INTEGRATION OF INDUSTRIAL SKILLS IN ENGINEERING TRAINING FOR SUSTAINABLE DEVELOPMENT: AN ANALYSIS OF SELECTED COURSES IN TECHNICAL INSTITUTIONS IN THE NORTH RIFT REGION KENYA.

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A THESIS SUBMITTED TO THE SCHOOL OF EDUCATION IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PHILOSOPHY IN TECHNOLOGY EDUCATION; ELECTRICAL & ELECTRONICS TECHNOLOGY.

DEPARTMENT OF TECHNOLOGY EDUCATION

SCHOOL OF EDUCATION

MOI UNIVERSITY

AUGUST, 2009

DECLARATION

DECLARATION BY THE CANDIDATE

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DEDICATION

I dedicate this work to my immediate family members for their patience and encouragement; wife, children and my parents.

ACKNOWLDEGEMENT

I wish to register my appreciation to all those who supported me by way of encouragement or material. I wish to express my special gratitude to my lecturers, supervisors and Post Graduate students for their support. Special thanks go to the Department of Technology Education, especially the Head of Department Dr. Okemwa P. and the supervisors; Mr. Wanami S. I., and Dr. Kitainge K.M., for having continuously encouraged me throughout the course period.

Thanks to all.

ABSTRACT

The Kenya National Development goal is for Kenya to be industrialized by the year 2030 as per the vision 2030 blue print in which the foundation originated from Session Paper Number Two of 1996 on Industrial Transformation and Development. In order to achieve this goal, the linkage between technology training and the world of work are of primary importance and that the training must be relevant and geared towards industrialization. This study was carried out in five technical training institutions in the North Rift region of Kenya, to evaluate the capacity of these training institutions in providing engineering training integrated with practical industrial skills for sustainable development. The research specifically focused on electrical engineering with a view to assessing the extent to which the programs prepared trainees adequately for the industrial activities and the training links with the industries. The data was collected using questionnaires which constituted thirty items, with both open and closed ended questions; which were distributed to six purposely selected institutions. The data was analyzed by use of descriptive and inferential techniques.

The results of this study showed that technical training institutions had insufficient resource capacity to translate training skills into practical industrial production applications; they lack modern equipment, shortage of funds to replace or renew them amongst other essential training requirements. It was also concluded that the trainers were inadequately industrially exposed to practical productive real life skills to be able to expose trainees to practical industrial skills for productive occupations. The curriculum was deficient in practical industrial production skills while the placement of trainees for industrial attachment work experience still posed a challenge. The study concluded that electrical engineering training had not been able to provide the resource capacity to effectively prepare the trainees adequately for industrial engagements. The recommendation of the study was that funds for purchase of equipment be availed and elaborate master plan be developed for intensive resource capacity, improvement and curriculum reviewed to make it dynamic and adaptive to emerging technologies, and to

keep abreast with manpower labour market demands. The theme of this research was 'Tell me and I forget, show me and I remember'.

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LIST OF ABBREVIATIONS $ ACRONYMS

ACE	Community and Adult Education
AQTF	Australian Quality Training Framework
ASEE	American Society for Engineering Education
CESO	Centre for Study of Education in Developing Countries
CyCoMo	Cyclic conception model
DVEC	District Vocational Education Committee of India
EBT	Enterprise based training.
GDP	Gross Domestic Product
HND	Higher National Diploma
ICCO	Inter Church Committee for Development.
ICT	Information Communication Technology
IDB	Inter-American Development Bank.
ILO	International Labor Organization
INPE	Indian National Policy on Education
LSDA	Learning and Skills Development Agency
NCVER	National Centre for Vocational Education Research
NITC	National Industrial Training Council
NVQ	National Vocational Qualification

SPSS	Statistical Package for Social Science
TAFE	Technical and Further Education
TVET	Technical, Vocational Education &Training
TVT	Technical and Vocational Training
UNDP	United Nation Development Program
UNESCO	United Nation Educational Scientific Cultural Organization.
USA	United States of America
VEP	Vocational Education Program
WB	World Bank.

CHAPTER ONE:

1.0. INTRODUCTION

This chapter highlights the background information on the role of technical training institution towards skill development for national development. The chapter also presents the statement of research problem, rational and objective of the study and the significance of the study**,** research questions, scope and limitation and the assumption of the study.

1.1. BACKGROUND INFORMATION

The Kenya National Development goal is for the country to be industrialized through the vision 2030 (Republic of Kenya, 2003).The vision is based on three 'pillars' namely; the economic, social and the political pillar. The vision 2030 has integrated Education and training as part of the social pillar for economic transformation. The policy framework paper of 1996 on transformation and development made an effort to introduce entrepreneurship awareness in institutions of higher learning including Technical Vocational Education Training (TVET) institutions with the objective of directing the graduands to the world of work. This policy framework paper gave the roadmap towards the achievement of industrialization through the enhancement of industrial establishment, the strengthening of informal sector and the diversification of skill manpower development through training. It was therefore necessary to develop an approach in which active learning is designed to promote creativity and a variety of process skills in the workforce which is adaptive to the fast changing technology. An effective technical and vocational training system should not only enhance employment creation but also

provide a favorable environment for industrial investors who would take the advantage of sufficient qualified labor force resulting in accelerating industrial growth.

The main macro-economic and demographic indicators that have an impact on education and training are income and growth potential, population growth and structure, and public sector structure and performance. A good performance in the education and training sector contributes to National development through the production of an appropriate human resource that helps to spur productivity. During the last two decades (from late eighties to time of research) the economy performed poorly mainly due to the dismal performance of the main growth sectors; manufacturing, production of goods and services sector. The manufacturing sector grew at the rate of 5.2 percent in 1990 but declined in performance to 0.8 percent in 2001.In the period 2003 to 2008, the economy was projected to grow at 4 percent, Real domestic product (GDP) was projected to grow from Ksh 108.5 billion to Ksh.138.5 billion in 2008; and per capita GDP was expected to grow from a level of US$ 303 to US$ 314 by 2008. The education and training sector was expected to play a key role in this projected growth through enhancing labour productivity by improving skills and knowledge of those in production, thus creating favourable conditions for innovations which, in turn would spur economic growth (Republic of Kenya, 2005).

TVET institutions play the role of equipping the trainees with scientific knowledge and practical skills for the world of work; through practical training and work experience at all levels. This is the transition from education and training to wage or self employment. The application of scientific knowledge and the skills in the production of goods and

services forms the foundation stage where industrial production skills are precipitated towards occupational activities. This depends on the relevance of training and hands on experience. Technical and Vocational Training involves the development of knowledge, skills and attitude required to carry out a particular economic activity competently. Competence which means the quality of adequately well qualified can be viewed as a factor of production. Training is expected to ease transition from the learning environment to work and thereby minimize the balance between skills needed in the economy and the ones available.

The Kenya Government with the assistance of the United Nations Development Program (UNDP) and International Labor Organization (ILO) has made an effort to introduce entrepreneurship concept with the objective of equipping the trainees with knowledge and skills that will enable them to respond appropriately to the prevailing social and economic challenges. Despite these efforts, production of goods and services had not been realized as a result of ineffective training; however the involvement of trainees in sandwich industrial internship exposed them only to line production setup (Ferej, 1996). The trainees failed to benefit much during internship, therefore practical production skills needed to be integrated with the training. This mode of training where production skills were integrated in the curriculum was expected to empower individuals, groups and institutions on productions of goods and services. This therefore creates the awareness of production enterprises and self employment as career options as well as developing positive attitudes towards the world of work. The industrial production of typical products would align institutions with their competencies.

1.2. STATEMENT OF THE PROBLEM

The main objective of engineering training is to equip the trainees with technical skills with a view to producing an engineer or technologist who would be industrially productive, be it in wage or self employment. The training among others involves a provision of relevant technical and managerial skills particularly essential for small and medium industries. The provision of adequate practical orientation and the development of positive attitude towards work produce desirable results for relevant industrial entrepreneurial engagement. In spite of the existence of engineering training institution for many years in this country, there has been little progress in the acquisition and effective utilization of technology for industrial development. The failure of the trainees from technical engineering institutions to secure occupational activities was a clear indication of the missing link between the training and the world of work (Republic of Kenya, 2005). The greatest challenge was that Technical Training Institution had been in existence and their training environment had failed to have the graduands smoothly be skillfully translated to the world of work.

