In the European countries, a number of initiatives were launched (European Training Foundation, 2019), including a 400 million Erasmus+ program by the European Commission, to realize so-called centres of vocational excellence in the Philippines, 80% of university education and TVET is provided by the private sector and most governments are still in a transition (Tom & Norton, 2021). In Bangladesh, Public-Private Partnerships (PPP) are recognized in National Skills Development Policy (NSDP) as an effective means to better the output in vocational training by promoting linkages between the private sector industries and government-funded TVET institutes

(www.ilo.org., 2018). In addition, technology and the engineering industry are pushing for this evolutionary progress. Karnataka State has collaborated with the Kangan University of Australia and TAFE Vocational Educational Institution for a training program for trainers, and State Government of Tamil Nadu has established a vocational training institute in the PPP model in sectors like aviation and shipping.

Africa is suffering from a chronic lack of skilled workforce, both quantitatively and qualitatively (Zizzamia, 2020). Glenda, Petersen, Fongwa, Azinga, and Rust (2017) indicate a significant misalignment between what the Higher Education and Training aspire to, the skills training (public and private) taking place, and the skills employers want. Therefore, there is a growing policy and strategic emphasis on the potential role of PPPs in promoting alignment in the skills development space. South Africa has produced explicit skills-gap diagnostics and is actively aligning public TVET provision with employer demand in priority technical occupations; donors and private firms are increasingly engaged in co-financing trainer upskilling and equipment (Salmi, Amegah, & Shinde, 2025). Zambia, Botswana, and Namibia similarly emphasize employer engagement and financing mechanisms to modernize workshop infrastructure (Swiss South African Cooperation Initiative (SSACI) , 2024). In West Africa, Ghana's first systematic TVET report and expanded public financing since 2020 illustrate a national push toward evidence-based TVET planning, while Nigeria and Senegal have combined national TVET reforms with donor-supported apprenticeships and private training centres to meet local industry needs (Ghana TVET Report, 2021).

Additionally, Agole, Kerre, Ochieng and Okaka (2022) pointed out that the universities-industry linkage can be a great vehicle to empowering innovation through knowledge exchange in Uganda. Many stumbling blocks exists in the Kenyan

Education Sector including financial, physical and human resources; more so soon after the introduction of free primary education (FPE) in 2003 and FDSE in 2008. Despite these challenges, the government was yet to embrace PPP in education (Manyonge & Kyalo, 2020). The private sector and general business community's involvement in education is usually limited and associated with philanthropy (Sears, 2023).

In Kenya EASTRIP, GIZ, Cooper Motor Corporation (CMC) Motors and ISUZU Kenya have partnered with the TVET institution through skills upgrading for the trainers, training infrastructure, materials and facilities, internship, and attachment placement for trainees (Gacheri, 2022). However, an ideal TVET system is an employer-led skills development structure anchored on research, policy and strategic planning. It is based on an analysis of the needs and the labour market, which then informs the job profiles, standards, qualifications, and curriculum development (Agole, Kerre, Ochieng & Okaka, 2022). This invokes urgency to strengthen the public-private partnership amongst public TVET institutions in order to propagate industrial skills in engineering training. Despite this, limited studies on public-private partnerships and industrial skills in engineering training in public TVET institutions in Nairobi County provide a gap for the current study.

1.3 Statement of the Problem

Technical and Vocational Training is an engine of economic development, international competitiveness in the knowledge-intensive economic sectors (Agole et al., 2022). This pushes for relook into how industrial skills in engineering training in TVET are compatible with the industrial demands. However, the existence of engineering training institutions in Kenya in the past decades has led to little progress in the acquisition and effective utilization of technology for industrial development. This is explained by

incessant resource challenges faced by TVET system in offering its trainees updated course training that aligns with the industry's changing needs (www.ilo.org., 2018). These resource challenges compromises on delivering relevant and high-quality training which undermines employability of their graduates and the overall economic growth (Aluoch, 2021). Furthermore, the engineering industry itself is an incessant victim of skills gap occasioning a challenge of practical, job-ready abilities. If this trend is allowed to continue then meeting the goals of Agenda 2063, which requires a robust engineering skill base would be a mirage.

These criticisms against TVET in provision of inadequate industrial engineering skills are likely to be reduced by productive partnerships with the industry. This implies that integrating PPPs into TVET bridges the engineering skills gap. PPPs are crucial in addressing the skill gap by providing the necessary resources, expertise, and alignment with industry needs (Ullah & Thaheem, 2018). PPPs can significantly enhance the quality and relevance of TVET programs, thus addressing the engineering skills gap key for innovative cutting-edge technology required by the industry. This enhances the reputation of TVET engineering programs for effective output. However, there exists no specific model that would include collaboration among the three major PPPs' stakeholders comprising the government, industries and TVET institutions (www.dcdualvet.org., 2019). PPPs with the private sector, particularly companies with significant financial, material, and knowledge resources, which can accomplish the goals of education for all (EFA) (Manyonge & Kyalo, 2020).

However, very few data exist on public-private partnership and industrial skills development in engineering training in public TVET institutions in Nairobi County providing a gap for the current study. Besides Wanjala et al. 2020; Sisimwo et al. 2023; Krishna and Babu, 2021; Wahungu et al. 2023 have highlighted the potential of PPPs

in industrial skills development, few have critically examined the influence of PPPs on specific aspects such as engineering internships, infrastructure development, and capacity building of trainers within urban TVET institutions. However, there is lack of contextualized, empirical evidence this engenders ambiguity on how effectively current PPP arrangements contribute to closing the skills gap in engineering training. Most research has not examined the impact of PPPs on the acquisition of industrial skills in engineering programs within urban TVET institutions in Nairobi County, where industry linkages are more dynamic. While PPPs are widely studied, there is limited evidence examining how specific PPP dimensions such as internships, infrastructure development, and trainer capacity building interact to influence practical skills acquisition in engineering training.

1.4 Purpose of the study

The purpose of this study is to assess how collaboration between public entities and private industry contributes to the advancement of industrial skills among engineering trainees within Technical and Vocational Education and Training institutions in Nairobi County.

1.5 The Specific Objectives of the study

- i. To establish the influence of partnering in engineering internships on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County
- ii. To examine how partnering in infrastructure development on industrial skills development influence engineering training in technical vocational education and training institutions in Nairobi County

- iii. To analyze the impacts of partnering in capacity building of trainers on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County

1.6 Research Questions

The research questions were as below;

- i. How does partnering in engineering internships influence industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County?
- ii. What is the influence of partnering in infrastructure development on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County?
- iii. To what extent does partnering in capacity building of trainers influence on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County?

1.7 Justification of the study

TVET sector as currently constituted in Kenya has been aligned towards creating a comprehensive, fair, and high-quality education opportunities for everyone (Langat, 2019). However, the TVET system has faced challenges in offering its trainees updated courses that reflect the continuously changing needs of the industry (www.ilo.org., 2018). Besides, the engineering industry itself is facing the persistent issue of the skills gap, which promises to stunt the growth of the entire sector. Thus, the weight of the TVET training on technical skills is still under debate calling for strengthening PPPs between academic - industry to bridge the gap in industry growth and productivity. Few studies on public-private partnership and industrial skills development exists in

engineering training in public TVET institutions in Nairobi County providing a gap for the current study.

Therefore, the current study is of significance to the government, policymakers, TVET institutions and researchers. The government institutions and policy makers may utilize the recommendations of this study to formulate or strengthen policies geared towards strengthening public-private partnerships on industrial skills in engineering training in technical vocational education in TVET institutions. Additionally, it is expected that the results of this study will help TVET instructors using plans that have been proven successful in developing students' technical skills. Particularly in light of Kenya's Vision 2030, this study would assist in addressing training needs and adapting to shifting demands for human resources.

1.8 Scope of the Study

This research assessed the influence of PPP on development of industrial based skills in engineering training in TVETs in Nairobi County. The independent variable was public-private partnerships which was studied in terms of Engineering internships, Infrastructure development, and Capacity building, the dependent variable was industrial developments of skills in engineering training in technical vocational education based on cognitive theory. The study looked into all public TVETs in Nairobi County. With 334 Heads of Departments (HoDs), course tutors, and electrical engineering trainers as the target population from January to August of 2024.

1.9 Theoretical Framework

In the 1936 Jean Piaget proposed Cognitive learning theory that knowledge is constructed through a set of developmental cognitive processes (Smith, 2017). Cognitive learning theory (CLT) asks us to think how thinking can be influenced by

internal factors (like how focused we are, or how distracted we've become) and external factors. The ability of the brain's mental processes to absorb and retain information through experience, senses, and thought is known as cognition (Zhang, 2019). In this theory, an individual's feelings, thoughts, and actions can affect how they learn. This means their mindset and thought patterns can influence how they learn and keep information. For example, someone's motivation to learn industrial skills and information in engineering training can refocus their lessons. Therefore, through public-private partnership, the TVET institutions can develop the external factors to influence how the engineering trainees learn industrial skills.

According to Cognitive Learning Theory, learning is more successful in PPP and TVET when students actively participate in real-world applications-related practical experiences. Public-private partnerships often involve hands-on training, apprenticeships, and internships in engineering fields. This theory posits that trainees in TVET institutions benefit from actively engaging with real-world problems, as it enhances cognitive processes such as comprehension and retention of complex engineering concepts. Additionally, Cognitive Learning Theory stresses that learning is more meaningful when learners can contextualize knowledge. PPPs provide TVET trainees with exposure to industry-specific problems, machinery, and practices, helping them contextualize theoretical knowledge gained in classrooms and apply it in practical industrial environments. This theory of Jean Piaget, focuses on the transfer of skills from one context to another. By working directly with industries, there can be theory to skills transfer, bridging education and practical engineering challenges. In fine, CLT explains that public-private partnerships in TVET institutions create a learning environment that enhances engineering skills through active engagement, real-world

problem-solving, feedback, scaffolding, and collaboration. These partnerships optimize the cognitive processes involved in skill acquisition, making the development of engineering skills more effective and applicable in the industry.

1.10 Conceptual Framework

A conceptual framework is a representation of the relationship you expect to see between your variables or the characteristics or properties that you want to study (Huppert & So, 2013). The study conceptualizes the link between the public-private partnership which has been studied in terms of Engineering internships, infrastructure and Capacity building of trainers, the dependent variable is industrial skills development in engineering training in technical vocational education. Partnering Engineering internship was assessed in terms of appropriate supervision and mentorship and provision of appropriate resources during an internship as the top influencing factors for the internship program (Gebeyehu & Atanaw, 2018). Partnerships in Infrastructure development was studied in terms of workshops, classrooms, and libraries. Partnering in capacity building was measured in terms of relevance, application and scope. Industrial skills in engineering training were measured focusing on the outcomes such as Knowledge Practical skills and social skills and responsibilities (Sukardi, et al., 2023).

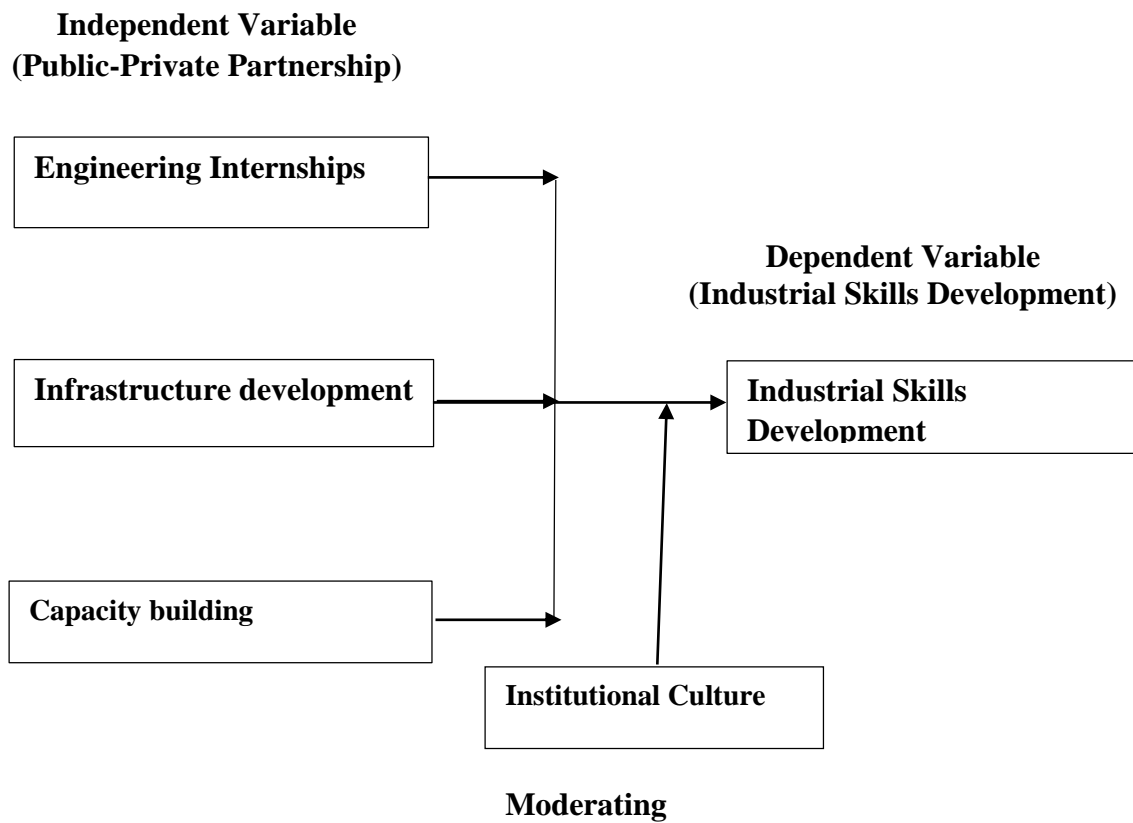


Figure 1.1: Conceptualization of the link between the public-private partnership and industrial skills in engineering training in institutions of technical vocational education training

Source (Author, 2024)

1.11 Operational Definition of Terms

Engineering Internship: a TVET trainee's learning experience in a real-life working environment that is relevant to his/her major in engineering.

Industrial Skills Development: abilities, knowledge, and expertise required by engineering trainees for successful employment in a variety of industrial settings including manufacturing, engineering, construction, maintenance, and other related professions in the industrial sector

Engineering Training: training on the application of science and math's to solve problems in TVET institutions

Technical Education: TVET programs that focus on new technology, applied sciences, skilled crafts, and job preparation

Vocational Education and Training (VET): Education and training for engineering trainees which aims to equip people with knowledge, attitudes, skills and competencies required in particular occupations or more broadly in the labour market

Capacity building: any activity or process aimed at improving of trainers skills to carry out essential functions, solve problems, define and achieve pre-set objectives of discharging their duty of training engineering courses trainees.