In order to analyze this effectively and diagnose the problem there was need to asses and evaluate the training capacity of technical training institutions mandated to train technical manpower. It was necessary to identify the defects; strengths, challenges and opportunities by seeking the opinion of Technical Institutions administrators and trainers that were involved in the engineering trainings. The “gaps” between the skills acquired during training and practical industrial production skills is widening indicative of the irrelevancy of training systems to the needs of industry. The findings of this study were

intended to steer the training system towards provision of relevant skills adaptable to the changing environment.

1.3. THE PURPOSE OF THE STUDY

The general objective of the study was to asses the nature of training and evaluates the strengths, weaknesses and opportunities of tertiary Technical, Vocational and Education and Training (TVET) institutions to integrate practical industrial production skills in the training.

1.4. SPECIFIC OBJECTIVES

The study was based on the following objectives:

(i) To establish the opportunities/resource capacity available in Engineering Training Institutions in support of the integration of practical industrial production skills.

(ii) To determine the resource capacity levels/strengths of the Engineering Training Institutions to integrate practical industrial production skills.

(iii) To investigate the challenges of integrating practical industrial production skills effectively in engineering training at Technical Training Institute.

(iv) To investigate whether Technical Training System was effectively responsive to industry skill demand for national development leading to industrialization.

(v) To determine the benefits/gains of industrial attachment for appropriate acquisition of technical skills.

1.5. RESEARCH QUESTIONS

(i) What were the resources available in technical engineering training institution to integrate practical industrial production skills with training?

(ii) What were the levels of availability/strengths of engineering training institutions to integrate practical industrial production skills training?

(iii) What were the challenges faced by technical training institutions to integrate practical industrial production skills training?

(iv) Were Technical Training Institutions effectively responding to the market demands of industry for national development leading to industrialization

(v) What were the benefits/gains of industrial attachment in technical training?

1.6. JUSTIFICATION OF THE STUDY

The findings and recommendations of the study are expected to be of importance to managers and trainers of the public and private institutions and also the ministries involved in technical trainings and planning. The study identified the major problems facing Technical, Vocational Education and Training in Kenya and recommended remedial solutions. This assisted in recommending better engineering training models/systems and in strengthening the existing institutions to make them deliver quality training services to the trainees.

In an effort to achieve this, the study provided useful information to the stakeholders of TVET; and it equipped them with knowledge on how to deal with the challenges. The study provided recommendations to address the challenges of the mismatch in skill development which had caused minimum translation of practical training skill into productive economic activities; which contributed to the rising unemployment. The challenges of skill mis-match, rising unemployment and failure of Technical Training graduates to secure economical activities necessitated the need to asses the capacity of these Institution to integrate practical industrial skills in the training. The study would not have been complete without Investigating the shortfalls and make recommendation on the methods and techniques of bridging the gap that existed between the training and the world of work. Since research is a tool for change, the study strengthened previous studies on skill training and provided support and firm foundation for vision 2030 that Education and Training can stimulate the process of industrialization.

1.7. SIGNIFICANCE OF THE STUDY

The findings of the study were useful for Technical Institutions Managers and the Ministry of Higher Education, Science and Technology or agents responsible for supervising the trainings. It is particularly important when an institution is to be transformed into technical training institution with enhanced skill development which combines production and business skills training, generating positive attitudes towards the world of work and geared to market demands for sustainable development. The study aimed at the system providing hands on experience, multi-skilled and computer proficiency skills.

The study formed a valuable aid because it enabled educators and policy makers know a wider range of factors that are relevant to a major decision on technical reforms. It brought out the emerging roles of TVET in creation of innovative skills and its contribution in productive activities that can lead to rural and urban transformation towards the achievement of vision 2030. The study became the foundation for TVET reforms as it identified the major factors required for Kenya to be globally competitive by provision of quality and relevant education in line with the vision. The findings formed a basis for further research on the management of resources for optimum utility.

1.8. THE SCOPE OF THE STUDY

The research study focused on the training in engineering training institution in the North Rift region of Rift Valley Province in Kenya, offering technical engineering courses in electrical and electronics. It examined the curriculum, the training strengths, weaknesses and opportunities, the relevance of training to the world of work, the quality of trainers, the adequacy of equipments and the strengths of linkages between the institution and the industries. The respondents were trainers in these institutions and the data was collected by the use of questionnaires. The research concentrated on five institutions and it was limited to the assessment of the capacity of technical training institution to offer quality technical education. The study was carried out between August 08 and February 2009.

1.9. LIMITATION OF THE STUDY.

The main limitation in this study was attributed to the sample population size and the generalization of the findings. There were then about five Technical and vocational training institution in the North Rift region of Rift Valley province of Kenya. Therefore,

adequate assessment of the capacity of tertiary institutions with a view to determining the relevance of industrial development skills and the technology capacity acquisition in the training required a consideration of a large number of TVET institutions. However due time and financial resource constraints, it was not possible to cover a large number of technical training institutions in the country. These constraints restricted the study to only trainers though other stakeholders of TVET such as industrialists, policy makers' educational planners, and the trainees and the alumina of these institutions, would have contributed to the study. The study was therefore confined to a sample of 43 respondents from five technical training institutions and could not be exceedingly extended to all training institution in the country.

1.10. ASSUMPTIONS

The assumptions of the study were:

(i) Lack of industrialization in the country was caused by the omission of production skills in the training process.

(ii) Unemployment growth rate was caused by the absence of production skills in the training process.

(iii) Technical Training mode did not expose the trainees to real life experiences focused on the transition to the world of work

(iv) The dependent and the intervening variables remained constant during the research period.

1.11. THE CONCEPTUAL FRAMEWORK

This study was based on Devore (1964) concept of technology education that technology be organized by the adaptive technological system of production. This concept of technology education was defined as a body of knowledge and the systematic application of resources to produce outcomes in response to human needs and wants (Savage & Sterry, 1990). In view of the above training concept the study itemized the variables as independent variables which included equipment, workshop space, funds, curriculum and the training staff whereas the dependent variables are sustainable development (how one easily get adapted to working industry), provision of quality trainings (how easy for one to be employed), utility of equipment (relevance of equipment), and exposure to practical on the basis of graduands in the market. The intervening variables included integration of production skills (production activities, investment skills, entrepreneurial skills etc.), industrial linkages, industrial based equipment, dynamic curriculum and relevant trainee industrial exposures coupled up with the emerging Technology. The intervening variables had been static for sometime hence it was presume the prevailed even during the time of research