1.12 Summary

This section provided the background and rationale for examining the influence of Public-Private Partnerships (PPP) on industrial skills development in engineering training within Technical and Vocational Education and Training (TVET) institutions in Nairobi County. The chapter outlines the persistent skills mismatch between industry needs and graduate competencies, emphasizing the need for collaborative engagement in curriculum delivery, industrial attachment, and technology transfer. The statement of the problem highlights limited integration between training institutions and industry, resulting in inadequate practical exposure and reduced employability. The chapter further presents the study objectives, research questions, justification, significance, scope, and limitations, anchoring the investigation within Cognitive Learning Theory and Human Capital Theory as the theoretical framework supporting the study focus.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

A highlight of previous literature to provide insight into the research problem. It presents a review of variables, a literature review of the study's objectives, and a research gap.

2.2 Public-Private Partnership in TVET

In order to offer a project or service that is typically delivered by the public sector, the public and private sectors collaborate to form a PPP (Hodge & Greve, 2017). To enhance public services or the management of public sector assets, public-private partnerships (PPPs) combine the deployment of private sector money with, occasionally, public sector capital. They provide a more advanced and economical method of risk management by the public sector by concentrating on public service outputs (Delmon, 2017). Private sector funding is central to all PPPs. Additionally; it has penetrated industries, public monopoly for decades or even centuries. However, PPP is being expanded to other areas of human development, like health, and even to activities related to poverty reduction, as well as education, particularly basic education, which is considered a universal human or fundamental right. (Tilak, 2010).

The PPP is envisioned as a key tactic to promote the private sector's active involvement in national development and to access untapped private financial and human resources, including specific talents that would not be available in government. (Tilak, 2010). Better access to education and higher educational quality would result from the expanded resource base. In this sense, TVET needs to be strengthened through PPP in order to meet its goals of enabling students to keep up with the rapidly evolving

technological world and creating jobs for sustainable living, as the government cannot handle this massive task on its own. (Oviawe, 2018).

There are a lot of challenges facing TVET in Africa the greatest of which is inadequate funding by the governments. The quality of TVET facilities like workshops, books, classrooms, learning environments, machines, computer rooms, TV/Audio visual, instructors and contents of curriculum is inadequate in most tertiary institutions (Akhemonkhan & Raimi, 2013). The education sector in Kenya faces many challenges (financial, physical and human resources), especially after the introduction of free primary education (FPE) in 2003 and free day secondary school education (FDSE) in 2008. Despite these challenges, the government has not fully embraced Public-Private Partnership (PPP) in education (Manyonge & Kyalo, 2020).

The PPP- TVET partnerships approach should be developed in the condition where TVET institutions and industry work together and undertake joint initiatives based on mutual commitment and shared responsibility to promote formal and non-formal TVET in accordance with the needs of the market and technological changes (Siddiky & Uh, 2020). PPP-TVET partnerships are used in Kenya. Furthermore, if TVET schools function independently from the operational industries that need skilled workers, they will be unable to fulfill their responsibility of producing high-quality labor with advanced abilities. These industries need their graduates, thus TVET universities need to build cooperative relationships with them.

2.3 Empirical Review

The empirical literature review captured the connection between the dependent variable, which was industrial skills in engineering training in technical vocational

education, and public-private partnerships in terms of engineering internships, training tools, capacity building of trainers, and apprenticeship.

2.3.1 Partnership in engineering internships and industrial skills development in engineering training in technical vocational education

Internships have been used globally as a platform for training and educating future engineers (Tan & Umemoto, 2021). Internship or Industrial training is a significant method for combining theoretical education and the practical working world. As defined by Parkinson, the global competence for engineering graduates should include attributes such as multicultural diversity appreciation, cross-cultural communication, engineering practice in the global context, and proficiency in handling multicultural variations, essential for achieving the desired outcomes and goals (Parkinson, 2009). One of the successful ways of cultivating these characteristics is through vigorous internship programs that can stimulate global sensitivity and awareness in mutual multicultural understanding (Martín-Lara, Iáñez-Rodríguez, & Luzón, 2019). Engineering competencies have been successfully attained by chemical engineering undergraduates at Cork Institute of Technology, Ireland by integrating the Engineering Research Project module with the Professional Work Placement module in final year of the program (Lenihan, Foley, Carey, & Duffy, 2020). However, Akunda, Ouma, and Wanjala (2024) ; Achuodho (2024) shows that internship effects are conditional and in some settings weak or inconclusive.

To help STEM educational institutions create more relevant programs that include employability skills in the United States, McGunagle and Zizka (2020) identified the employability abilities that employers believe are lacking in the STEM (science, technology, engineering, and math) business. All 16 skills' median scores attested to their significance for employability across the five manufacturing sectors. Teamwork,

self-motivation, verbal communication, problem-solving, and initiative were the top five talents, in line with other research on workplace competencies. Accordingly, Mavrikios, Papakostas, Mourtzis, and Chryssolouris, (2013) note that an appropriate technology framework, dealing with the needs of engineers and blue-collar workers, for practicing the manufacturing knowledge content within digital environments, is suggested at this point.

Fakhri and Munadi (2019) evaluate the implementation of an industrial internship program on the aspects of planning, process and results. In this study, the industrial internship is for the trainees of Vocational High School in the Mechanical Engineering program. This research is quantitative research with the respondents of teachers, trainees, and the industries in Tegal Regency. The location of this research is in three Vocational High Schools (VHS) with an engineering program and the industries for trainees' internship. The result shows that the planning of the internship is in the suitability level for trainees, teachers and industries, the process of the internship is in the suitability level for trainees, teachers and industries; and the result of the internship is in the suitability level for trainees, for teacher, and 55% for the industries. In conclusion, the execution of the internship program of the VHS in Tegal is suitable for the stakeholders.

The effect of internships on the development of a subsequent capstone project was investigated by (Jaime, Olarte, García-Izquierdo, & Domínguez, 2019). From the findings Internships before capstone projects improve trainee skills in autonomy, technology, methodology, and project management; increase the complexity and technological novelty of the resulting projects; and reduce advisor involvement in practical (technology, execution) and keep-the-project-alive issues, and increase advisor involvement in monitoring trainee work (meetings, reports, and initial

arrangements). This effect was observed in both industrial and academic projects. Krishna and Babu (2021) on influence of internships on the Employability of undergraduate Engineering Trainees: in Malla Reddy Engineering College. From the findings, the score of trainee's performance in the industry is in the category 'Excellent' with an 82% average for 5 Academic years based on internship. The score of trainee's performance in the industry is in the category 'Medium' with an average of 54.4% for 5 Academic years based on non-internship. Out of all the trainees undergone internships more than 53% of trainees got placement in good companies.

Gebeyehu and Atanaw (2018) presented the impact of the mandatory Engineering and Technology Internship Program (ETIP) in views the employer's perspective based on a nationwide assessment study. Different sector employers gave primary data using a standard survey questionnaire. The major results showed that the length of the internship period and working hours in the industry, appropriate supervision and mentorship and provision of appropriate resources during internship as the top influencing factors for the internship program to bring the intended impact on the technology and engineering education in Ethiopia.

Wahungu, Wawire, and Kirimi (2023) investigated methods for bringing engineering TVET and training processes in Kenya's institutions into line with industry demands for skills. An in-depth overview of TVET training was provided via a descriptive survey that combined qualitative and quantitative methodologies. 489 individuals were used in the study, including 339 trainers, 3 directors of TVET, KAM, and LIWA, 24 industry representatives involved in TVET, 64 TVET engineering trainees, and 59 graduates of TVET engineering trainees. Focus groups, interview guides, and questionnaires were the primary methods used in the study. The Collaborative Training Program should be institutionalized at TVET, according to the study's conclusions. These results served as

a benchmark for alignment initiatives and highlighted some of the competencies needed in the modern workplace. The study recognizes that to do so, the country requires the full participation of industry.

2.3.2 Partnership in infrastructure development and industrial skills development in engineering training in technical vocational education

The two most obvious elements that will quickly affect how the community, especially parents and prospective trainees, perceives the overall quality, value, and appeal of the TVET programs are the learning environment (and thus infrastructure development) and innovative pedagogy in improving the TVET quality and image (Tan & Seet, 2020). A contemporary, well-equipped campus that is thoughtfully designed and brimming with worthwhile, captivating educational opportunities will greatly encourage parents to enroll their kids in TVET programs. Furthermore, it is crucial for engineers to have ongoing training. As technology, procedures, infrastructure, and tools advance quickly, so too should our abilities.

A big impact from training on the personnel's ability to perform the tasks which consequently impacts the equipment availability by reducing the need for maintenance actions or executing it more effectively. The lack of workshops hinders institutions' ability to promote practical teaching which is critical in skill development (Wanjala, Chepkoech, & Khatete, 2020). According to Wahungu, Wawire and Kirimi (2023), 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. Inadequacies of infrastructure resources in TVET are issues that have happened in TVET education throughout the years (Yeap, Suhaimi, & Nasir, 2021).

Kumar and Gupta (2023) examined the impact of public-private partnerships on the modernization of industrial training facilities and the subsequent enhancement of trainees' vocation-specific skills. The study found that PPPs led to significant modernization of industrial training facilities, which in turn enhanced trainees' vocation-specific skills. The collaboration facilitated access to advanced technologies and industry-relevant training. Othoo, Sika, Ojuok, and Opiyo, (2022) investigated access to Quality Technical Education Vocational and Training following Post Covid-19 Pandemic in Kenya. The methodology adopted includes systematic review of literature from primary and secondary databases and featured articles. The results revealed poor physical facilities; poor funding mechanism; inadequate materials for trainers and trainees and poor assessment methods.

Besides Wanjala, Chepkoech, and Khatete (2020) established of infrastructures in various TVETs and how it has impacted their capacity to produce quality graduates/manpower in line with Kenya's development aspirations. The study, in 10 public TVETs. The study examined various infrastructures in terms of their availability and adequacy. The findings on these two were used in correlating with Trainees' academic achievement. The study utilized a correlation research design. Ten principals, 100 heads of departments and 800 Trainees were involved in the study. Questionnaires, interview schedules and observation schedule guides were the main instruments for data collection. The results established that the correlation between infrastructure and academic achievement was very significant at 0.725. However, over 80 percent of the institutions lacked ICT infrastructures; workshops, libraries and modern classrooms. From the results, the state of infrastructures at the TVET institutions is negatively impacting manpower development, and the country's' ability to meet her development

aspirations in the Kenya Vision 2030 and the Sustainable Development Goal number four.

According to Sisimwo, Kiplagat, and Ochieng (2023), the study identified the infrastructure elements that affect the adoption of e-learning in TVET institutions in Uasin Gishu County. According to the results, the model only explained 44.9% of the variance or change in the e-learning implementation, as evidenced by the coefficient of determination (R square) of .449. However, Selina, (2020) notes that infrastructure investment was not accompanied by effective systems other factors such as industry linkages, internship/practice opportunities, updated curricula, assessment systems all play a role.

2.3.3 Partnership in capacity building of trainers and industrial skills development in engineering training in technical vocational education

Development of the TVET workforce has been a focus area for UNESCO and Member States and continues to be a priority given the critical role of skills development for work and life. Trainers have a varied range of qualifications, sometimes with little or no specialist trainer training. The main qualification does not appear to be a (pedagogical) trainer competence, but rather the possession of an academic degree, often in a subject not necessarily related to the one taught (UNESCO., 2019). Thus, there is a significant demand for skilled labour in manufacturing industries and a lack of alignment among stakeholders. In response to this, the proposed Locality-Public-Private Partnership (LPPP) model prioritizes and the role of locality in strengthening this relationship. Through this partnership and synergy in capacity building of trainers, it is expected that the competence of trainers will continue to be maintained and in accordance with the needs of industries for effective training. TVET teachers are left unsupported with often inadequate pedagogical skills, lack of industry experience, and

poor career prospects (Levin, Indhira, & Weber, 2023). These issues reduce the effective delivery of high-quality training and negatively affect the acquisition of practical skills demanded by the labor market.

The United Nations Committee of Experts on Public Administration specifies that capacity building occurs at three levels: the individual, institutional, and societal levels. UNESCO's TVET Strategy 2016-2021 confirms that an adequately prepared TVET staff is fundamental for TVET systems to provide youth and adults with innovative skills in fast-changing labour markets and to empower active citizens in sustainable societies. It also stresses the need for capacity-building initiatives for national decision-makers and institutions responsible for the training of TVET leaders, staff and managers at national, regional and international levels.

According to Kipkirui (2021) Professional development for trainers is widely recognized as a vital tool for educational reform. Greater emphasis is therefore being placed on importance of trainers towards application of pedagogical learner-centered approaches in TVET. Besides, training of in-service trainers should incorporate innovative practices, both in course content and instructional pedagogy. Additionally, Trainers must utilize emerging technologies, and industry trends from class through systematic and continuous professional development (CPD). Continuing TVET teacher education, particularly in the following areas: practical skills to correspond to the industry and economy; pedagogical skills; didactics (UNESCO.,2009). International cooperation programs based on multilateral partnerships between third-country nations not affiliated with the Program and organizations involved in VET are known as capacity development projects. Supporting the responsiveness, accessibility, and relevance of VET systems and institutions is their goal.

Aliemeke, Ehibor, and Omoakhalen (2020) discussed the challenges and improvement strategies responsible for capacity building in TVET in Nigeria. The study revealed the following factors as challenges of attaining capacity building in TVET programs: Inadequate funding, poor research attitude, poor training of TVET instructors, poor supervision of teachers, inadequate facilities and poor assessment of TVET trainees' competency. Also, the study shows that the public and private partnership, adequate supervision of TVET teachers, training of TVET teachers, adequate funding of TVET programmes and total implementation of TVET policy are the improvement strategies for capacity building in TVET programmes in Nigeria.

Vuyisile (2021) concentrated on the value of training and development as well as how it affects worker productivity and organizational efficacy. Employee awareness of their present knowledge and abilities is increased through training and development, which also conveys new information, skills, and evolving attitudes.

2.4 Literature Gap

Literatures on the concepts focused were examined and provided an empirical review on the link between the dimensions of public-private partnership and industrial skills to provide research gaps as highlighted. Studies carried out by Manyonge and Kyalo (2020) suggest that establishing PPPs with the private sector can assist governments in expanding the quality of education services. The specific effectiveness of these PPPs in achieving enhance education services, particularly industrial skills, could be explored further.