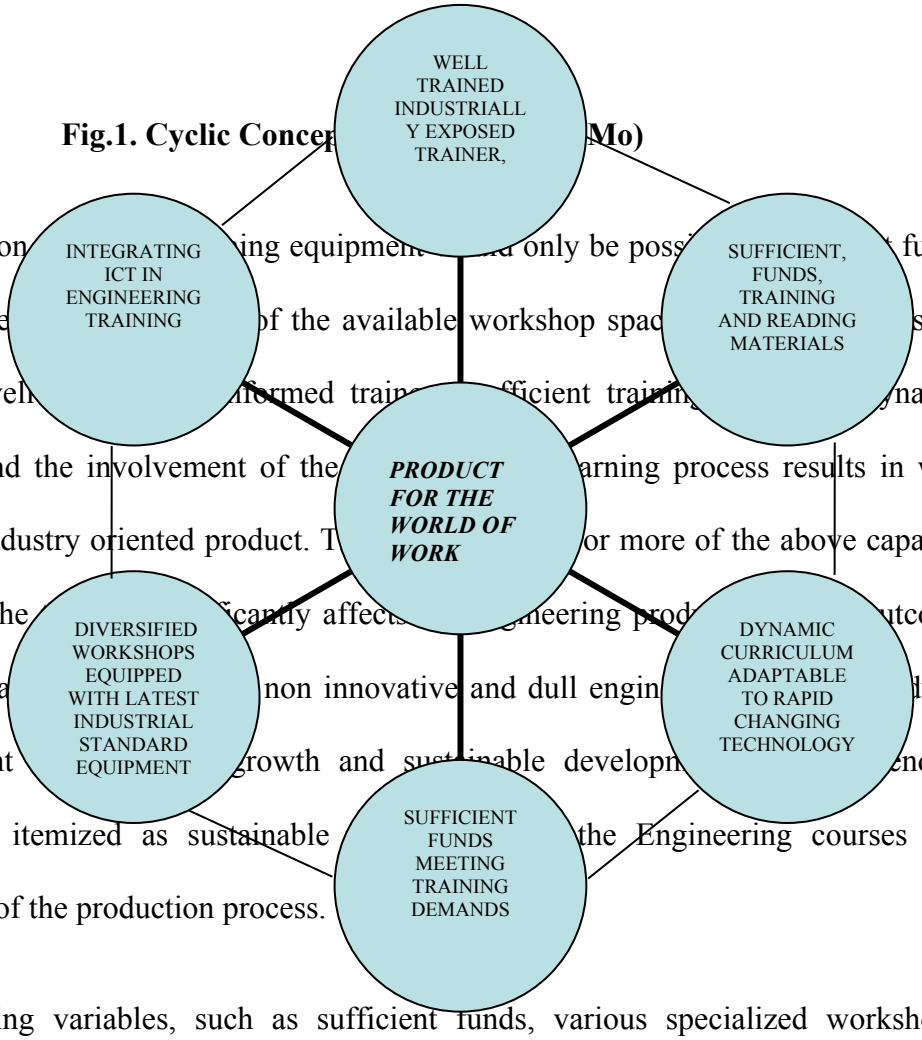
1.11.1 Correlation of the variables.

The model in Fig 1 shows the major requirement blocks for effective technical engineering training which must interact to produce a product for the world of work. A well trained engineer should be able to see self-employment option as a viable alternative to paid employment. This could be achieved if the curriculum of electrical and electronic engineering was responsive to the changing technology. The implementation of the program be carried on by well trained and industrially exposed trainers who themselves

are well versed in the latest technology such as computer information technology (ICT) integrated in engineering training. The trainers should be capable of using emerging instructional technological techniques. Quality Technological training needs to be carried out in specialized workshops equipped with equipment compatible with modern industries.

Provision of Effective Technical Training.

Fig.1. Cyclic Concep Mo)



The acquisition ing equipment only be poss funds were available f the available workshop spac shop equipment, well formed train fficient train namic curriculum and the involvement of the arning process results in well trained and industry oriented product. T or more of the above capacity resources in the ficantly affect gineering prod utcome will be gradua non innovative and dull engin ducts not competent growth and sust inable develop ndent variable was itemized as sustainable the Engineering courses and development of the production process.

The intervening variables, such as sufficient funds, various specialized workshops, dynamic curriculum and well trained, industrially exposed trainer when appropriately utilized can lead to effective performance in training. The training subsequently enhances

skill transfer of industrial production skills for adaptive and sustainable development in the Engineering training. The arrows represented the operational intervening variables mediating the training process.

This study assessed the resource capacity of engineering training to support industrial productions skills transfer. It was therefore essential that training system be transformed to be adaptive to the emerging economies that would promote creativity and research undertakings in order to meet the evolving technologies from time to time. The integration of production skills coupled up with research components introduced new production processes essential for the developing industrial economies. This concept of combining Engineering training with productions is seen as part of a broader educational methodology of providing educational training experiences which links the training – learning process with the world of work. This mode of training facilitated the trainees not only gain relevant skills and knowledge, attitudes and values but also hands on experience to apply their competencies in production of goods and services.

1.12 OPERATIONAL TERMS.

Curriculum: The carefully organization of goals and problem solving instruction and activities that would facilitate attainment of prescribed objectives.

De-skiling: the tendency to lose competency by lagging behind or lacking to acquire new technological skills.

Integration: refers to Interaction training skills and industrial production skills

Technology mismatch: refers to the interlink relation between training technology transfer and the technology needed in the labour market.

TVET: in this document adopted the 1997 UNESCO definition of Education and training as to 'acquire the practical skills, know-how and understanding necessary for employment in a particular occupation, trade or group of occupations'.

1.13 SUMMARY.

This chapter gives the background of the problem facing the transfer of technical skills through training by Technical Training Institution; having been in existence for decades and no much progress achieved in terms their graduands of acquisition of technological skills for effective industrial development. The chapter states the purpose of the study as: to investigate the technical training capacity to transfer technical skills for sustainable development. The research was carried in five engineering training institution in the North Rift Region of Rift Valley-Kenya. The capacity of engineering training was measured in terms of facilities; equipment, training materials and workshops, and the quality of trainers and the curriculum. The study sought to integrate the practical industrial production skills concept in the technical training program.

CHAPTER TWO:

2.0. LITERATURE REVIEW

2. 1. INTRODUCTION

This chapter reviews literature on technology education development and its impact to human resource and productions. The role of TVET was discussed together with the challenges it is facing in Sub-Saharan Countries. The chapter also reviewed the impact of perspective engineering technology and the changing technology on skill development. In the chapter a comparative case study of training models of India, Germany, China, Australia and United Kingdom.

2.2. BACKGROUND INFORMATION

Demographic evidence revealed that many developing countries are now in or soon to enter a period of peak youth population (World Bank, 2006). The World Bank report of 2007 argued that there were substantial returns to investment in human capital formation and that such interventions are most effective during childhood or adolescence. One of the most important features of TVET was its orientation towards the world of work and the emphasis of the curriculum on the acquisition of employable skills. TVET delivery systems are therefore well placed to train the skilled and entrepreneurial workforce that Africa needs to create wealth and emerge out of poverty. Another important characteristic of TVET is that it can be delivered at different levels of sophistication. This means that TVET institutions can respond to the different training needs of learners from different socio-economic and academic backgrounds, and prepare them for gainful employment and sustainable livelihoods (African Union, 2007). Developing countries that are able to support education and training today will reap the economic reward tomorrow (World Bank, 2007).

There was a growing demand that Technical Education be re-examined to make it prepare the trainees adequately with skills needed to prosper them after graduation. The need to link training to employment (either self or paid employment) is at the root of all the best practices and strategies observed world-wide. The World Bank report of 1991 had cited at that time, high training costs, poor quality of training, the mismatch between training and labour market needs and the high rate of unemployment among TVET graduates as justification to recommend a policy shift away from school-based technical

and vocational education and training (World Bank, 1991). However, there is now a fresh awareness among policy makers in many African countries and the donor community of the critical role that TVET can play in national development. The increasing importance that African governments now attach to TVET is reflected in the various Poverty Reduction Strategy Papers that governments have developed in collaboration with the World Bank.

2.2.1. Learning Skills for Sustainable Livelihood.

The Nairobi declarations that emerged from UNESCO (2001) sub-regional seminar on skill development for livelihood enumerated several benefits of TVET and gave recommendations necessary for implementation by member states. On learning skills for sustainable development, it emphasized the importance of laying a foundation of knowledge, skills, and attitudes that prepare individuals for productive livelihood that contribute to sustainable development (UNESCO, 2001). The conference found that there was need for stimulating and promoting a culture for technological innovations, entrepreneurial and industrial growth. The other recommendation on trainees' transition to the word of work was utilization of learners centered and innovative TVET delivery methods such as enterprise based training (EBT) together with the best available instructional aids to prepare individuals who are competent, creative, practical and able to continue learning throughout their lives. These goes hand in hand with reviewing, structuring and harmonizing TVET programmes regularly to respond to the changing technologies and demands of industry and commerce in globalizing the world of work (UNESCO, 2005).

2.2.2. Education for Work.

Three TVET co-financing organization, Inter Church Committee for Development (ICCO), Edukans and Woord En Daad conducted an evaluation on TVET activities in four countries namely India, Kenya, Ethiopia and Albania between 2003 and 2006. The evaluation focused on TVET policies, the extent to which TVET contribute to graduates improved livelihood and the relevance of technical, vocational education and training activities. The evaluators sum up their observation that the countries should develop a capacity building strategy on the four levels of capacity building: tools (curricula & syllabi development), individuals (teacher training), organizational development (human resource policies to maintain well qualified staff), and Institutional development (Strategic partnership and networking), (ACE-Europe, 2006). Knight (2008) observed that Adult and Community Education providers (ACE) , which are usually community based organization provides an overlap between training and general education; Secondary schools delivering school based apprentice or Universities being dual-sector institutions delivering both VET and higher education programs (Knight, 2008).

2.2.3. Trends of TVET in Developing Countries.

The consultative meeting held in Bonn (2009) on UNESCO strategy on Technical, Vocational Education and Training observed that TVET aims at enabling the learners to meet needs of employers for qualified labor and/ or own needs related to production of goods and services. In developing (poor) countries the resources for TVET skill training are found easily; the materials and resources are plenty, but faced with significant challenges relating to relevance and quality of training. The curricular itself should

include basic entrepreneurship education in support of self employment for candidates in areas with limited employment opportunities (Farstad, 2009).

Industrial development is a process by which a nation acquires competence in the manufacturing of products required for sustainable development. Technology is considered the prime mover. Engineering is the specialized aspect of technology which deals with design, development and evaluation of technological processes. Engineers provide the leadership in technological manpower development in any Nation and this includes technologists and technicians, and craftsmen and artisans. It is the engineer who by training is to provide the thrust for acquisition, adaptation and diffusion of technology (Zymelman, 1993). The inability of technical engineering institutions products to secure occupational activities indicates wider gap between the training and the world of work (Republic of Kenya, 2005). This had contributed to decline of production of goods and services, slow economic growth, diminishing employment creation, dormant informal sector and redundancy. This problem may be attributed to the nature of training given by these institutions, most of which are more or less carbon copies of foreign institutions (UNDP, 1994). There was a growing need for curriculum review, with a view to making training more relevant to the needs of a developing Nation.

2.3. TECHNICAL, VOCATIONAL EDUCATION AND TRAINING (TVET)

Technical and Vocational Training (TVET) had in a large part not led to increased employment (UNESCO 2006). The majority of young people enter a workforce characterized by high rates of self employment with an expanding informal sector. A question often asked by market demand for skills is “how can technical training

institutions prepare their trainees with skills needed for either self employment or wage employment in order to curb the rising rates of unemployment amongst the youth?" "Do the institutions have the capacity to provide adaptive skills for both industrial set up and informal sector?" Close linkages between technical and vocational education and the world of work are of primary importance to the relevance of training towards industrialization.

Seminars and cooperation between Educational Institutions and the world of work in technical and vocational were held for Asian and African participants, (Berlin, Germany 1995, Ouagadougou Burkina Faso 1997), and it was observed that changes in the nature of work, the technologies of production and in standards of manufacturing have pedagogical and training prerequisites. TVET needs to create new opportunities for the trainees through innovative approaches to curriculum and pathways, and developing a coherent strategy that integrates different dimensions of skills/attitudes development as part of the strategy. The analysis provided in research reports on learning TVET in Australia published in 2006 reinforced the statement that the vocational education and training system needs a capability building approach that focuses on quality, professional judgments and growth rather than simply on compliance. This model is more holistic than the earlier work based learning model. It is personalized and self directed, involving work/life integration and it recognizes the blurring of boundaries between work and learning, and acknowledges that learning occurs through relationship and conversations (Staron, Jasinsk & Weatherlyet , 2006).

2.4. CHARACTERISTICS OF ENGINEERING TRAINING WITH PRODUCTION

The combination of engineering training with market production is learning through hands on experience. The close connection between production and training holds a major chance of avoiding the weaknesses of reality removed technical and vocational education thus making reality based learning possible. This model of training improves the integration of theory and practice through better understanding of scientific principles and processes of deduction implied in the various types of job seekers. It also assists in learning the roles of different technologies and new method of production. It develops the ability to choose freely and more adequately the field of occupational operation as it becomes clearly defined. This model also exposes the trainees to broad range of practical skills, problem solving and production skills and allow skilled workers to find new opportunities for technical self actualization. In the context of the goals of technical education engineering training combined with production promotes the capacity in trainees to apply the skills to produce goods and supply of services becomes particularly significant.

In the traditional training course method, concentration was usually in theory without linking it much to practice. Although occupational problems were broken down into learning sequences and structured according to theoretical considerations, they were not completely cut off from the real work context. Unlike the traditional method, the dual system, the Engineering training is under the direction of full time instructions and the attachment of production process units to training institutes will attempt to promote the

trainees relation to the realities of genuine job situations. The idea is to prevent the trainee's relationship to genuine job situation from becoming stunted as a result of attending a separate piece of learning for too long a time (Claudio de Moura, 1998).

Training workshops and science laboratories were becoming more common in almost every educational setup and 'hands on' is a popular description of in-service training programs. Through hands on experience with the technology, trainees can integrate learning, enhance higher order thinking skills, and increase their ability to interact with technology devices and systems (Zuga, 1998). Even in the development of critical thinking, the importance of active and contextual learning has been recognized. Practical or active learning makes the operation of the production process and jobs simpler than when these have to be done by reading books and memorizing the works which describe action. In some Latin American countries, the primary objective of the cooperation between the government vocational training institutions and private enterprises is the training of skilled workers for the demand of modern industrial enterprises (Lohmar & Cornelia, 1992).

2.5. THE ROLE OF TVET IN NATIONAL DEVELOPMENT

Technical and Vocational Education contributes to National Development by producing skilled human capital, thus raising the productivity capacities of societies, and this is assessed by measuring any increase in the gross national product (GNP) (Thomas , Potter & Allen, 1992). In another school of thought National Development is attained by emphasizing on education technology and industrialization as agents of transformation (Little & Leach, 1999). Sen (1999) argued that development should be focusing on

economic growth as the primary indicator of development, but more so, on assessing the needs of individual: their freedom, equity, participation and empowerment to fulfill their potential capability (Sen, 1999). In a more holistic perspective, human development is about creating an environment in which people can develop their full potentials and lead productive, creative lives in accordance with their needs and interest (UNDP, 2002). This therefore entails economic development and social freedom. According to Alam (2008), human capital theory has powerful influence on the analysis of the labour market. Its investment return for the society will be skill workforce that will enable global competitiveness and economic growth. Vocational education and training (VET) system helps the unemployed young people get jobs, reduce the burdens on higher education, attract foreign investment which ensures foreign earnings and employment, and reduce the inequality of earning between the rich and the poor (Alam,2008).

2.5.1. Technology Improves Workforce Productivity.

Productivity is the main determinant of trends in living standards (Hatsopoulos, et al, 1988) and the growth rate data shows that American competitors, for instance Japan, have been able to increase their productivity at a much faster rate. Between 1979 and 1985, U.S was rated below seven of its competitors (Berger, 1987) with growth rate of 5.1% increase amongst the twelve leading industrial countries. In 1986, U.S had the highest productivity growth of at 3.7% (Klein, 1988). There are three primary ways to improve productivity:

i). Improvement of productivity through the development of new technologies.

Productivity growth can be attributed to technological innovations. A strong research and development effort is needed to ensure that new innovations are forthcoming. It is also evident that without research and development expenditure, it is doubtful that significant innovations can be developed (Young, 1988). The growth in per capita income induced by growing productivity is the engine of development. The World Bank report stated "What drives productivity is technological progress" (World Bank 1991, p.4).

ii). Improvement of productivity through education and training

Technological development has been the driving force behind productivity improvements. The advancement in technology demands the acquisition of new skills by workers to ensure that they remain relevant to the demand of industry. This has become a key objective of the employer. Industrial technical training helps to keep workers skills in line with new technologies and business practices, which, in turn help business increase productivity, improve quality and boost competitiveness (Magoha, 2003).

(iii). Improvement of productivity through increased capital expenditure.

While the development of technology is a key to productivity growth, the technology is worthless unless it is used. Modern facilities, new equipment, and innovative organizational strategies are needed to keep up with new production techniques.

2.6. THE IMPACT OF CHANGING TECHNOLOGY ON SKILL REQUIREMENT

As occupational skill required changes with technology, the education and training needed by future existing workers must also change accordingly. The literature identifies three different views regarding the impact of technology on skill requirement.

i). Advanced technology creates a wider gap between high skill and low skill job.