Inadequacies of infrastructure resources in TVET are issues that have happened in TVET education throughout the years (Yeap et al., 2021). Krishna and Babu (2021) Wahungu, Wawire, and Kirimi (2023) Gebeyehu and Atanaw (2018) noted that the

length of the internship period and working hours in the industry, appropriate supervision and mentorship and provision of appropriate resources during an internship as the top influencing factors for the internship program to bring the intended impact on the technology and engineering education. Exploring these factors in more depth, such as the specific challenges and success stories, could provide insights for optimizing internship programs in industrial skills acquisition. According to Oviawe (2018), ensuring students are up in task with changes in the workplace, TVET institutions and industry must share tools and equipment.

Wanjala, Chepkoech, and Khatete (2020) state that the infrastructure at the TVET institutions is negatively impacting workforce development and the country's ability to meet its development aspirations in the Kenya Vision 2030 and Sustainable Development Goal number four. Vuyisile (2021) examined the value of training and development and how it affects worker performance and organizational efficacy, discovering a favorable correlation. According to Makau (2017), there was a favorable and correlation in performance of workers and capacity building. These provided conflicting findings, which provided a gap for the current study. Furthermore, limited studies in the Kenyan context have been conducted on public-private partnerships in industrial skills in engineering training in TVETs, providing a gap for the current study.

2.5 Summary of the Chapter

This chapter describes the literature review based on the concept of public-private partnership in TVET. It also provides an empirical review of the literature in terms of the study's specific objectives; Partnering in engineering internships on industrial skills development in engineering TVETs; partnering in infrastructure development and industrial skills development in engineering training in TVETs; partnering in capacity building of trainers on industrial skills development in engineering training in technical

vocational education and training institutions. The empirical review has helped uncover the various research gaps per the study's objectives in terms of conflicting results, limited studies in the Kenyan context have been conducted on public-private partnerships in industrial skills in engineering training in TVETs, providing a gap for this research.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The approach utilized to accomplish the study's goals is described in depth in this chapter. A research methodology consists of certain approaches used to gather, compile, and assess data during the research process.

3.2 Research Design

A research design is a set of strategies and techniques for acquiring and examining data regarding the variables listed in the studied topic (Patten, 2017). To explore a scientific topic, a research design is a framework of research methods and procedures. Descriptive study design was used to characterize the population, setting, or phenomenon being studied in this study. Surveys acquire data for descriptive research designs on various topics (Nardi, 2018). Descriptive research is the best option when a study's objective is to identify traits, frequencies, trends, and associations. The effectiveness of this design in gathering evidence of current events or conditions, in developing standards or norms against which current conditions may be evaluated, in determining how to proceed after determining where you are and where you want to go led to the selection of this design (Levitt et al., 2021). Using this design, the researcher compiled information on how public-private partnership approaches affect trainees' industrial skills in engineering training in TVETs in Nairobi County. A descriptive research design is the most appropriate choice when the intent is to capture the current state, distribution and characteristics of variables as they exist naturally without researcher (Enago., 2023). Descriptive design therefore aligns directly with the study's

aim to document how PPP modalities are implemented and how trainees' skill outcomes vary by exposure to those modalities.

3.3 Study Area

This research was based in Nairobi County. Nairobi is Kenya's capital and largest city, with an estimated population of 4,397 073 in the recent 2019 census. There are seventeen sub-counties in Nairobi and eighty-five electoral wards. The study area houses 17 public Technical and vocational training institutions, as listed in Appendix IV.

3.4 Target Population

The target population refers to the entire group of individuals, units, or elements that possess the characteristics relevant to a particular research study and to whom the researcher intends to generalize the study findings (Stockemer, 2019). It represents the theoretical or intended population from which a sample may be drawn for investigation. The entire population of the units from which survey data is gathered to form conclusions is the target population for a survey (Pandey & Pandey, 2021). HoDs, Course tutors and electrical engineer trainers were the target population. It is prudent for a small study population due to resource limitations like time, space, and financial limits; thus, the study resorted to using the available population, a subgroup of the target group. In this study, the target population was 334 HoDs, Course tutors, and electrical engineering trainers, as Appendix III indicates. Based on their familiarity with public-private partnership initiatives and industrial skills in electrical engineering training in technical vocational education, they could give great insights into the study.

3.5 Sampling Frame

The group of individuals that can be selected from the study's target population based on the selection process and access methods used is called the sampling frame (Sarstedt et al., 2018). Sampling frame consisted of all HoDs, Course tutors who coordinate for each course and electrical engineering trainers in the TVETs in Nairobi County. Their knowledge on public-private partnership initiatives and industrial skills in electrical engineering training in technical vocational education.

3.6 Sample Size and Sampling Technique/Procedures

The sampling procedure in statistical analysis entails choosing a certain number of observations from the target (Rivera, 2019). For this investigation, a multi-stage sampling technique was employed. According to Topchiy et al. (2018), multi-stage sampling techniques use smaller sampling units and sample in phases. The sampling frame comprised stakeholders directly involved in engineering training within TVET institutions in Nairobi County, specifically Heads of Departments (HoDs), engineering course tutors, and industry-based trainers linked through public-private partnership (PPP) arrangements.

Purposively, the TVET institutions were initially identified with active or notable PPP arrangements in their engineering programs. Within these institutions, engineering departments were purposively selected to ensure that only departments directly implementing industrial skills development through PPPs were added in the study. This step ensured that the sample focused on the most relevant units for investigating the influence of PPPs. Second, within each selected engineering department, stratified sampling was used to categorize potential respondents into three distinct strata: HoDs, course tutors, and industry-based trainers. Stratification was necessary to ensure that

each subgroup's unique perspectives on PPP influence and industrial skills development were adequately captured (Manna & Mete, 2021).

Finally, in the individual stratum, simple random sampling was further used, giving every eligible member an equal chance of inclusion (Mweshi & Sakyi, 2020). This random selection minimized selection bias and enhanced the representativeness of the sample.

Overall, this multistage sampling procedure combining purposive sampling of institutions and engineering departments, stratified sampling by role, and simple random sampling of individuals ensured that the study gathered diverse, relevant, and credible insights on how public-private partnerships contribute to industrial skills development in engineering training within Nairobi County's TVET sector.

3.6.1 Sample Size

Every item in the population had an equal probability of being chosen for a sample using essential random sampling (Manna & Mete, 2021). Each item has an equal chance of being chosen for a sample using simple random sampling. The method maximizes survey precision while decreasing variation for a given sample size. The study used Slovin's formula to calculate the sample size, which is 182. Slovin's formula calculates the minimum sample size needed to estimate a statistic based on an acceptable margin of error. Slovin's Formula provides the sample size (n) using the known population size (N) and the acceptable error value (e). 182 persons were taken for a sample for this study. An excellent maximum sample size is usually around 10% of the population (Bullen, 2016). Therefore 182, which is 54% of the population, was preferable.

The Slovin's Formula is given as follows:

$$n = N/(1+Ne^2),$$

where n = sample size,

N = population size

e = the margin of error (0.05).

$$n = 334 / (1 + 334(0.05)^2)$$

$$n = 182$$

The following formula in calculating the sample proportions from each TVET institution was used:

$$n_i = (N_i \times n) / N$$

3.7 Data Collection Instrument

According to specific objectives, the study collected the primary data utilising questionnaires. Questionnaire was the primary source of information for this study. A questionnaire is a structured data collection instrument that consists of a series of written questions designed to gather information from respondents on specific variables of interest in a study (Dubey & Kothari, 2022). According to Kothari, (2020), a questionnaire enables systematic and standardized collection of data across a defined population, which enhances reliability and comparability of responses.

A questionnaire was distributed to HoDs, Course tutors and electrical engineering trainers in technical vocational education and training institutions in Nairobi County was the major research tool used to gather primary data. Likert scales, frequently used in the social sciences to evaluate people's opinions, attitudes, values, and behaviour, are used in the survey's closed ended questions and the five possible responses (Stockemer, 2019). The questionnaire had a total of 25 statements with 2 sections parts as shown in (See Appendix II). Section I contained questions relating demographic background of the respondent with 4 items. Section II will had four parts with items relating

Engineering internships, Infrastructure development, Capacity building, and industrial developments of skills in engineering training in technical vocational education. A 5-point Likert scale was used to design the questionnaire and responses ranging from (5 = very high Extent (VGE), 4 = High Level (GE) (3 = moderate level) (ME), 2 = Narrow Range (SE) Character 1 represents Very Small Extent (VSE). This is because the 5-point Likert scale is simple to understand and use for a survey.

3.8 Piloting of Research Instrument

A study undertaken before the "primary study" to verify the effectiveness of the research tool - "pre-test" (Rupprecht et al., 2021). To determine if the developed instrument is consistent with the content of the study questions, the questionnaire was pre-tested among TVET institutions in Kiambu County. As a result, the researcher confirmed the sample participants' reliability of the questionnaire. Additionally, it guaranteed that the questionnaire offer insight into the topic being researched. Before conducting the research, it was useful to correct some of the wording of the questions. 10% of the sample population was involved (Dubey & Kothari, 2022). This means 18 respondents were taken from the Kiambu National Polytechnic formerly Kiambu Institute of Science and Technology in Kiambu County.

3.8.1 Validity of the Instrument

Based on internal validity, it is demonstrated how closely data collection, analysis, and interpretation connect to the study variables. Content validity was attained by guaranteeing the relevance of study findings with theoretical frameworks and literature evaluations (Benova et al., 2020). The researcher investigated the literature on measurement of constructs factors. The public-private partnership that was studied was in terms of Engineering internships, infrastructure development and Capacity building

of trainers; the dependent variable is industrial skills in engineering training in technical vocational education. The supervisor was the questionnaire and read it before examining it to determine whether it made sense. Validity was also attained by ensuring that questionnaires cover all study constructs. The articles were representatively sampled with care.

3.8.2 Reliability of Instruments

According to Collis and Hussey (2014), reliability is the absence of variations in the findings if the study were conducted again. Reliability was defined by the researcher as the validity, precision, and consistency of the information gathered and the findings reported. Cronbach's alpha coefficient was used to determine internal consistency. SPSS (Statistical Package for Social Science, Version 29.0) was used to calculate the reliability test. Reliability was calculated using the Cronbach's alpha coefficient (Blumberg et al., 2014).

3.9 Data Collection Procedures

With approval from the University and each technical institute, self-administered questionnaires were used to gather primary data.

3.10 Data Processing and Analysis

Both descriptive (mean, standard deviation, frequencies, skewness, and kurtosis) and inferential statistics were used to analyze the data. In addition to helping identify mistakes and outliers, descriptive statistics offer a conclusion regarding the distribution of data. SPSS V 26.0 program, multiple regressions were employed under inferential statistics to analyse the impact of a collection of independent factors (public-private partnership approaches) on the dependent variables' coefficient of correlation.

The regression model was as:

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \dots \dots \dots \text{Equation 3.1}$$

Where y Represented industrial skills in engineering training in technical vocational education, which was the dependent variable x represents the public-private partnership Approaches, β Is the standardized regression coefficient.

X_1 represents engineering internships.

X_2 represents infrastructure development

X_3 represents the Capacity building of trainers

3.10.2 Assumptions of Multiple Regression

The study tested for linear relationship, normality, multicollinearity, and homoscedasticity regression assumptions (Houlahan et al., 2018).

Normality: Regression makes the assumption that the distributions of the variables are normal. Relationships and significance tests can be distorted by non-normality distributed variables, which include severely skewed or kurtotic data or those with significant outliers. Skewness and kurtosis were used in this study to evaluate the assumption (Knief & Forstmeier, 2021). According to Hatem et al. (2022), kurtosis values must be between +3 and -3, while data skewness values must be between +1 and -1.

Multicollinearity: When two or more explanatory variables in a multiple regression model are extremely linear, this is referred to as multicollinearity. Multicollinearity was tested using three main criteria: variance inflation factor, tolerance, and correlation (Knief & Forstmeier, 2021). The VIF quantifies the impact of co-linearity among the variables in a regression model. 1. The VIF is tolerance. The VIF number should be

less than 10. When the VIF exceeds 10, multicollinearity occurs; the tolerance should be between 0 and 1 (Williams, 2015). 1s' can be found on the major diagonal of the correlation matrix since a factor's correlation coefficient with itself is always 1. Knief and Forstmeier (2021) state that this indicates that the matrix is an identity matrix devoid of multicollinearity.

Homoscedasticity: This assumption describes a situation in which the error term (the “noise” or random disturbance in the relationship between the independent variables and the dependent variable) is the same across all values of the independent variables. Heteroscedasticity (the violation of homoscedasticity) is present when the error term's size differs across an independent variable's values (McDonald, 2017). This assumption was tested by visually examining scatter plots (Allison, 2015).

3.11 Ethical Considerations

Ethical considerations for research are principles that protect morality and guide researchers when conducting research; they keep researchers accountable, thus ensuring proper use of funds and avoiding research misconduct (Moumita, 2022). Ethical considerations are a series of guidelines researchers should follow when researching behavior. Bell and Waters (2018) insist that researchers should consider possible ethical concerns their study might face before carrying out a research project. Research authorization was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) and followed by authority from the County Commissioner and County Director of Education of two counties, Kiambu and Nairobi. Before administering the questionnaire, a letter stating the purpose of the study and how the researcher maintained privacy, anonymity, and a consent form for participants to

sign before they engage in the research as suggested by Creswell and Creswell (2017) was attached. This form ensured that participants' rights are protected during data collection. Voluntary and informed consent is one of the major ethical issues in conducting research, which implies the fact that "a person knowingly, voluntarily, intelligently, and clearly and manifestly, gives his or her (Dankar et al., 2019). This was achieved by the researcher explaining to the respondents the purpose of the study and the risks that could be involved. It also guarantees the confidentiality of the research subjects by observing anonymity and freedom to participate or not participate in the study.

The researcher identified himself clearly to the subjects by explaining the benefits of the study to the subjects to enhance their confidence in participating in the study. The respondents were granted the right to withdraw, allowing participants to stop and leave at any point in the study. From before the study begun until after the data had been collected.