This view is built on the premise that technology creates a need for highly trained and educated workers to design, develop and maintain the technology (Nettle, 1986).

(ii). Advanced technology creates job at both middle and high skill levels

This view suggests that advances in technology creates job at both the high and middle level skills (Grubb, 1984).

(iii). **Advanced technology decreases the overall skill requirements of the workforce**

This view suggests that advances in technology will actually decrease the overall skill requirements needed by the workforce (Bartel & Lichtenberg, 1987). While the skill requirements do increase initially as technology is further developed and refined, the skill requirements needed to use that technology actually decrease. For instance when the computer was originally invented it was a complex machine that was difficult to use. Further refinement in computer technology has led to the development of a machine that is relatively easy to use. The trend to simplify the use of equipment results in a deskilling

of the workforce because the technology reduces the need for much of the mental and physical work needed to conduct daily work tasks.

(iv). The effect of competitive Production on training.

Its critical that productivity increase in order to maintain a competitive advantage in the global market. The problem of increasing productivity is compounded by the ever changing workplace in which a knowledgeable and skilled workforce is needed to adapt to new technological processes. The recent trends in technology and the workplace suggest that post secondary training needs modifications in order to equip the trainees with knowledge and skills needed to be successful.

2.7. GLOBAL PERSPECTIVES OF ENGINEERING AND TECHNOLOGY EDUCATION

The scope of engineering and technology is changing very rapidly worldwide and the adequacy of most training curricula is being called to question. Most employers of engineering labour all over the world believe that the products of engineering institutions are deficient in many ways; they lack the critical skills required by today's work place: listening, communicating and defining problems. They also lack the capacity to complement the skills of others in the teams so as to effectively functions in a complex and rapidly changing environment but instead they are still so divorced from the needs of business, and are not prepared for future employment (Smith, 1996).

The American Society for Engineering Education (ASEE) recommended that colleges of engineering must re-examine curricula and programmes to ensure they prepare trainees for broadened world of engineering. In particular, it was recommended that engineering curricula includes such important topics as communication skills, team skills, leadership skills, ethics and an understanding of the societal, economic and environmental impacts of engineering decisions (ASEE, 1995). Engineering institutions globally are also under severe pressure to close the 'cultural gap' that exists between industry and academia. Leadership skills refers to those skills required to mobilize resources across functional specialties, to introduce new initiatives, and frankly, to make technology pay off at the bottom line.

2.7.1. The Global Impact of Technology.

The United States was once the premier leader in industrial strength and influence. The countries previously unable to compete with it in both technological and economical arenas have made drastic changes in the way they develop and produce goods. Through modernization of their factories and by using innovative organization systems, these so called non industrial countries have begun to compete with the industrial giants in their own turf. The competition from countries such as Japan, Korea and China is having a dramatic impact on the economic, political and educational system in the developed and developing countries.

In response to competitiveness, countries must strive to develop a highly skilled adaptable workforce that develops and uses technology. This effort will result in a renewed competitive advantage through improved technologies and innovative, creative

and highly educative workers. This approach is not without drawbacks. New technologies are likely to replace many workers, Electronic robots which could result in higher unemployment. Advances in technology could also lead to deskilling of the workforce who may result in a wider gap between the workers who develop new technologies and those who use it (Bright, 1996).

Technology education has a unique role to play in improving productivity of the future workforce (Technology Education Advisory council, 1988). It provides the opportunity for the trainee to interact with technological systems and processes .It reinforces the content learned in other curricular areas and enhances higher order thinking skills (Johnson et al, 1989).

2.8. CHALLENGES OF TECHNICAL TRAINING IN SUB-SAHARAN COUNTRIES.

2.8.1 Weak National Economies.

In sub Saharan African countries with exception of South Africa, the per capita income is less than 400 U.S dollars. Although the economy in a few countries including Botswana and Ghana is growing at a respectable rate of about five percent, the annual real growth rate in many countries is less than two percent limiting the prospect for employment creation. It is estimated that about five hundred thousand young people add to the labour force each year in Kenya, as many as seven thousand in Tanzania and two fifty thousand in Zimbabwe (Johanson & Adams, 2004) and comparatively 44% of the unemployed are youth (ILO,2006). African economies face the daunting task of finding productive

employment for seven to ten million annual new entrants into the labor market over the next five years. Apart from Botswana, Ivory Coast, Ghana and South Africa, the industrial labor force is less than ten percent in most African countries (World Bank, 2000).

In many African countries with exception of South Africa and Mauritius, about eighty five percent of the workforces are in the informal sector, non wage employment sector. The phenomenal growth of the informal sector in Africa today is closely linked to the acquisition and eventual utilization of knowledge and skills in production of a range of goods and services (King, 1996; Grierson, 1997). This labour force distribution pattern needs to be kept in mind when developing national TVET policies and strategies.

2.8.2. Educated but Unemployed College and University Graduates.

In almost all countries in Africa large numbers of graduates coming out of the formal school system are unemployed, although opportunities for skilled worker do exist in the economy. This situation has brought into sharp focus the mismatch between training and labor market skill demands.

Higher education system in Africa has been described as irrelevant and incapable of producing skills and training which are required for technological and economic development. It does not prepare the graduates for the world of work and does not inspire in them the culture of entrepreneurship (Isoun 1987; Scott, Forster, Sachwell, 1991). At a brainstorming meeting held in November 2006 in Bangkok with participants representing international organizations, Ministries of Education, Ministries of Labour, industries and

youth groups, the following key issues for youth unemployment were identified as mismatch of qualifications with employers' needs: lack of labour market information, shortfall in proper career guidance and information, Lack of exposure of students to the real world of work and insufficient soft skills (Cheng, 2007).

The quality of training is low, with undue emphasis on theory and certification rather than on skills acquisition and proficiency testing. Inadequate instructor training, obsolete training equipment and lack of instructional materials. The factors that minimize the effectiveness of training in meeting the required knowledge and skills objectives include; High quality skills training requires appropriate workshop equipment, adequate supply of training materials and practice by learners. The lack of teachers and trainers is a major constraint. Most TVET teachers training at graduate levels usually take place outside Africa. This further depletes available resources and encourages the brain drain (Kerre, 1997). The high cost of TIVET programs prevents most schools and institution from offering the programs due to lack of appropriate resources and facilities. This, in the long run denies the nation critical manpower required for national development.

2.8.3 The Traditional Culture of Training Institutions.

A researcher describes the effect of the traditional establishment of the institution as 'The mind and the hand do not learn together' (Claudio de Moura, 2008). He went on to say the TVET system in developing countries tends to follow two patterns. There are those that are associated with ministry of education and tend to be part of academic system. The other education packages with academic and vocational components producing products often referred to as Technicians.

The recent findings by Claudio de Moura (2008) reports that the vocational trainers have two different profiles: they may be experienced instructors, but of low status. Inevitably, a trainer of low status lowers the aspirations of the trainees to pursue the trades they are taught which turns out to a self be defeating undertaking. The other lot of workshop trainers in vocational training institution, which is common, is just regular trainers who received improvised and second rate training in the vocational subjects. The trainers themselves are not professional and cannot give the trainees a true professional training in whatever trade. These case comprises the' trade schools'. These training institutions were the descendants of craft schools. These institutions tended to have descent professional trainers recruited from the world of work. However, the complimentary education in math's, drafting and science tend to be inadequate. The trainees tended to have come from weak background and lower social extractions, thus their overall status is low. This therefore means there were technical training institutions with better trainees and those that recruit weak trainees. The workshop activities of the academically strong institution were not so bad. The conclusion is the mind versus hand gap is less profound and dysfunctional (Claudio de Moura, 2008).

2.8.4 A Rising and for Relevance n Technical Training

There is a growing recognition amongst a number of bodies such as UNESCO that there is need to orient TVET towards sustainable development (UNESCO, 1991), and within the context of Jomtien conference, UNESCO continued to strengthened its view of the relevance of technical and vocational education in contemporary society (Hoppers & Komba, 1996). There has been mis-match between the training offered and the skill

needed in the labour market, particularly regard to informal sector (Gill et al,1999), and growing need for self employment (Grierson, 2002).

As it stand now vocational education is not meeting the full needs of their beneficiaries, to be Specific TVET do not prepare trainees with the skills needed to prosper after graduation (Kafka & Stepheson, 2006). The majority of young people in developing countries enter workforce characterized by high rates of self employment within an informal sector. Secondary education system prepares students for university entry, despite the fact that only 9% of student in developing countries go on to higher education (World Bank, 2004).

2.9. TVET AND ENTERPRISE ASSOCIATION IN SUB-SAHARAN AFRICA

Most of the countries in sub-Saharan Africa regarded technical and vocational education as vital to the economic development, as this sector were associated with acquisition of the Qualifications needed to be competitive in the international arena. TVET had been going through a stage of transition and reorientation in the region, as efforts were being made to give trainees some basic skills and knowledge, as well as the tools they needed to play an active role in the production system.

An international recommendation for the improvement of technical education and Vocational training systems systematically refers to the need to forge closer links between the Training and the labour market. The search for a better match between jobs and training is based on a two-horned problem: The labour market was considered to be

characterized by an acute shortage of skilled labour, as reported by many employers. Paradoxically, many economies suffered, at the same time, from rising unemployment, particularly among the young people leaving the education system, as reflected in graduate employment rates. Secondly the pace of technological change required workers to have new qualifications in order to perform the tasks required in modern jobs. Careful studies have shown that good training provided at the right moment to the right group pays well in terms placement and cultivation of interest and attitude. Training increases human productivity, and hence, the income of workers. It also tends to improve their employability and adaptability to different occupations. Economic modernization requires increasingly complex forms of training. Training is a privileged form of technology transfer. It is a tool to increase efficiency and competitiveness (IDB, 2000). To cope with these two issues, technical and vocational education should establish close links with enterprises to make it easier for graduates to make the transition from school to Work. In sub-Saharan Africa, however, the term 'enterprise' may be applied to entities which differ enormously in terms of size, structure, resources and technology.

The integration of enterprise and training is a 'double edged sword' kind of training which constitutes training of the youth both in a school environment and in practical production environment. The use of both the enterprise and the school as training sites is considered essential to improving the integration of young people in the labor market. This form of training is based on the complementarities between the enterprise and the school, in the sense that it involves not merely the sum of the knowledge acquired in the classroom plus the know-how acquired within an enterprise, but also the constant application of the knowledge acquired. The two milieus reinforce and complement each

other to turn out trainees who are better qualified and better able to adapt to the business world (Greffe, 1997).

The necessity of finding new ways of making training more vocational, and the desire to have a closer association with enterprises, have led TVET training systems to have keen interest in dual training. It constitutes an approach to initial training which allows for: the concrete participation of the professional milieu in the training delivery and a step towards its adaptation to the needs of the enterprises, and allows for a better reciprocal knowledge of the partners and an opportunity to make the enterprises more aware of the benefits of training. It also allows for the discovery for young people of the reality of life in the enterprises, and the possibility of using their skills and it promote the possibility for the students to be trained on materials that the centers, as a consequence, no longer need to buy, which corresponds to a rationalization in the use of equipment.

2.9.1 The Trends of Skill Training in Developing Countries.

Bringing work experience into the schooling context can improve the youth transition to work (chapter 3); at the same time employers provide and finance training on and off the job long after youth exit school. As a source of skills for youths, employers are often overlooked in favor of public training programs. Surveys conducted by the World Bank in 37 countries covering 18,217 manufacturing firms show that enterprises are active trainers Tan, (2005). Nearly 60 percent of firms in East Asia and the Pacific provide training with the share falling to just under 20 percent in the Middle East and North Africa. Leaving training to enterprises does not, however, ensure access for all to training. Enterprises often are less likely to invest in skills widely used by other

enterprises for fear of losing trained workers and their investment. Thus, not all firms will train, nor will all workers in enterprises be trained. In Colombia, Indonesia, Malaysia, Mexico, and Taiwan, China, large manufacturing firms are more likely to train than smaller ones (Tan, & Batra, 1995).

Kenya, Zambia, and Zimbabwe show a similar pattern, with manufacturing firms employing 151 or more workers being twice as likely to invest in external training for their workers as those employing 51 to 150, and more than 10 times as likely as those with firms of 10 or fewer workers. Firms with a higher likelihood of training are those that export, have foreign investment, and adopt new technologies—and they are more likely to train workers with more education Johanson & Adams, (2004). Other firms will need financial incentives to train young inexperienced workers. Policies can also condition the participation in other programs (like wage subsidies for new entrants) on the provision of training for young workers. Because not all firms can provide technical training and because not all young workers benefit from employer training, public interventions are needed. Training offered by employers is relevant and effective, but that provided by the public sector is subject to question. Rigid, low-quality training systems disconnected from labor markets have led many countries to reform their programs. Non-formal training systems outside formal education are changing the way providers are governed, managed, and financed (World Bank 2007). Competition promotes efficiency in delivery and more closely links training to market demands, shifting the shifting the financing model for training from supply driven to demand-driven. Johanson and Adams (2004) and Cinterford/ILO (2001).

Overall, training systems are moving away from a narrow focus on inputs for training, with more instructors, workshops, and equipment—to a focus on outcomes, with attention to skills standards set by employers and competency based delivery by a mixture of public and private provision, measuring performance in terms of job placement and increased worker productivity. Curricula developed in a modular fashion promote flexible entry and exit for training consistent with a lifelong learning model. Sound monitoring and evaluation programs are important in guiding reforms, policy development, and market operations. Overall, training systems are moving away from a narrow focus on inputs for training, with more instructors, workshops, and equipment—to a focus on outcomes, with attention to skills standards set by employers and competency-based delivery by a mixture of public and private provision, measuring performance in terms of job placement and increased worker productivity. Curricula developed in a modular fashion promote flexible entry and exit for training consistent with a lifelong learning model. Sound monitoring and evaluation programs are important in guiding reforms, policy development, and market operations (World Bank, 2007).

2.10. CASE STUDIES

This section presents case studies of training models which involves productive activities and learning from China, UK, Germany and India. Learning and engaging in productive activities lies at the heart of emphasizing TVET for sustainable development. Although theory is still being taught, a greater proportion of time is spent putting this theory into practice. Reducing costs associated with uncertainty, trainees graduate with the rightful confidence that if they run a successful enterprise within the confines of an institution set

up, they will be more than capable of bettering these results out in their future working places.

2.10.1. The Need for Case Studies.

The main questions are ‘How can this dual mode of training prepare individual for particular job or cluster of jobs.” What can we learn from the experiences from other countries?” What are the dynamics over time of developments in combining training with the world of work?” “Can learning by doing and work experience and other pedagogical characteristics of the dual integration be a good investment?” The question that needs to be addressed is to what extent do engineering training combined with practical production promotes specific cognitive skills, values, attitudes and work culture such as diligence, creativity and personal responsibility.

The study has the important function of keeping researchers, educationists and planners informed of alternative techniques used elsewhere. Furthermore, every rigorous analysis of an educational system or problem requires comparison of some kind. Comparative analysis of cases will help in this respect to document instances of differential mode. The case studies are expected to focus on how technical and vocational training be can promoted for industrial development. The case study therefore will provide international comparison as the link between training and production that has been undertaken in many parts of the world and in situations that differ widely in terms of socio-cultural characteristics, political and ideological system and levels of development.

2.11. VOCATIONAL EDUCATION PROGRAMME IN CHINA

Introduction.

The combining of vocational learning with production has inspired the present growth development of China in disseminating information on modalities and experiences on interaction of education and the world of work. The introduction of labour and work study into schools as part of curriculum was an attempt to end the privilege held by the educated in China. The pragmatic economic concerns following requirements of personal survival, educational expansion and providing the modern workforce needed to modernize the country soon became equally important.

2.11.1 The Training System

During the communist period the movement of combining training and production became the moving force for the establishment of industries. After a period of 40years, China saw several industrial establishments come up. Institutions such as Xianyuang technical school whose aim is training of skilled workers and technicians provided practical training and work experience. As regards the curriculum, there are twenty weeks of practical training during the four years and the basic skills are taught in separate learning workshops. Practice in operations takes place under supervision of experienced instructors. During their training, the trainees finish part of the production, and then finishing the work is done by employed professional workers in order to reach the precision and quality specified in the blue print.