3.12 Summary of the Chapter

Chapter Three presents the research design and methodology adopted to investigate how public-private partnership (PPP) approaches influence industrial skills development in engineering training within Nairobi County TVET institutions. The chapter outlines a descriptive research design which supports the empirical documentation of current conditions and relationships between PPP modalities and trainee skills outcomes. The study area is Nairobi County, characterized by a high concentration of public TVET institutions relevant to engineering training. The target population comprises 334 Heads of Departments, engineering course tutors, and industry-based trainers directly engaged in PPP-linked training activities. A multistage

sampling procedure was applied, involving purposive selection of TVET institutions with active PPP initiatives, stratification of respondents by role, and simple random sampling within each stratum. Slovin's formula generated a sample size of 182 respondents. Structured questionnaires using a five-point Likert scale constituted the primary data collection instrument, with piloting conducted in Kiambu County to ensure validity and reliability, including Cronbach's alpha assessment. Data collection adhered to formal authorization and ethical standards emphasizing confidentiality and voluntary participation. Data analysis employed descriptive and multiple regression techniques using SPSS, supported by diagnostic checks for normality, multicollinearity, and homoscedasticity. Overall, the methodology ensured rigor, representativeness, and relevance to the study's objective of assessing PPP contributions to engineering industrial skills training.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

In this chapter, the response rate, reliability tests, background information of respondents, findings of descriptive statistics and inferential statistical results were presented respectively. The findings of descriptive and inferential analysis according to the study variables and objectives.

4.2 Response Rate

A sample size of 182 was chosen from 334 HoDs, course instructors, and electrical engineering trainers. Subsequently 182 questionnaires were sent out. Out of the 167 returned questionnaires Twelve were rejected because they were incomplete, incorrectly filled out, or did not receive a response. In the end, 155 surveys were correctly completed by the researcher. This indicates an 85.2% response rate. The response rate was sufficient for external validity. For surveys, a 30% response rate is deemed appropriate. For reporting and analysis, a 50% response rate is sufficient. According to Wu, Zhao, and Fils-Aime (2022), a response rate of 60% is considered good, and 70% or higher is considered very good. As a result, the 85.2% were deemed acceptable.

4.3 Reliability Test Findings

The internal consistency of the research questionnaire was tested as shown in Table 4.1.

Table 4. 1: Reliability Test

Variables	Cronbach's Alpha	Test Items
Internship	.827	6
Infrastructure	.752	5
Capacity building	.825	5
Industrial skills development	.780	6

From the Table 4.1, the results indicated that partnership in engineering internship had the highest Cronbach's alpha coefficient (0.827), with 6 test items. Partnership in capacity building had the second highest Cronbach's alpha coefficient (0.825), with 5 test items. Industrial skills development in engineering had the third highest Cronbach's alpha coefficient (0.780), with 6 test items. The findings also showed that partnership in infrastructure development had a Cronbach's alpha coefficient (0.752), with 5 test items making it the fourth highest. This implies that the research instrument met the reliability threshold, the constructs had Cronbach's alpha coefficients greater than 0.7.

4.4 Demographic Information

The study took into account the demographic information of the respondents in terms of age, gender, level of education, and work experience.

4.4.1 Gender

Table 4. 2 Gender of respondents

	Frequency	Percent
Male	110	71.0
Female	45	29.0
Total	155	100.0

From the findings there were 71% of respondents were males while 29% were females. In this regard there was gender parity amongst the trainers of engineering in technical vocational education and training institutions in Nairobi County. A nearly equal gender balance among trainers can reduce the likelihood of gender bias in curriculum delivery, assessment, and mentorship under PPP programs. Gender diversity among trainers ensures that PPPs address both technical and soft skills relevant to diverse needs on the gender-diverse workforce in engineering (Hickey, 2023).

4.4.2 Age

The age findings are presented in Table 4.3.

Table 4. 3 Age of respondents

	Frequency	Percent
Less than 30 years	24	15.5
31-40 years	74	47.7
41-50 years	41	26.5
Over 50 years	16	10.3
Total	155	100.0

From the findings 15.5% were less than 30 years, 47.7% were between 31-40 years, 26.5% were 41-50 years, 10.3% were over 50 years of age. In this regard majority of the trainers were youthful. Young trainers are often more familiar with modern technologies and innovations, making them better equipped to align PPP initiatives with current and emerging industrial needs (Matshidze, 2021). Their technological proficiency can bridge the gap between theoretical knowledge and practical industrial applications, enhancing the relevance of engineering training. Additionally, younger trainers are often more willing to experiment with innovative teaching methodologies, including technology-driven approaches supported by PPPs. These innovative methods can enhance the delivery of industrial skills training, ensuring trainees are well-prepared for modern engineering roles.

4.4.3 Level of Education

Table 4. 4 Highest level of education of Respondents

	Frequency	Percent
Diploma	16	10.3
Higher Diploma	56	36.1
Bachelors	51	32.9
Post Graduate	32	20.6
Total	155	100.0

From the findings majority of trainers at 36.1% had higher diploma education and above level of education, 32.9% had Bachelors level of education and above, 20.6% had a post graduate level of education while 10.3% had diploma level of education. In this regard all the trainers had diploma level of education and above. This diverse expertise provided a balanced understanding of how PPPs impact both the operational and strategic aspects of industrial skills development. Additionally, the diverse expertise improved the quality and depth of findings, particularly regarding the long-term impacts of PPPs on skills development.

4.4.4 Work Experience

The work experience of the respondents are presented in Table 4.5.

Table 4.5 Work experience of respondents

	Frequency	Percent
Less than 5years	75	48.4
Between 6-10years	16	10.3
Between 11-15years	32	20.6
Over 16-20years	32	20.6
Total	155	100.0

4.5 Descriptive Statistics of the Variables

This section illustrates descriptive findings and discussions based on the objectives of the study. The study focused on the following features of the study variables; Partnership in engineering internships, Partnership in infrastructure development, partnership in capacity building and industrial skill development. The findings were presented in form of frequencies, Mean and Standard Deviations. The responses were measure on a 5 Point Likert-Scale ranging from (5 = very high Extent (VGE), 4 = High Level (GE), 3 = moderate level) (ME), 2 = Small Extent (SE) Character, 1 = Very Small Extent (VSE).

4.5.1 Partnership in engineering internships

According to the study findings presented in Table 4.6, the researcher sought to know the status of partnership in engineering internships in in technical vocational education and training institutions in Nairobi County.

Table 4.6 Partnership in engineering internships

Statement	MIN	MAX	SKEW	KURT	M	SD
The internship programs are designed to build on the trainee's strength or correct their deficiencies	1	5	-.833	-.871	3.80	1.501
The quality criteria of curriculum and practicals provided by the companies are integrated during the internship program	1	5	-.883	-.775	3.79	1.519
Internship programs enhance the trainee's innovativeness	1	5	-1.129	.354	4.25	.971
The companies which offer internship programs have provide adequate supervision to trainees	1	5	-.330	-1.378	3.61	1.306
The TVET institution and hosting company is committed in the follow up of trainees	1	5	-.423	-1.195	3.79	1.190
The hosting company provides the necessary facilities in favour of electrical engineering	2	5	-.525	-1.303	3.92	1.184

Key: N = Number, MIN = Minimum, MAX = Maximum, SKEW = Skewness, KURT = Kurtosis, M = Mean, SD= Standard Deviation

Partnerships in engineering internships are key for bridging the gap between theoretical knowledge and practical application (Urquia-Grande & Perez Estebanez, 2020). These collaborations, typically involving educational institutions, private sector companies, and sometimes government agencies, offer several benefits and implications for trainees, institutions, and industries. From table 4.5 majority of the respondents agree to a great extent that the internship programmes are designed to build on the trainee's strength or correct their deficiencies with mean = 3.80 and SD 1.501. The responses were normally distributed with a Kurtosis= -.871 and Skewness= -.833 with a min of 1

and max of 5. Designing internship programs to build on trainees' strengths or correct their deficiencies has significant implications for the success of the program, trainee development, and industry-academia alignment. However, the TVET institutions and industry should focus on this alignment more than it is to boost self-esteem and engagement amongst engineering trainees, leading to higher productivity during the internship. This is further enhanced by the fact that employers' benefit from interns with fewer deficiencies, reducing the need for extensive post-hiring training (Ranabahu, Almeida, & Kyriazis, 2020). In consonance, majority agree that the quality criteria of curriculum and practicals provided by the companies are integrated during the internship programme, mean=3.79 and SD 1.519. The responses were normally distributed with a Kurtosis= -.775 and Skewness= -.883 with a min of 1 and max of 5.

Besides majority of the respondents agreeing that internship programmes enhance the trainee's innovativeness, mean of 3.79 and SD 1.519. The responses were normally distributed with a Kurtosis= -.354 and Skewness= -1.129 with a min of 1 and max of 5. Thus, Internship are enhancing trainees' innovativeness by exposing them to real-world challenges, diverse work environments, and opportunities to apply theoretical knowledge creatively. This is because internships allow trainees to work on actual projects or tasks, encouraging them to think critically and devise innovative solutions. Additionally, majority of the people agree to a great extent that the companies which offer internship programmes have provided adequate supervision to trainees, mean of 3.61 and SD 1.306. The responses were normally distributed with a Kurtosis= -.330 and Skewness= -1.378 with a min of 1 and max of 5. Besides, majority of the respondents agree to a great extent that the TVET institution and hosting company is committed in the follow up of trainees, a mean of 3.79 and SD 1.190. The responses were normally distributed with a Kurtosis= -1.195 and Skewness= -.423 with a min of 1 and max of 5.

This affirmed by the fact that regular follow-up ensures that trainees focus on specific skill areas relevant to their roles and industry needs. In addition, supportive supervision and consistent feedback boost trainees' confidence in their abilities and performance. Finally, majority of the respondents agree to a great extent that the hosting company provides the necessary facilities in favour of electrical engineering with a mean of 3.92 and SD 1.184 the responses were normally distributed with a Kurtosis= -1.303 and Skewness= -.525 with a min of 2 and max of 5. The provision of necessary facilities by hosting companies during electrical engineering internships significantly impacts trainees' skill development, confidence, and employability (Twiner, Major, & Wegerif, 2021). It aligns education with industry standards, encourages innovation, and strengthens educational institutions and the industry linkage. While it requires investment and planning, the long-term benefits for trainees, companies, and the broader engineering sector outweigh the initial costs.

4.5.2 Partnership in Infrastructure Development

The status of partnership in Infrastructure Development in TVETs in Nairobi County.

Table 4.7 Partnership in Infrastructure Development

Statement	MIN	MAX	SKEW	KURT	M	SD
Classes are adequate to accommodate all Trainees during the lessons	3	5	-.562	1.116	4.77	.435
The college has had adequate electrical engineering workshops through partnership	4	5	-.763	-1.117	4.74	.439
Private organizations have supported our institution in development of the spacious library adequate for all trainees	4	5	-.474	-1.238	4.76	.428
The workshops are equipped with relevant equipment	3	5	-.560	-1.024	4.46	.775
Trainees can easily asses learning resources from the library	2	5	-.850	2.370	4.34	.606

Key: N = Number, MIN = Minimum, MAX = Maximum, SKEW = Skewness, KURT = Kurtosis, M = Mean, SD= Standard Deviation

Infrastructure development in TVET institutions through partnerships is a crucial strategy for enhancing the quality of training, fostering industry-ready graduates (Simpungwe, 2024). From the findings in table 4.6 majority of the respondents agreed to a very greater extent with a mean of 4.77 and SD of .435 that classes are adequate to accommodate all trainees during the lessons with a min of 3 and max of 5. Additionally, majority of respondents also agreed to a very great extent with a mean of 4.74 and SD of .439 that the college has had adequate electrical engineering workshops through partnership with a min of 4 and max of 5. Besides, majority of the respondents agreed to a very greater extent with a mean of 4.76 and SD of .428 that private organizations

have supported our institution in development of the spacious library adequate for all trainees with a min of 4 and max of 5. Partnerships that provide adequate electrical engineering workshops and libraries are transformative for TVET institutions, offering tangible benefits for trainees, faculty, and industry stakeholders (David, 2023). These partnerships improve the quality of education, skill development, and employability of graduates while fostering innovation and collaboration between the education sector and industry. Additionally, majority of the respondents agreed to a great extent that the workshops are equipped with relevant equipment with a mean of 4.46 and SD .775. The responses were normally distributed with a Kurtosis= -1.024 and Skewness = -.560 with a min of 3 and max of 5. This implies that through partnership in infrastructure development the TVET institutions to provide quality education, industry-ready skills, and alignment between education and industry demands has been immensely enhanced. Additionally, majority agree to a great extent that the trainees can easily assess learning resources from the library, mean of 4.34 and SD .606. with normally distributed with a Kurtosis= 2.370 and Skewness = -.850 , mean of 2 and max of 5. This implies that partnership has proved to be solution to limited resources that TVET institutions have suffered in the past as a setback to enhancing Industry-Centric and eco-centric Skills amongst its graduates.

4.5.3 Partnership in Capacity Building

Table 4.8 Partnership in Capacity Building

Statement	MIN	MAX	SKEW	KURT	M	SD
Training and development improve service provision to trainees	2	5	-.132	-.084	4.17	1.082
Training and development increases opportunities for career development	4	5	-.440	-1.830	4.61	.490
Trainers are given a chance to apply new skills	2	5	-.482	2.188	4.52	.687
Capacity building sessions are aligned with electrical engineering needs	2	5	-.509	1.114	4.39	.963
Skills provided during training and development are applicable to the working environment	2	5	-.659	-.786	4.10	.979

Key: N = Number, MIN = Minimum, MAX = Maximum, SKEW = Skewness, KURT = Kurtosis, M = Mean, SD= Standard Deviation

Capacity building for staff in TVET institutions is crucial for improving education, enhancing the competencies of educators, and ensuring a rapidly evolving world (Niyonasenze, Nzabwirwa, & Nizeyimana, 2024). From the findings in table 4.7 majority of the respondents agreed to a very greater extent with a mean of 4.17 and SD of 1.082 that enhanced development and training improves service provision to trainees with a min of 2 and max of 5. Additionally, majority of respondents also agreed to a very great extent with a mean of 4.61 and SD of .490 that Training and development

increases opportunities for career development with a min of 4 and max of 5. Partnerships ensure that TVET staff receive ongoing training, exposure to new technologies, and access to expert knowledge, which directly enhances the quality of education provided to trainees (Niyonasenze, Nzabwirwa & Nizeyimana, 2024). Besides, majority of the respondents agreed to a very greater extent with a mean of 4.52 and SD of .687 that Trainers are given a chance to apply new skill with a min of 2 and max of 5. As educators gain more knowledge and experience, trainees benefit from a higher quality of instruction and more relevant, industry-aligned skills.