2.11.2 Guangdong Market Based Training Approach.

Governance in China is hierarchical but multi-layered, with central, provincial, municipal and district levels. VET provision is through technical and vocational schools, technical institutes and training centres. The rapid growth of the manufacturing sector in areas such as Guangdong has created a high demand for middle level skills. As a consequence of this demand, there is a strong link between these industries and the upper secondary technical and vocational skills. Overall, the graduates from these schools have a higher rate of employment entry of over 97% (Keating 2006) as compared to the graduates from either the universities or the academic secondary schools. The national and provincial schools typically are better funded and have high levels of autonomy. They specialize in different industry areas and many have established close relationships with a small number of large enterprises. These enterprises typically provide practical placements or internships for periods of up to six months and in some cases provide equipment and even some support for building programs. Upon graduation, many students will be given employment in these enterprises. For instance, in the city of Guangzhou, about 40% of the graduates in automotive from one school gained employment in the nearby Honda factory in 2005 (Keating, 2007).

Guangdong therefore is an example of a market based approach within a tight institutional structure. This has led to direct relationships between partially autonomous providers and individual firms. Industrial input is achieved through localized and market relationships between providers and individual companies. Some high tech companies have established their own tertiary level training colleges or polytechnics and there are a

small number of high quality private secondary technical colleges for the children from middle class homes whose test scores do not allow them to enter the elite public schools. The 'system' is driven by a huge demand for skills, but depends mostly on a combination of public investment in schools and fees paid by students in these schools.

Planning is multi-level with each level of government able to implement key schools and schools able to decide on specializations. All courses deliver national qualifications that are based upon skill standards developed at the central government level. One clear advantage of the Guangdong approach is its simplicity. Technical and vocational schools have large occupational training schemes that have direct links with enterprises and most of their graduates enter these enterprises upon graduation.

2.12. VOCATIONAL EDUCATION PROGRAMME (VEP) IN INDIA

The Indian National Policy on Education (INPE) of 1986-1992 emphasized the introduction of Vocational Education Programme (VEP) for students and its sole purpose was to provide trainees with professional skills in X1 (one plus ten) and X (plus ten) classes.

The training programmes lay great emphasize on practical work; hands on work experience. About three quarters of the time available is devoted to Engineering theory and skill training. Apart from practical subjects in laboratories and training workshops at the institution, planned that strong school-industry linkages be developed, so that student trainees of vocational courses get an exposure to real work situations in industry under the existing vocational education. Program, infrastructure facilities have been provided

for training in vocational skills. The students learn the skills in the training workshops-cum-productive enterprise, and gain experience in the marketing of products and services; however the same facilities are used for production of goods and services. Students learn the skills in the training workshops cum productive enterprise and gain experience in the marketing of products and services. The District Vocational Education Committee (DVEC) in collaboration with government departments involved in the provision of health, electricity, employment and human resources and community services, takes appropriate step to promote school industry linkages; asses the strengths and weaknesses and suggest remedial measures.

The service production centre; Vigyan Ashram at Pabal, Pune is a vocational training institution which work like an industry. The technical services provided include Electronics, Electrical, workshop fabrication, water resource management and rural laboratory amongst others. The production cum training centre is a feasible program for the rural and urban area including smaller villages of less than ten thousand population. This facility complements the existing vocational educational and secondly it facilitates the development of the region. Don Bosco Technical Institution in New Delhi, was established as an alternative to the existing engineering colleges and polytechnics. The institute was initially established to train local Christians for modern industry in mechanics and electrical engineering.

This institute has one of the best training programs on printing. The fundamental of printing which include composing layout, camera, film assembly, plate making and printing and binding takes two years. Upon completion the trainee is given specialized

training in printing, desktop publishing and digital pre-press. This is the only way to meet the demand for graduates by the local industries. In India there are about seventy thousand to eighty thousand printing presses in the country serving enormous population (Singh, 1998).

2.13. TVET TRAINING IN UNITED KINGDOM

Introduction.

TVET is about preparing people for the jobs they will do today and tomorrow, and the careers they embark on for the rest of their working lives. In the United Kingdom (UK), some young people stay in full-time education at school until they are 18 before going on to universities which offers wealth of vocational opportunities ranging from medicine to engineering or architecture to biotechnology. The Britain's dynamic global economy creates a need for lifelong learning. Changing industries demand changing skills. These are catered for in UK TVET through well developed welfare-to-work programmes and excellent opportunities for work-based learning and qualifications.

2.13.1 The United Kingdom TVET Training System

The Government: About the total expenditure on TVET in the United Kingdom (UK) half is spent by the government to support learning for students and state employees. The rest is spent by industry to raise the skills of its staff and by learners themselves. Young people and those who leave school without adequate qualifications are entitled to free training. The colleges receive government funds to provide theory and practical teaching and training towards nationally recognized qualifications. Colleges are responsive to

requests from employers for new or customized courses and training programmes. In many cases, employers determine the shape of the provision – it is demand-led – rather than being tailored to suit the college and its staff.

Providers: Work-based learners are usually employed in companies where they also study, guided by tutors and assessors from the training provider. Major sectors for work-based learning are engineering of all kinds, construction, healthcare and social care. Two innovative new schemes are now adding to the range of private training provision. Both are intended to further strengthen the connection between TVET and the most up-to-date needs of the economy. First is a network of national skills academies, each one related to a major occupational sector, each one recognized and financially supported by the government. Second is a government scheme called Train to Gain, which gives funding directly to employers to help them train their own staff, or commission training for them from training providers or colleges, guided by approved brokers. Brokers or providers establish the overall training needs of the company and then the individual training requirements of each Train to Gain learner. The UK also has a government sponsored national e-learning network called learn-direct which is particularly effective in providing the basic literacy and numeracy skills which underpin TVET, and training in information and communications technology (ICT).

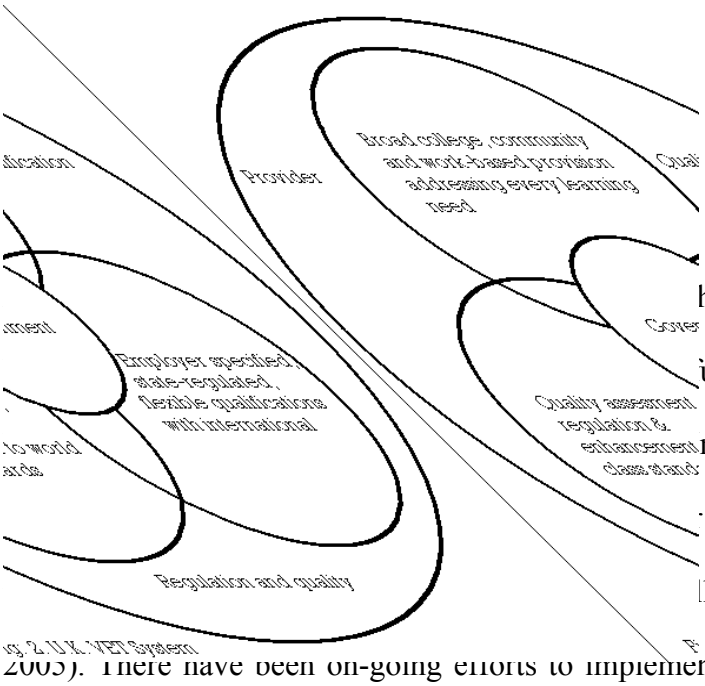
Regulators and quality: British TVET qualifications are organized so that they remain relevant to up-to-date demands for workplace skills. Stringent, government-backed regulators ensure that qualifications match employer-specified occupational standards and that awards are made consistently at the intended level across the UK.

Apprenticeships are particularly well developed in the UK. They offer a paid, on-the-job alternative to the long established national certificates, higher national certificates, diplomas and higher national diplomas of formally taught TVET. British apprenticeships are not time-served but depend on an assessment of competency against the national occupational standards There is a ladder of apprenticeship awards from entry to employment; designed for young people who have left school without any substantial educational qualifications to apprenticeship, advanced apprenticeship and foundation degree. Apprenticeships are also open to older people, some years after they have left school.