Additionally, majority of the respondents agreed to a great extent that capacity building sessions are aligned with electrical engineering needs with average 4.39 and SD .963. The responses were normally distributed with a Kurtosis= -1.114 and Skewness = -.509 with a min of 2 and max of 5. In this regard the TVET trainers are abreast with relevant, up-to-date, and effective VET engineering. Majority of the respondents agreed to a great extent that skills provided during training and development are applicable to the working environment with a mean of 4.10 and SD .979. The responses were normally distributed with a Kurtosis= -.786 and Skewness = -.659 with a min of 2 and max of 5. Partnerships play a crucial role in the capacity building of TVET staff. Working together with industry, government bodies, universities, and NGOs, TVET institutions can enhance the quality of education they offer, improve the employability of graduates, and contribute to national and global economic development.

4.5.4 Industrial Skill Development

The findings presented in Table 4.9, the research revealed the status of industrial skill development in TVET institutions in Nairobi County.

Table 4.9 Industrial Skill Development

Statement	MIN	MAX	SKEW	KURT	M	SD
The trainees respect ideas and contributions of other members	2	5	-.831	-.221	4.34	.767
Mastery of theoretical knowledge in electrical engineering has increased	4	5	-.217	-.763	4.74	.439
Trainee can perform practical aspects of electrical engineering with ease	2	5	-.683	.578	4.43	.592
Trainee readiness to rapidly changing engineering technology has been enhanced	1	5	-.299	1.502	4.19	.952
The trainees are able to effectively solve electrical engineering related problems	1	5	-.792	-.178	4.26	.853
Trainees learnt how to communicate with different particular goals	1	5	-.163	.745	4.40	1.182

Key: N = Number, MIN = Minimum, MAX = Maximum, SKEW = Skewness, KURT = Kurtosis, M = Mean, SD= Standard Deviation

Industrial based skill development in electrical engineering refers to the enhancement of skills that align with the industry (Nadeem, Oroszlányová, Lushi & Farag, 2024). It involves both technical and soft skills training designed to equip electrical engineering trainees and professionals with the necessary competencies to succeed in modern industrial settings. From the findings in Table 4.8 majority of the respondents agreed to a very greater extent with a mean of 4.34 and SD of .767 that the trainees respect ideas and contributions of other members with a min of 2 and max of 5. Additionally, majority of respondents also agreed to a very great extent with a mean of 4.74 and SD of .439 that mastery of theoretical knowledge in electrical engineering has increased with a min of 4 and max of 5. Besides, majority also agreed to a very great extent with

a mean of 4.43 and SD of .590 that trainee can perform practical aspects of electrical engineering with ease with a min of 2 and max of 5. Additionally, majority agreed to a great extent that trainee readiness to rapidly changing engineering technology has been improved with a mean of 4.19 and SD .952. The responses were normally distributed with a Kurtosis= 1.502 and Skewness = -.299 with a min of 2 and max of 5. Absolutely, industrial skill development in electrical engineering should focus on evolving engineering technology to ensure that trainees and professionals are prepared for current and future industry demands. This eulogizes the place of strengthening partnerships between TVET institutions and industries.

In addition, majority agreed to a great extent that the trainees are able to effectively solve electrical engineering related problems, mean of 4.26 and SD .853. there was normal distributed with a Kurtosis= -.178 and Skewness = -.792 with a min of 1 and max of 5. However, based on the standard deviation not all TVET institutions have comprehensively developed trainees' industrial skills to effectively solve electrical engineering related problems. This indicates variability in the quality and effectiveness of skill development across different institutions. This gives the need for a more robust collaboration between TVET institutions and the industry to offer practical training and real-world problem-solving experiences. Besides, majority of the respondents agreed to a great extent that trainees learnt how to communicate with different particular goals with a mean of 4.40 and SD of 1.182. The responses were normally distributed with a Kurtosis= -.163 and Skewness = -.745 with a min of 1 and max of 5. Industrial skill development should foster communication, teamwork, problem-solving, leadership and management skills that are essential in industrial environments (Patel, 2024). Therefore, industrial skill development in electrical engineering in TVET should create

a workforce that is ready to adapt to the evolving needs of the electrical and electronics industries.

4.6 Multiple Regression Analysis Assumptions

4.6.1 Assumption of Normality

Normality of data was assessed using Skewness and Kurtosis statistics (Hatem, Zeidan, Goossens & Moreira, 2022). According to Demir (2022), kurtosis values +3.00 and -3.00, while data skewness values must be between +1.00 and -1.00.

Table 4.10 Test of Normality

Construct	N	Skewness		Kurtosis	
		Statistic	Std. Error	Statistic	Std. Error
Engineering Internship	155	-.279	.195	-.257	.387
Infrastructure Development	155	-.455	.195	-.613	.387
Capacity Building	155	-.574	.195	-.290	.387
Industrial Skills	155	-.609	.195	-.183	.387

Table 4.10 show that the normalcy assumption was validated. All of the Kurtosis and Skewness readings were within the specified ranges. For many statistical studies, the data can be deemed well-behaved if the skewness and kurtosis values fall within acceptable limits, reducing the likelihood of violating assumptions and increasing the robustness of conclusions drawn from the data.

4.6.2 Multicollinearity

Table 4.11 Multicollinearity test

Model	Collinearity Statistics	
	Tolerance	VIF
Engineering Internship	.313	3.195
Infrastructure Development	.149	6.727
Capacity Building	.773	1.294

Dependent Variable: Industrial Skill Development

The tolerance values of every variable in the linear connection were modest. A tolerance value may be less than or equal to one, claims Shrestha (2020). Table 4.11 indicates that there is no multicollinearity because the VIF and Tolerance are under the threshold values. All values in this investigation fell between 1.294 and 6.727, according to Table 4.10. There was no multicollinearity, as indicated by the VIF values being less than 10. Infrastructure Development (6.727), Capacity Building (1.294), and Engineering Internship (3.195) were the VIF values for the different variables in this study. Since the VIF for each of these variables is less than 10, multicollinearity between the variables is not present. The correlation coefficient between a factor and itself is usually 1; hence the principal diagonal of the correlation matrix in Table 4.11 contains 1s. This therefore means it is an identity matrix therefore there was no multicollinearity (Kyriazos & Poga, 2023).

4.6.3 Homoscedasticity

Homoscedasticity means that the variances of all the observations are identical to one another. They are different if they are heteroscedastic (Alabi, Ayinde, Babalola, Bello, & Okon, 2020). A scatter plot shows how two variables are related to one another.

Appendix V's Figures 4.1 to 4.3 shows a roughly linear link between the practices of public-private partnerships and the development of industrial skills in engineering education. It displays heteroscedasticity as a statistical condition. For a heteroscedastic data set, the variation in the dependent variable differs depending on the values of predictors.

4.7 Influence of public-private partnership on development of industrial skills in engineering training in technical vocational education and training institutions in Nairobi County

4.7.1 Pearson product moment correlation of public-private partnership and industrial skills development in engineering training

Asghari, et al (2022) in their work define linearity as the amount of change or rate of change between scores on two sets of variables. Therefore, the link between an independent variable and a dependent variable is represented by the constant slope of change. The regression analysis's non-linearity understates the actual correlation between the variables under investigation. APPM correlation was used to determine linearity. According to Janse et al. (2021), a perfect linear correlation is represented by a correlation of 1, a strong positive correlation is indicated by a correlation between 0.9 and 1, and a high correlation is found between 0.7 and 0.9. A moderate level of positive association is indicated by a correlation between 0.5 and 0.7. A positive correlation is one that is between 0 and 0.5, a weak correlation is one that is between 0 and 0.5, and a negative association is one that is between -1 and 0. Thus, the linearity assumption was met. This suggests that industry skills growth in engineering training at TVETs in Nairobi County is positively and correlated significantly with all aspects of the public-private partnership under investigation.

Table 4. 12: Correlations for Testing Linearity

		Internship	Infrastructure	Capacity building	Industrial Skills
Internship	Pearson Correlation	1			
	Sig. (2-tailed)				
Infrastructure	Pearson Correlation	.037	1		
	Sig. (2-tailed)	.648			
Capacity building	Pearson Correlation	.104	.242**	1	
	Sig. (2-tailed)	.196	.002		
Industrial Skills	Pearson Correlation	.243**	.361**	.463**	1
	Sig. (2-tailed)	.002	.000	.000	
	N	155	155	155	155

*. significant at the 0.05 level (2-tailed).

**.. significant at the 0.01 level (2-tailed).

4.7.2 Multiple Regression Analysis

This study showed combined influence of public-private partnership on industrial development skills in engineering training in technical vocational education and training institutions in Nairobi County. The results are in Table 4.13.

Table 4.13: Model Summary on influence of public-private partnership on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County

Model	R	R Sq	Adjusted R Sq	Std. Error of the Estimate	Durbin-Watson
1	.564 ^a	.318	.304	.389	2.407

a. Predictors: (Constant), capacity building, internship, infrastructure

b. Dependent Variable: Industrial skills development in engineering training

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.658	3	3.553	23.434	.000 ^b
	Residual	22.891	151	.152		
	Total	33.549	154			

a. Dependent Variable: Industrial skills development in engineering training

b. Predictors: (Constant), capacity building, internship, infrastructure

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.130	.596		.219	.827
	Internship	.155	.054	.194	2.867	.005
	Infrastructure	.449	.119	.262	3.779	.000
	Capacity building	.425	.078	.380	5.459	.000

a. Dependent Variable: Industrial skills development in engineering training

According to Kouadri, Pande, Panneerselvam, Moharir, and Elbeltagi (2022), the correlation coefficient, or R, quantifies the degree and direction of the linear relationship between the dependent variable's observed values and the values that the model predicts. based on the study's conclusions, as shown in table 4.12. The public-

private partnership and industry skills growth in engineering training at TVETs in Nairobi County have a strong linear relationship ($R = .564a$). Furthermore, R^2 is the percentage of the dependent variable's variance that can be predicted based on the independent variables. The results showed that, at technical vocational education and training institutions in Nairobi County, public-private partnerships accounted for 31.8% of the variation in industry skills development in engineering training. In social science research, assuming the explanatory factors are statistically significant, an R-squared of 0.10 to 0.50 (or 10 percent to 50 percent when expressed in percentage) is acceptable (Ozili, 2023; Hoffmann, 2021).

Important details regarding the overall significance of the regression model are provided by the ANOVA table. It showed that the explained variance is much larger than the unexplained variance, with the F-statistic (23.434) less than 0.05, which is comparatively large. It shows that there is statistical significance in the model. This implies a substantial evidence to refute H_0 , which holds that there is no connection between the development of industry capabilities in engineering training at TVET institutions in Nairobi County and public-private partnerships. Questions guiding the study.

How does partnering in engineering internships influence development of industrial skills in engineering training in technical vocational education and training institutions in Nairobi County?

From the findings, a unit increase in partnering in engineering internships would cause an increase in industrial skills development in engineering training in technical vocational education and training institutions by a factor of 0.155 ($\beta_1 = 0.155$). Besides, partnering in engineering internships has a statistically significant influence on

industrial skills development in engineering training in technical vocational education and training institutions ($t = 2.867$; $p\text{-value} = 0.000$) which is less than $\alpha = 0.05$). In this regard there is a statistically significant influence of partnering in engineering internships on industrial skills development in engineering training in TVETs in Nairobi County. This implies that partnering in engineering internships results in industrial skills development in engineering training in TVETs in Nairobi County. Fakhri and Munadi (2019), Jaime, et al. (2019), Gebeyehu and Atanaw (2018) also found a significant correlation between partnering in engineering internships on industrial skills development in engineering training. Thus, TVET institutions should shape their curricula with industry needs, ensuring that theoretical knowledge complements practical skills. This partnership allows for continuous feedback from industry partners, enabling curriculum updates to reflect current technological advancements and practices. Additionally, real-world applications of classroom learning can increase trainees' motivation and engagement with their studies. Understanding the practical relevance of their education can inspire them to perform better academically. By partnering with TVET institutions, industries help shape the training of future employees, ensuring that graduates have the skills required to meet current and future industry needs (Njengele, Engel-Hills & Winberg, 2024). This reduces the time and cost associated with on-the-job training.

In fine, internships allow trainees to engage actively with real-world engineering tasks. According to Cognitive Learning Theory, this hands-on experience helps in building stronger cognitive connections and deeper understanding. After performing tasks, trainees reflect on their experiences, which consolidates learning and helps in developing problem-solving skills. Reflection is a key component of cognitive learning, aiding in transforming experiences into knowledge. Cognitive Learning Theory

effectively explains the link between partnering in engineering internships and industrial skills development by highlighting the importance of active, contextual, and social learning processes (Joseph, 2023). However, Akunda, Ouma, and Wanjala (2024) ; Achuodho (2024) shows that internship effects are conditional and in some settings weak or inconclusive.

The influence of partnering in infrastructure development on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County?

From the findings, a unit increase in partnering in infrastructure development leading to increase in development in engineering training in technical vocational education and training institutions by a factor of 0.449 ($\beta_1 = 0.449$). Besides, partnering in infrastructure development has a statistically significant influence on industrial skills development in engineering training in technical vocational education and training institutions ($t = 3.779$; $p\text{-value} = 0.000$) which is less than $\alpha = 0.05$). In this regard there is a statistically significant influence of partnering in infrastructure development on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County. This shows that partnering in infrastructure development results in industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County. The findings agrees with Sisimwo, Kiplagat & Ochieng, (2023) Kumar and Gupta (2023) Othoo, Sika, Ojuok and Opiyo, (2022) who found a significant influence of partnering in infrastructure development on industrial skills development in engineering training. These studies and the current study collectively underscore the importance of robust public-private partnerships in infrastructure development for enhancing industrial skills development within engineering training in TVET institutions. However, Selina, (2020)

notes that infrastructure investment was not accompanied by effective systems other factors such as industry linkages, internship/practice opportunities, updated curricula, assessment systems all play a role.

Ongoing partnerships can ensure the sustainability of the infrastructure through continuous investment and maintenance. These partnerships often promote competency-based education and training (CBET), focusing on specific skills required by industries. Courtesy of partnerships gain from better-equipped workshops and laboratories which provides trainees with hands-on experience using industry-standard tools and technology. These findings are supported by CLT. CLT explains the significant influence of partnering in infrastructure development on industrial skills development in engineering training by fostering an enriched learning environment, promoting active engagement, enabling the practice of knowledge, and encouraging continuous feedback and collaboration. These elements are crucial for effective learning and skill acquisition in the engineering field.

To what extent does partnering in capacity building of trainers influence on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County?

From the findings, a unit increase in partnering in capacity building of trainers lead to increase in industrial development of skills in engineering training in technical vocational education and training institutions by a factor of 0.425 ($\beta_1 = 0.425$). Besides, partnering in partnering in capacity building of trainers has a statistically significant influence on industrial skills development in engineering training in technical vocational education and training institutions ($t = 5.459$; $p\text{-value} = 0.000$) which is less than $\alpha = 0.05$). There is significant influence of partnering in capacity building of trainers on industrial skills development in engineering training in technical vocational

education and training institutions in Nairobi County. The results agreed to Aliemeke, Ehibor, and Omoakhalen (2020); Kipkirui (2021) Professional development for trainers is widely recognized as a vital tool for enhancing industrial skills development. However, Levin, Indhira and Weber (2023) laments that TVET teachers are left unsupported with often inadequate pedagogical skills, lack of industry experience, and poor career prospects.

This suggests that industry partnerships for trainer capacity building allow trainers to remain abreast of industry practices and technological developments, guaranteeing that their instruction is up to date and pertinent. Besides, trainers equipped with industry-specific knowledge can better align the curriculum with industry requirements, ensuring that trainees acquire the skills needed for the job market. Trainers familiar with the latest equipment and technology can train trainees on the same, ensuring they are adept at using tools they will encounter in the workplace (Jenny, Krause, & Armstrong, 2021). Trainers with industry experience can provide more practical, hands-on training, which is crucial for developing industrial skills in engineering. Capacity building enables trainers to teach metacognitive strategies, encouraging trainees to think about their learning processes. Cognitive Learning Theory (CLT) emphasizes that acquiring complicated abilities, such as those required in engineering, requires metacognition—the ability to think critically about one's own thinking. Trainers are frequently exposed to innovative, active learning through capacity building (Nguyen et al., 2021). According to CLT, in order to improve understanding and retention of industrial skills, students must be actively involved in the learning process, which these approaches enable. The model expression from the results

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \dots \dots \dots \text{Equation 4.1}$$

Industrial skills development = .130 + .155 Internship + .449 Infrastructure + .425
Capacity Building + ε

The model shows that Internship, Infrastructure, and Capacity Building positively contribute to industrial skills development. Among these variables, Infrastructure has the largest impact (0.449), followed closely by Capacity Building (0.425), and then Internship (0.155). The constant (0.130) indicates the baseline level of industrial skills development when no consideration is put on the independent variable. This model indicates that improving partnership in infrastructure and partnership in capacity building initiatives, followed by partnership in internship programs, significantly enhances industrial skills development. Investments in these areas are likely to yield positive outcomes in equipping individuals with relevant industrial skills.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the summary of findings, conclusion, and recommendations presented respectively. The study concluded that industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County significantly influenced by public-private partnerships in terms of engineering internships, Infrastructure development, and Capacity building. When combined, all public-private partnerships under study had a significant positive influence on industrial skills development in engineering training compared to a single factor.

5.2.1 Influence of partnering in engineering internships on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County

The significant influence of partnering in engineering internships on industrial skills development has transformative implications for TVET institutions, trainees, and industries (Hussain, Zulkifli, Kamis, Threeton & Omar, 2021). These partnerships create a symbiotic relationship where each stakeholder contributes to and benefits from the process, leading to a more competent workforce, relevant educational programs, and a stronger connection between education and industry. This is confirmed by the descriptive analysis that designing internship programs to build on trainees' strengths or correct their deficiencies has significant implications for the success of the program, trainee development, and industry-academia alignment. However, there should be a focus on aligning the TVET institutions and industry to boost self-esteem and engagement amongst engineering trainees, leading to higher productivity during the internship. This is further motivated by the fact that employer's benefit from interns

with fewer deficiencies, reducing the need for extensive post-hiring training (Ranabahu, Almeida, & Kyriazis, 2020).

This is affirmed by the findings of the study partnering in engineering internships has a statistically significant influence on industrial development of skills in engineering training in TVETs ($t = 2.867$; $p\text{-value} = 0.000$) which is less than $\alpha = 0.05$). In this regard there is a statistically significant influence of partnering in engineering internships on industrial skills development in engineering training in TVETs in Nairobi County. These findings are in line with the findings of Fakhri and Munadi (2019), Jaime, et al. (2019), Gebeyehu and Atanaw (2018) who also found a significant influence of partnering in engineering internships on development of key industrial skills in engineering training. CLT effectively explains the link between partnering in engineering internships and industrial skills development by highlighting the importance of active, contextual, and social learning processes (Joseph, 2023). However, Akunda, Ouma, and Wanjala (2024) ; Achuodho (2024) shows that internship effects are conditional and in some settings weak or inconclusive.

5.2.2 Influence of partnering in infrastructure development on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County

The significant influence of partnering in infrastructure development on industrial skills development has transformative implications for TVET institutions, trainees, and industries (Kumar & Gupta, 2023). This is confirmed by the descriptive analysis findings Partnerships that provide adequate electrical engineering workshops and libraries are transformative for TVET institutions, offering tangible benefits for trainees, faculty, and industry stakeholders (David, 2023). These partnerships improve

the quality of education, skill development, and employability of graduates while fostering innovation and collaboration between the education sector and industry. Partnership has proved to be solution to limited resources that TVET institutions have suffered in the past as a setback to enhancing Industry-Centric and eco-centric Skills amongst its graduates. Through partnership in infrastructure development the TVET institutions to provide quality education, industry-ready skills, and alignment between education and industry demands has been immensely enhanced.

This is corroborated by the findings of inferential analysis that partnering in infrastructure development has a statistically significant influence on industrial skills development in engineering training in technical vocational education and training institutions ($t = 2.867$; $p\text{-value} = 0.000$) which is less than $\alpha = 0.05$). In this regard there is a statistically significant influence of partnering in infrastructure on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County. This finding are in line with the findings Sisimwo, Kiplagat & Ochieng, (2023) Kumar and Gupta (2023) Othoo, Sika, Ojuok and Opiyo, (2022) who also found a significant influence of partnering in infrastructure development on industrial skills development in engineering training. These studies and the current study collectively underscore the importance of robust public-private partnerships in infrastructure development for enhancing industrial skills development within engineering training in TVET institutions. These findings are supported by Cognitive Learning Theory (CLT). However, Selina, (2020) notes that infrastructure investment was not accompanied by effective systems other factors such as industry linkages, internship/practice opportunities, updated curricula, assessment systems all play a role.

5.2.3 Influence of partnering in Capacity Development on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County

Industrial skills development in engineering training in technical vocational education and training institutions is influenced by partnering in capacity development. According to the study's findings, industry skills development in engineering training at technical vocational education and training institutions will rise by a factor of 0.425 ($\beta_1=0.425$) for every unit increase in trainer capacity building partnerships. Additionally, industry skills growth in engineering training at technical vocational education and training institutions is statistically significantly impacted by trainer capacity building partnerships ($t = 5.459$; $p\text{-value} = 0.000$), which is smaller than $\alpha = 0.05$. In this sense, collaboration in trainer capacity building has a statistically significant impact on the development of industry skills in engineering training at technical vocational education and training facilities in Nairobi County. This findings are in line with the findings of Aliemeke, Ehibor, and Omoakhalen (2020); Kipkirui (2021) Professional development for trainers is widely recognized as a vital tool for enhancing industrial skills development. However, Levin, Indhira and Weber (2023) laments that TVET teachers are left unsupported with often inadequate pedagogical skills, lack of industry experience, and poor career prospects. In this regard the TVET trainers need to be abreast with relevant, up-to-date, and effective vocational education in electrical engineering. This is confirmed by the descriptive analysis that majority of respondents were in agreement that partnerships play a crucial role in the capacity building of TVET staff. However, there are lapses which need to be attended to base on the standard deviations calling for continued capacity building sessions being aligned with electrical engineering needs.

5.3 Conclusion

In technical vocational education and training institutes, collaborating on engineering internships significantly and favorably impacts the development of industry skills in engineering training. The essence of partnering in engineering internships lies in creating a dynamic and collaborative environment where trainees, educational institutions, and industries come together to enhance learning, skill development, and employability. This partnership not only benefits the individual stakeholders but also contributes to the overall growth and innovation within the engineering sector.

Partnering in engineering internships has a positive and significant influence on industrial skills development in engineering training in technical vocational education and training institutions. The essence of partnering in engineering internships lies in creating a dynamic and collaborative environment where students, educational institutions, and industries come together to enhance learning, skill development, and employability. This partnership not only benefits the individual stakeholders but also contributes to the overall growth and innovation within the engineering sector.

There is a statistically significant influence of partnering in engineering internships on industrial skills development in engineering training in technical vocational education and training institutions in Nairobi County. Partnerships in infrastructure development for enhancing industrial skills development within engineering training in TVET institutions. These findings are supported by Cognitive Learning Theory (CLT).

Industrial skills development in engineering training in technical vocational education and training institutions is influenced by partnering in capacity development. This is affirmed by the findings of this study a unit increase in partnering in capacity building of trainers would lead to increase in industrial skills development in engineering training in technical vocational education and training institutions. Trainers with

industry experience courtesy of partnership in capacity building can provide more practical, hands-on training, which is crucial for developing industrial skills in engineering.

5.4 Recommendations

It is clear from the study's results and the literature review that improving infrastructure, capacity building, and collaboration in engineering internships enhances the industrial skills development in engineering education at technical vocational education and training institutions. Therefore, the study makes the following recommendations:

- i. TVET institutions should implement monitoring and evaluation for the quality of internships, ensuring that theoretical knowledge complements practical skills.
- ii. The government should establish and enforce quality standards for internship programs with clear objectives, learning outcomes, and mentorship to ensure consistency and effectiveness across institutions and industries through quality framework.
- iii. Industry partners should provide TVET institutions with state-of-the-art training facilities, such as labs and workshops, equipped with current technology and machinery. Provide mentors and knowledgeable industrial experts and best practices persons, to enhancing the learning experience for trainees.
- iv. TVET institutions should actively seek and establish partnerships with various industry sectors to align training with real-world needs and technological advancements.
- v. TVET institutions should partner with industries to access modern equipment and tools, ensuring trainers and trainees are familiar with the latest technology.

- vi. Industry Stakeholders should offer apprenticeships and internship programs for TVET trainers and trainees to gain practical industry experience. Organize regular forums and workshops for TVET trainers and industry professionals to exchange knowledge and best practices. Improve on evaluation of the impact of PPPs on trainer capacity development and industrial skills enhancement.

5.5 Suggestions for Further Research

The study concentrated on three public-private partnerships approaches; engineering internships, infrastructure development, and capacity building impact on the development of industrial skills in engineering training at TVETs in Nairobi County, In addition to that, the study's scope needs to be expanded to include all the other PPPs approaches in other counties.

REFERENCES

- Achuodho, H. O. (2024). Experiencing online training and educational inequality in TVET delivery among trainers and trainees in Kenya during the COVID-19 pandemic: A case study. *ERIC / ResearchGate*.
- Agole, P., Kerre, B., Ochieng, R., & Okaka, W. (2022). Confronting the Challenges of University TVETs in Uganda. *African Journal of Education, Science and Technology*, 7(2).
- Aithal, P. S., & Maiya, A. K. (2023). Innovations in Higher Education Industry—Shaping the Future. *International Journal of Case Studies in Business, IT, and Education (IJCSBE)*, 7(4), 283-311.
- Akhuemonkhan, I. A., & Raimi, L. (2013). Quality Assurance and TVET in Nigeria: An impact Assessment Survey. *International Journal of Vocational Education & Training*, 21(2).
- Akunda, T., Ouma, P., & Wanjala, K. B. (2024). An exploration of the factors affecting skills development amongst trainees of building and civil engineering in Technical and Vocational institutions in Uganda. *IOSR Journal of Research & Method in Education*, 14(5), 58–74.
- Alabi, O. O., Ayinde, K., Babalola, O. E., Bello, H. A., & Okon, E. C. (2020). Effects of multicollinearity on type i error of some methods of detecting heteroscedasticity in linear regression model. *Open Journal of Statistics*, 10(4), 664-677.
- Aliemeke, B., Ehibor, O., & Omoakhalen, A. I. (2020). Capacity Building In TVET Sector In Nigeria. *National Engineering Conference and Annual General Meeting*.
- Aluoch, J. R. (2021). The extent to which technical and vocational education and training institutions prepare their graduates for the labour market in Kenya. *Doctoral dissertation, University of Eldoret*.
- Amdany, M. J. (2017). The Perceived Effect of Career Development Practices on Employee Retention at the Safaricom Call Centers in Kenya.

- Asghari, M., Fathollahi-Fard, A. M., Mirzapour Al-E-Hashem, S. M., & Dulebenets, M. A. (2022). Transformation and linearization techniques in optimization: A state-of-the-art survey. *Mathematics*, *10*(2), 283.
- Awonuga, O. (2020). Skills gap assessment to enhance technical and vocational education delivery: A case study of electrical installation graduates in Ogun and Kaduna states of Nigeria. *Doctoral dissertation*.
- Blumberg, B., Cooper, D., & Schindler, P. (2014). EBOOK: Business research methods. *McGraw Hill*.
- Brock, T. (2022). *Public-Private Partnerships (PPPs): Definition, How They Work, and Examples*. www.investopedia.com
- David, W. A. (2023). Synergising the creation of knowledge processes in a Technical and Vocational Education and Training College with industry demands for sustainable lecturer learning environments . *Doctoral dissertation, University of the Free State*.
- Delmon, J. (2017). Public-private partnership projects in infrastructure: an essential guide for policymakers. *Cambridge University Press*.
- Demir, S. (2022). Comparison of normality tests in terms of sample sizes under different skewness and Kurtosis coefficients. *International Journal of Assessment Tools in Education*, *9*(2), 397-409.
- Dialogic., & Ecorys. (2020). Eindevaluatie Regionaal Investeringsfonds mbo 2014-2018. *Utrecht*.
- Dubey, U. K., & Kothari, D. P. (2022). Research methodology: Techniques and trends. *CRC Press*.
- Enago. (2023). *Descriptive research design: Definition, types, and best practices*. . Retrieved from [Retrieved from https://www.enago.com](https://www.enago.com)
- Fakhri, A. A., & Munadi, S. (2019). The evaluation of industrial internship for the vocational school of mechanical engineering in Tegal. *American Journal of Educational Research*, *7*(11), 806-809.

- Gacheri, H. (2022). *Role of Industry-TVET Institution Partnerships in Improving Performance*. <https://www.eastrip.iucea.org>
- Gebeyehu, S. G., & Atanaw, E. B. (2018). Impact of Internship Program on Engineering and Technology Education in Ethiopia: Employers' Perspective. *Journal of Education and Training*, 5(2), 64-68.
- Ghana TVET Report. (2021). Scripted by CTVET in collaboration with BIBB under the auspices of Ministry of Education Ghana .
- Glenda, K., Petersen, I., Fongwa, S., Azinga, T., & Rust, J. (2017). *Towards An Integrated Public-Private Partnership Strategy For Skills Development In The Tvet College System*. <https://psetresearchrepository>
- Hassan, A. S., & Muhammad, A. A. (2017). Research proposal writing. *Department of Political Science, Faculty of Business and Social Sciences, University of Ilorin*.
- Hatem, G., Zeidan, J., Goossens, M., & Moreira, C. (2022). Normality testing methods and the importance of skewness and kurtosis in statistical analysis. *BAU Journal-Science and Technology*, 3(2), 7.
- Hickey, P. J. (2023). A Study of Gender Diversity in US Architecture, Engineering, and Construction (AEC) Industry Leadership . *Doctoral dissertation, University of Maryland, College Park*.
- Hodge, G. A., & Greve, C. (2017). On public-private partnership performance: A contemporary review. *Public Works Management & Policy*, 22(1), 55–78.
- Hoffmann, J. P. (2021). *Linear regression models: applications in R*. . *Chapman and Hall/CRC*.
- Hussain, M. A., Zulkifli, R. M., Kamis, A., Threton, M. D., & Omar, K. (2021). Industrial engagement in the technical and vocational training (TVET) system. *International Journal of Learning, Teaching and Educational Research*, 20(12), 19-34.
- Jaime, A., Olarte, J. J., García-Izquierdo, F. J., & Domínguez, C. (2019). The effect of internships on computer science engineering capstone projects. *IEEE Transactions on Education*, 63(1), 24-31.

- Janse, R. J., Hoekstra, T., Jager, K. J., Zoccali, C., Tripepi, G., Dekker, F. W., & van Diepen, M. (2021). Conducting correlation analysis: important limitations and pitfalls. . *Clinical Kidney Journal*, *14*(11), 2332-2337.
- Jenny, S. E., Krause, J. M., & Armstrong, T. (2021). Technology for physical educators, health educators, and coaches: Enhancing instruction, assessment, management, professional development, and advocacy. *Human Kinetics Publishers*.
- Joseph, T. (2023). Learning linkages between projects and work placements in engineering education. *Doctoral dissertation, The University of Waikato*.
- Kipkirui, L. (2021). *TVET trainers undergo pedagogy training and CPD for lifelong learning*. <https://www.tveta.go.ke>
- Kothari, C. R. (2020). *Research methodology: Methods and techniques (4th ed.)*. New Age International Publishers.
- Kouadri, S., Pande, C. B., Panneerselvam, B., Moharir, K. N., & Elbeltagi, A. (2022). Prediction of irrigation groundwater quality parameters using ANN, LSTM, and MLR models. *Environmental Science and Pollution Research*, 1-25.
- Krishna, B. V., & Babu, J. S. (2021). Impact of Internship on Employability of Undergraduate Engineering students: A Case Study. *Journal of Engineering Education Transformations*, *34*(4).
- Kumar, S., & Gupta, R. (2023). Examining the impact of public-private partnerships on the modernization of industrial training facilities and the subsequent enhancement of students' vocation-specific skills. *International Journal of Vocational Education and Training*, *29*(2), 145-162.
- Kumar, S., & Gupta, R. (2023). Examining the impact of public-private partnerships on the modernization of industrial training facilities and the subsequent enhancement of students' vocation-specific skills. *International Journal of Vocational Education and Training*, *29*(2), 145-162.
- Kyriazos, T., & Poga, M. (2023). Dealing with multicollinearity in factor analysis: the problem, detections, and solutions. . *Open Journal of Statistics*, *13*(3), 404-424.

- Langat, K. (2019). *Research is Key to Developing and Implementing Sustainable TVET Policies in Kenya*. <https://www.tveta.go.ke>
- Lee, D. K. (2020). Data transformation: a focus on the interpretation. *Korean journal of anesthesiology*, 73(6), 503-508.
- Levin, V., Indhira, S., & Weber, M. (2023). *Unlocking the promise of skills development through technical and vocational education and training*. <https://blogs.worldbank.org>
- Lim, C. Y., Lee, X., Tran, M. T., Markus, C., Loh, T. P., Ho, C. S., & Zakaria, R. (2024). Linearity assessment: deviation from linearity and residual of linear regression approaches. *Clinical Chemistry and Laboratory Medicine (CCLM)*, 62(10), 1918-.
- Makau, L. (2017). Effect of Performance Management and Capacity Building on Employee Performance in MICLk, *Journal of Entrepreneurship and Project Management*, 1(1) 34–45.
- Makworo, E., Mwangi, S., & Wesonga, J. (2013). Linking TVET Institutions and Industry in Kenya: Where Are We? . *International Journal of Economy, Management and Social Sciences*, 2(4), 91-96.
- Manna, R., & Mete, J. (2021). Population and Sample. *International Journal of research and analysis in Humanities*, 1(1), 30-30.
- Manyonge, L. M., & Kyalo, J. (2020). Effect Of Public-Private Partnerships On Revamping TVETs: A Case Of Kenyaassociation Of Manufacturers (KAM) and Gesellschaft Fürinternationale Zusammenarbeit (GIZ) Partnership. *International Journal of VTE Research*, 6(2), 52-65.
- Martín-Lara, M., Iáñez-Rodríguez, I., & Luzón, G. (2019). Improving the internship experience in the master of chemical engineering at the University of Granada. *Educ. Chem. Eng.*, 26, 97–106.
- Matshidze, L. B. (2021). Developing a Public Private Partnerships (PPP) framework for implementing road maintenance projects in South African rural communities. *Doctoral dissertation, Heriot-Watt University*.

- Mavrikios, D., Papakostas, N., Mourtzis, D., & Chryssolouris, G. (2013). On industrial learning and training for the future factories: a conceptual, cognitive and technology framework. *Journal of Intelligent Manufacturing*, 24, 473-485.
- McGunagle, D., & Zizka, L. (2020). Employability skills for 21st-century STEM students: the employers' perspective. *Higher education, skills and work-based learning*, 10(3), 591-606.
- Moerman, P. (2021). Public-private partnership to solve the skills gap? Info University Lifelong Learning. *European Journal*, 5(1), 71–78.
- Muhammad, W., & Sajjad, A. (2019). Impact of Capacity Building and Managerial Support on Employees' Performance: The Moderating Role of Employees' Retention. *SAGE Open* , 9(3), 215824401985995.
- Nadeem, M., Oroszlányová, M., Lushi, A., & Farag, W. A. (2024). Bridging the gap: Analyzing skill demands in Kuwait's electrical engineering job market to enhance employability of graduates. *Industry and Higher Education*, 09504222241297556.
- Nguyen, K. A., Borrego, M., Finelli, C. J., DeMonbrun, M., Crockett, C., Tharayil, S., & Rosenberg, R. (2021). Instructor strategies to aid implementation of active learning: a systematic literature review . *International Journal of STEM Education*, 8 .
- Niyonasenze, S., Nzabairwa, W., & Nizeyimana, G. (2024). Building Trainer Competencies and Skills for Quality Training Delivery in TVET Schools, Rwanda. *Advances in Physical Education*, 14(3), 94-118.
- Njengele, T., Engel-Hills, P., & Winberg, C. (2024). Technical and vocational education and training (TVET) colleges and industry: Strengthening partnership-building practices. *Journal of Vocational, Adult and Continuing Education and Training*, 7(2), 23-23.
- Oviawe, J. I. (2018). Revamping technical vocational education and training through public-private partnerships for skill development. *Makerere Journal of Higher Education*, 10(1), 73-91.

- Ozili, P. K. (2023). The acceptable R-square in empirical modelling for social science research. In *Social research methodology and publishing results: A guide to non-native english speakers. IGI global*, 134-143.
- Parkinson, A. (2009). The rationale for developing Global competence. *Online J. Glob. Eng. Educ.*, pp. 4, 2.
- Patel, R. (2024). Collaborative Learning in Engineering: Developing Teamwork and Problem-Solving Skills. . *Bulletin of Engineering Science, Technology and Industry*, 2(3), 100-106.
- Quintero-Rincon, A., D'Giano, C., & Risk, M. (2020). Epileptic seizure prediction using Pearson's product-moment correlation coefficient of a linear classifier from generalized Gaussian modeling. *arXiv preprint arXiv:2006.01359*.
- Radian, G. B. (2021). Project-based Learning Approach in Teaching Power and Energy Engineering Courses. *ASEE Annual Conference 2021*. American Society for Engineering Education.
- Ranabahu, N., Almeida, S., & Kyriazis, E. (2020). University-led internships for innovative thinking: a theoretical framework. *Education Training*, 62(3), 235-254.
- Reinsch, W., & Caporal, J. (2020). Workforce for 2030: A Pillar of Trade Leadership. *A Report of the CSIS Trade Commission on Affirming American Leadership*.
- Rupprecht, A. G., Tran, U. S., & Gröpel, P. (2021). The effectiveness of pre-performance routines in sports: a meta-analysis. *International Review of Sport and Exercise Psychology*, 1-26.
- Sachdeva, M., Fotheringham, A. S., Li, Z., & Yu, H. (2022). Are We Modelling Spatially Varying Processes or Non - linear Relationships? *Geographical Analysis*, 54(4), 715-738.
- Salmi, J., Amegah, A., & Shinde, A. R. (2025). Digital Skills, Innovation, and Economic Transformation: Opportunities and Challenges for Sub-Saharan Africa. . *Education Working Papers*, (203093).

- Sears, J. B. (2023). *Philanthropy in the history of American higher education*. Routledge.
- Selina, C. S. (2020). Impact of infrastructure at technical - vocational education institutions and how it has impacted on skill development among TVET graduates in Kenya. *Journal of Emerging Trends in Educational Research and Policy Studies*, 11(1), 18-24.
- Shrestha, N. (2020). Detecting multicollinearity in regression analysis. *American Journal of Applied Mathematics and Statistics*, 8(2), 39-42.
- Siddiky, M. R., & Uh, S. B. (2020). Linking tvet with industries in bangladesh: Need for supportive policies and an approach to tvet. *Journal of Technical Education and Training*, 12(3), 1-21.
- Sileyew, K. J. (2019). *Research design and methodology* . Rijeka: IntechOpen , 1-12.
- Simpungwe, F. C. (2024). Development and Implementation of an Innovative Higher Educational Integrated Strategy for Preparing the Industry-Ready Future Workforce. *Doctoral dissertation, University of Liverpool*.
- Sisimwo, F., Kiplagat, H., & Ochieng, R. (2023). Influence of Infrastructure on Implementation of E-Learning in Technical Vocational Education and Training Institutions in Uasin Gishu County, Kenya. *Journal of Advances in Education and Philosophy*, 7(8), 296-301.
- Smith, L. (2017). *Necessary knowledge: Piagetian perspectives on constructivism*. Routledge.
- Srivastava, R., Awojobi, M. O., & Amann, J. E. (2020). Training the Workforce for High-Performance Buildings: Enhancing Skills for Operations and Maintenance. *American Council for an Energy-Efficient Economy, Washington*.
- Sukardi, S., Jalinus, N., Islami, S., Sakti, R. H., Husnuzhan, H., Zaus, A. A., & Zaus, M. A. (2023). Soft Skills and Hard Skills Needed In Industry 4.0 For Electrical Engineering students. *Journal of Applied Engineering and Technological Science (JAETS)*, 5(1), 142-149.

- Swiss South African Cooperation Initiative (SSACI) . (2024). Identification of Skills Gaps in South Africa. *A Popular Research Report. Produced for the Department of Higher Education and Training as part of the Labour Market Intelligence research programme.*
- Tan, S. H., & Seet, I. (2020). Infrastructure and Pedagogy Innovation—A Differentiating Factor in TVET. Anticipating and Preparing for Emerging Skills and Jobs: Key Issues, Concerns, and Prospects, 109-115.
- Tan, W. K., & Umemoto, M. (2021). International Industrial Internship: A Case Study from a Japanese Engineering University Perspective. *Education Sciences, 11(4)*, 156.
- Tilak, J. B. (2010). Public-private partnership in education. . *The Hindu*, 24, 1-16.
- Tom., & Norton, M. (2021). The Necessity of Partnerships in TVET. <https://tvetjournal.com>
- Twiner, A., Major, L., & Wegerif, R. (2021). ‘Collaborating2Create’: A conceptual tool to develop learners’ capacity for collaborative creativity through Virtual Internships in schools. Online repository of the American Educational Research Association, I.
- Ullah, F., & Thaheem, M. J. (2018). Concession period of public private partnership projects: Industry–academia gap analysis. *International Journal of Construction Management, 18(5)*, 418-429.
- UNESCO. (2009). *Developing Capacity of TVET Teacher Educators* . Retrieved from <https://unevoc.unesco.org>
- UNESCO. (2019). *Enhancing Institutionalized Partnerships between TVET; Institutions and the World of Work in Egypt.*
- unevoc.unesco.org. (2021). *TVET advocacy Ensuring multi-stakeholder participation.* <https://unevoc.unesco.org>

- Urquia-Grande, E., & Perez Estebanez, R. (2020). Bridging the gaps between higher education and the business world: internships in a faculty of economics and business. *Education Training*, 63(3), 490-509.
- Vuyisile, M. (2021). How Training and Development of Academic Staff Impact on Employee Performance For Organisational Effectiveness at A Selected College in The Eastern Cape Province. *Durban University Of Technology*.
- Wanjala, G., Chepkoech, S., & Khatete, I. (2020). Impact of infrastructure at TVET on human resource development on realization of sustainable development goals in Western Kenya. *Journal of Emerging Trends in Educational Research and Policy Studies*, 11(1), 18-24.
- Wanyama, B. W. (2022). Physical facilities on students' participation in science and technology programmes in public universities in Kenya. *International Research Journal of Science, Technology, Education, and Management*, 2(1), 217-231.
- Wu, M. J., Zhao, K., & Fils-Aime, F. (2022). Response rates of online surveys in published research: A meta-analysis. *Computers in Human Behavior Reports*, 7, 100206.
- www.dcdualvet.org. (2019). *Private public patnership for universities and TVET institutions*. <https://www.dcdualvet.org>
- www.ilo.org. (2018). Public-Private Partnerships benefit TVET institutes and industry alike. <https://www.ilo.org>
- Yamoah, E. (2013). Capacity Building and Employee Performance. DOI: 10.3968/j.css.192366972013013.1160.
- Yeap, C., Suhaimi, N., & Nasir, M. (2021). Issues, Challenges, and Suggestions for Empowering Technical Vocational Education and Training Education during the COVID-19 Pandemic in Malaysia. *Creative Education*, 12, 1818-1839.
- Zhang, J. (2019). *Cognitive functions of the brain: perception, attention and memory*. *arXiv preprint arXiv:1907.02863*.

Zizzamia, R. (2020). Is employment a panacea for poverty? A mixed-methods investigation of employment decisions in South Africa. *World Development*, *130*, 104938.

APPENDICES

APPENDIX I : QUESTIONNAIRE FOR HODS, COURSE TUTORS AND ELECTRICAL ENGINEERING TRAINERS

Questionnaire Number

Kindly put a tick (√) against the correct choice

Section I Demography

1. Age bracket

Less than 30 years 31 -40 years

41 -50 years Above 50 years

2. Gender

Male Female

3. Highest level of education?

Diploma Higher Diploma

Bachelors' Post Graduate

PhD

4. What is your work experience in TVET?

Less than 5 years 6-10 years

11-15 years 16-20 years

Above 20 years

Part II and III

Parts II and III.

**5 = Very Great Extent (VGE) 4 = Great Extent (GE) 3 = Moderate Extent (ME)
2 = Small Extent (SE) 1 = Very Small Extent (VSE)**

Part II a: Partnering in Engineering Internship

Please, indicate, the extent to which you agree with statements on partnering in engineering internship provided

Statements	5 VGE	4 GE	3 ME	2 SE	1 VSE
The internship programmes are designed to build on the trainee's strength or correct their deficiencies					
The quality criteria of curriculum and practicals provided by the companies are integrated during the internship programme					
Internship programmes enhances the trainee's innovativeness					
The companies which offer internship programmes have provide adequate supervision to trainees					
The TVET institution and hosting company is committed in the follow up of trainees					
The hosting company provides the necessary facilities in favour of electrical engineering					

Part II b: Partnering in Infrastructure Development

Please, indicate, the extent to which you agree with statements on infrastructure development

Statements	5	4	3	2	1
	VGE	GE	ME	SE	VSE
Classes are adequate to accommodate all Trainees during the lessons					
The college has had adequate electrical engineering workshops through partnership					
Private organizations have supported our institution in development of the spacious library adequate for all trainees					
The workshops are equipped with relevant equipment					
Trainees can easily asses learning resources from the library					

Part II c: Partnering in Capacity Building

Please, indicate, the extent to which you agree with statements on partnering in capacity building provided

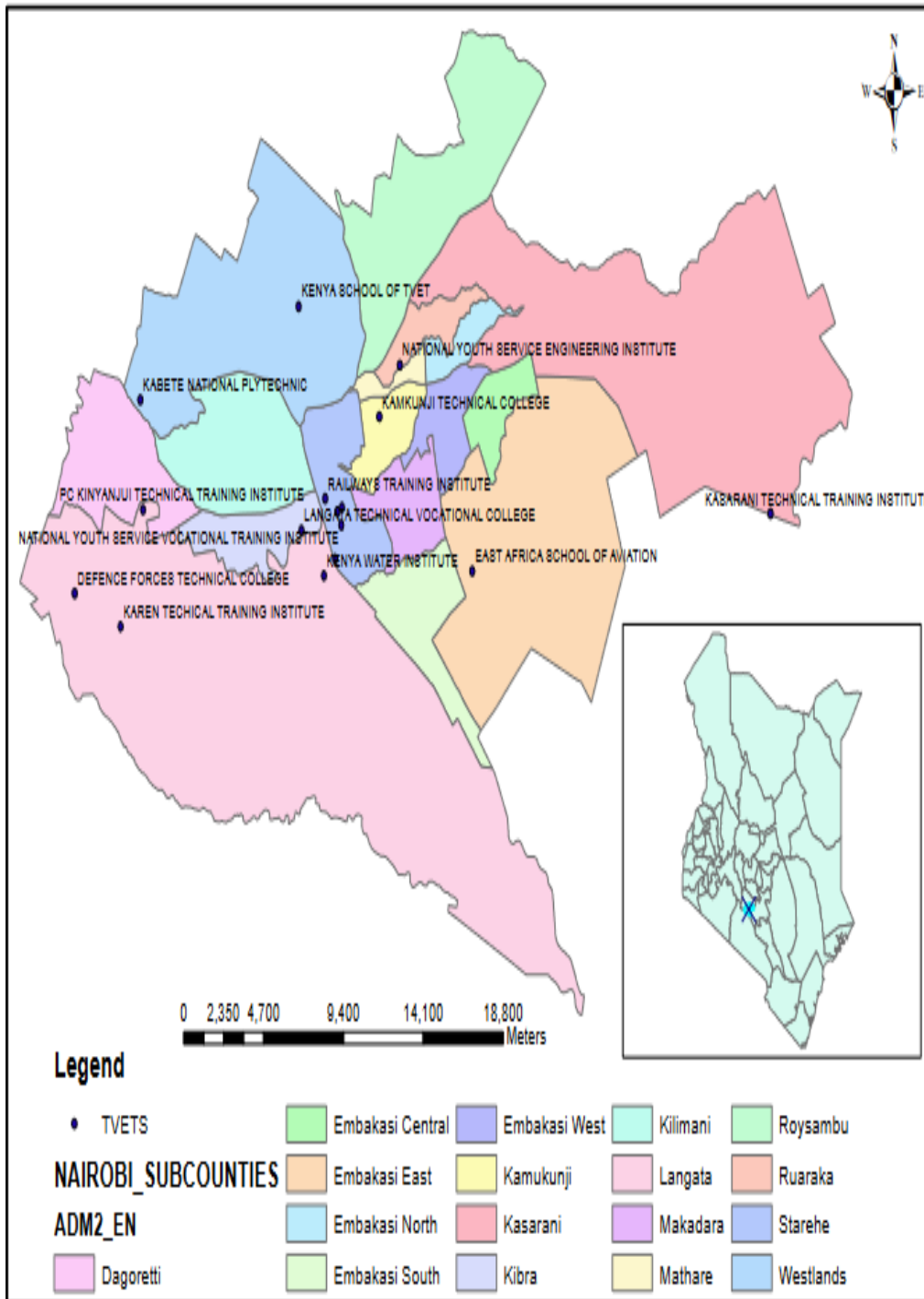
Statements	5	4	3	2	1
	VGE	GE	ME	SE	VSE
Training and development improve service provision to trainees					
Training and development increases opportunities for career development					
Trainers are given a chance to apply new skills					
Capacity building sessions are aligned with electrical engineering needs					
Skills provided during training and development are applicable to the working environment					

Part III: Trainees Industrial Skills development in Electrical Engineering Training

Please, indicate, the extent to which you agree with green just in time teaching provided

Statements	5 VGE	4 GE	3 ME	2 SE	1 VSE
The trainees respect ideas and contributions of other members					
Mastery of theoretical knowledge in electrical engineering has increased					
Trainee can perform practical aspects of electrical engineering with ease					
Trainee readiness to rapidly changing engineering technology has been enhanced					
The trainees are able to effectively solve electrical engineering related problems					
Trainees learnt how to communicate with different particular goals					

APPENDIX II: MAP SHOWING TVET INSTITUTIONS IN NAIROBI CITY COUNTY



Source: Kenya GIS Data

APPENDIX III: TARGET POPULATION AND SAMPLE SIZE

	TVET institutions	Target population	Sample size
1	Kabete National Polytechnic	37	20
2	Karen Technical Training Institute	9	5
3	Kamkunji Technical College	4	2
4	Kasarani Technical Training Institute	5	3
5	Kenya School of TVET	20	11
6	Kenya Water Institute	14	8
7	Kenya Institute of Highways and Building Technology	30	16
8	Kenya Institute of Mass Communication	28	15
9	Railways Training Institute	55	30
10	Nairobi Technical Training Institute	32	17
11	PC Kinyanjui Technical Training Institute	18	10
12	East African School of Aviation	10	5
13	Defense Forces Technical College	13	7
14	National Industrial Training Authority	13	7
15	National Youth Service Vocational Training Institute	10	5
16	National Youth Service Engineering Institute	33	17
17	Langata Technical Vocational College	3	2
	Total	334	182

APPENDIX IV: SCATTER PLOTS FOR TESTING HOMOSEDASTICITY

FIG 4.1-4.4

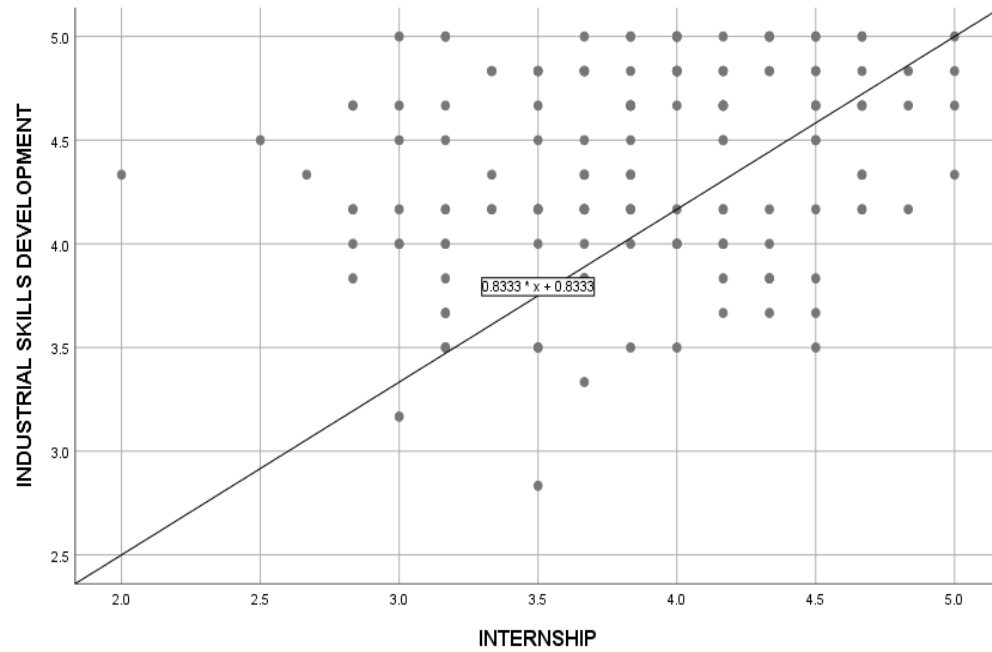


Figure 4.1 Scatter plot for partnership in engineering internship and Industrial skills development

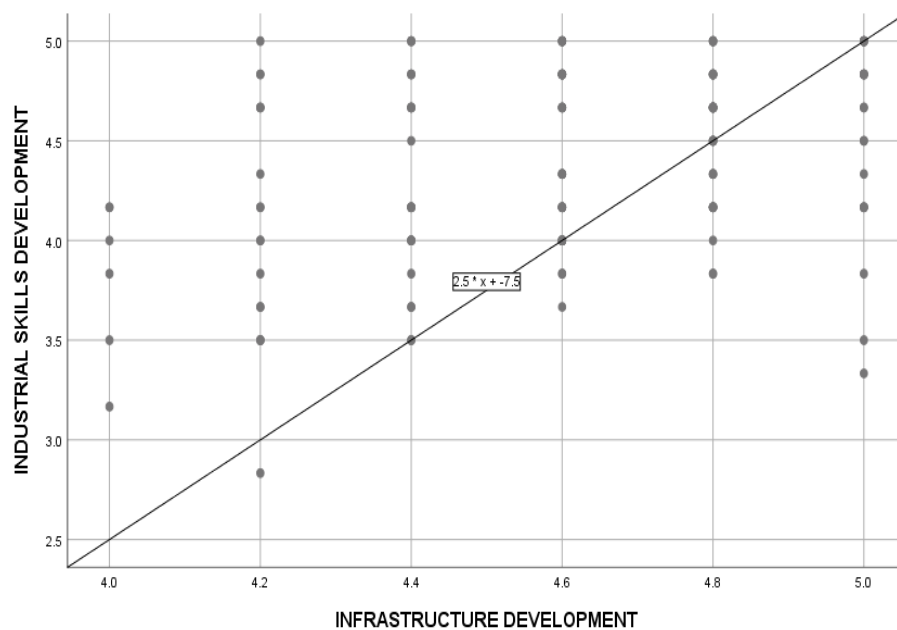


Figure 4.2 Scatter plot for partnership in infrastructure development and Industrial skills development

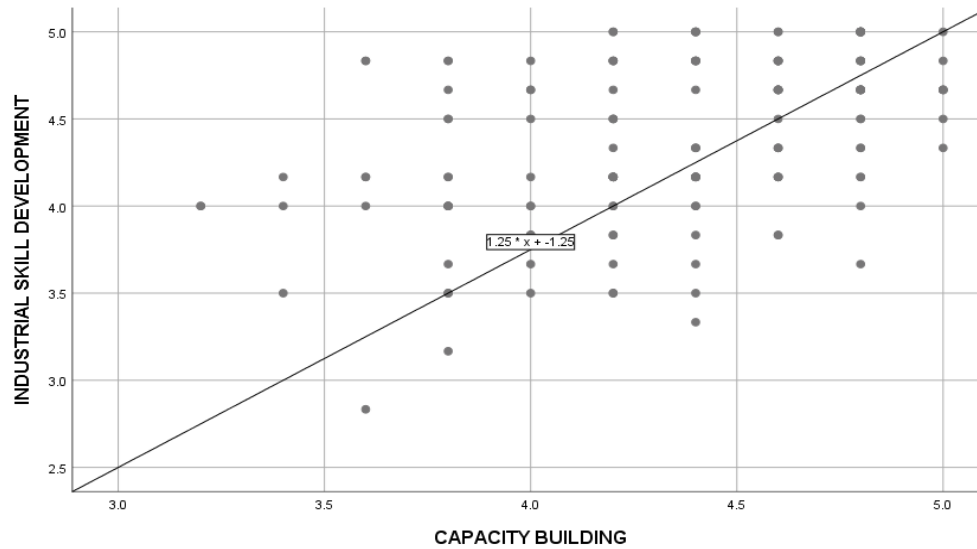


Figure 4.3 Scatter plot for partnership in capacity building and Industrial skills development

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013 (Rev. 2014)
Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

The National Commission for Science, Technology and Innovation, hereafter referred to as the Commission, was established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

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