Qualifications: While the National Vocational Qualifications (NVQs) are the basis of the apprenticeship system, they can also be achieved as stand-alone qualifications. NVQs are organised in five levels and are available for most occupations. They are structured in free-standing units, which may be achieved over time and at different places.

Assessment: Assessment is based on the demonstration of competency in each task. It is normally carried out at work involving real, everyday activities. Assessors must be qualified to assess and must have relevant occupational qualifications and experience themselves. Learners' prior attainment and experience can be taken into account towards an NVQ. Learners progress at their own pace according to their capabilities and the assessment opportunities offered by their jobs. NVQs, like other TVET awards, are recognized alongside academic qualifications at the same level for progression to higher level study (British Council, 2009); as shown in Figure 4.

U.K TVET System of Training



ht be termed a 'mixed model' in its

uture skill needs. However, the UK

nion (EU) economies over the past

training is the major challenge of

lls Development Agency) (LSDA, 2005). There have been on-going efforts to implement numerous measures to stimulate employer and individual demand for training. Foster (2006) and Learning and Skills Development Agency (LSDA) reviews have signaled a movement away from planning and regulation to a more market based and contestable approach.

2.14. VOCATIONAL TRAINING IN GERMANY

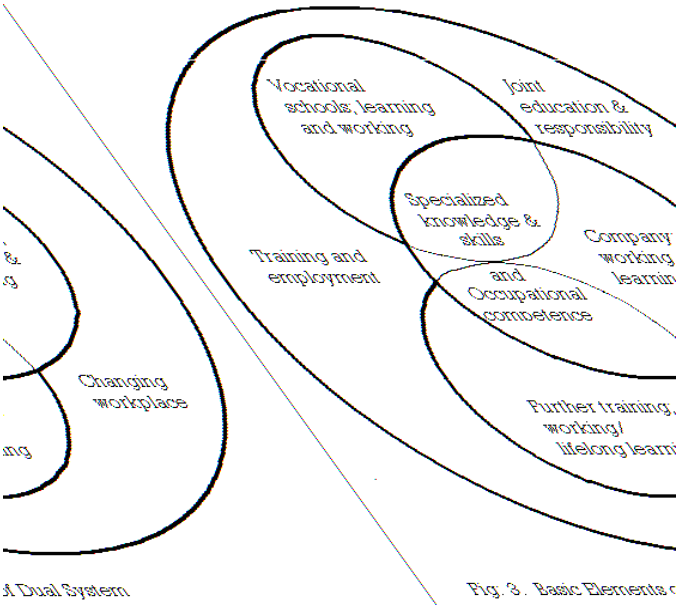
Introduction

The highly skilled labour force is fundamental strength of German industry. The basis for this labour force is provided by an extensive apprenticeship and training system which is second to none throughout the world. Vocational training in Germany is divided into training on the job and theoretical education in vocational training school. This is a double edged system providing apprenticeship for the young people.

2.14.1 Vocational Training in Germany - The Dual System

Vocational training in the Federal Republic of Germany is provided on the job and in vocational training schools. Based on what is referred to as the dual system, practical vocational training is given at work, backed up by theoretical training and general education provided in vocational training schools which are generally attended one or two days a week. The characteristic feature of this system is that the provision of knowledge and skills is linked to the acquisition of the required job experience. This ensures that training will proceed under the same conditions that the trainee will encounter when practicing his chosen occupation. Only on the job will a trainee be able to learn to cope with the constantly changing demands of the job and to appreciate the variety of social relationships that exist in the field of labour. In addition, learning by doing will give a sense of achievement and provide a special source of motivation for the trainee. It promotes independence and a sense of responsibilities, which are indispensable qualities in a developed industrial country; because by tackling concrete tasks under true working conditions the trainee can give evidence of the knowledge and skills he has acquired and can himself experience the success of his efforts. This shows that training on the job is more than just a process of institutionalized and organized learning.

The Dual -System of training.



2.15. VOCATIONAL EDUCATION AND TRAINING IN AUSTRALIA

An Overview.

Australia has a very wide range of learning programs available, including vocational education and training. Programs may be accredited (that is, formal) or unaccredited (non-

formal or informal): formal learning, involving a structured teaching program that leads to a recognized qualification or non-formal learning, involving a structured teaching program that does not lead to a recognized qualification. Vocational Education and Training (VET) in Australia describes education and training arrangements designed to prepare people for work or to improve the knowledge and skills of people already working. Preparation for work can range from gaining basic literacy skills to training for particular tasks. TVET covers education and training both before and during employment. People may undertake Vocational Education and Training throughout their working lives. VET can include craft based training such as that associated with traditional apprenticeships, and industry wide training such as associated with Office Skills or general employment skills.

2.15.1 Type of Vocational Education Programme in Australia

Formal Sectors: Under the Australian Quality Training Framework (AQTF) nationally recognized VET is delivered and assessed by registered training organizations, which must satisfy the quality standards set down in the AQTF as well as the more general laws and regulations that apply to all businesses. In 2007 there were over 4000 registered training organizations in Australia, ranging from very small or specialized businesses with only a few qualifications and units of competency on their scope of registration, to very large public institutions that are registered to assess and certify majority of nationally recognized VET programs. The public institutes of Technical and Further Education (TAFE) (including the VET arms of dual-sector institutions that cover both VET and higher education) comprise the largest single provider sector and obtain the majority of their funding from governments. They also receive the majority of government recurrent funding for VET and constitute the core of the public VET system.

TAFE institutes were originally established to provide the off-the-job training to traditional apprentices but their role has since expanded significantly to cover VET programs of all types and learners of all ages. Each year, about 40% of upper secondary school students undertake recognized VET as part of a senior secondary certificate (known as VET in Schools), including a school-based apprenticeship or traineeship (NCVER 2008b).

Informal Sectors: Australians, particularly older adults, participate extensively in non-formal or informal learning activities. The importance of non-formal (that is, unaccredited) training is also confirmed by employers, with 49% of the respondents to the 2007 Survey of Employers' Use and Views of the VET System indicating that they use unaccredited training. The positive economic return to experience that has been confirmed by research also attests to its importance. The main reasons for using this form of training are to provide skills required for the job or to maintain professional or industry standards (NCVER 2007b).

National Training Packages: The National training packages were developed by industry for industry; indicating the central role of industry in development and its maintenance. The role of industry work and is to drive continuous improvement throughout setting the scope and timing of work and providing wide expert advice throughout the development and validation. The objective in this case is to have a highly responsive training package to changing industry needs. The process for training package review also requires considerable employer involvement in environmental skills scan or 'stock take' and subsequent continuous improvement plan.

Providers: VET is provided in colleges or other training institutions, skill centers found in larger companies and in the workplace. Workplace training can be on-the-job, off-the-job or a combination of these. The role of vet providers; registered training organizations or others is delivery, assessment and certification of accredited vet programs. Training Providers wishing to deliver and assesses nationally recognized vocational training, and issue recognized qualifications must demonstrate its ability to comply with essential registration standards. This includes a requirement for registered organization to gather information the performance against three quality indicators: Employer satisfaction, learner engagement and competency completion. Providers have close relationship with employer or employer bodies and many deliver training to niche industries, subject areas and group of student on full cost recovery basis. VET is supported by State and Territory Governments. The Government directly funds the development of standards, teaching and learning resources for VET. Government also funds the Technical and Further Education Institutes**.**

Training Standards: The authority for VET lies with industry, which sets its own competency standards. Vocational Education and training in Australia is competency-based; it focuses on what is expected of an employee in the work place rather than on learning process, and embodies the ability to transfer and apply skills and knowledge to new situations and environments (Brian & Mlotkowski, 2009). Employers/industrialists are fully involved in the development of national competency standards for the skills that are on demand by their industries. VET is directed towards the needs of the industry and the workplace. Government policies have encouraged competition in the training market. With more private training providers entering the VET market.

2.16. SUMMARY.

In general the forgoing literature has exhaustively reviewed the issues related to the capacity of technical (TVET) institutions in the process of industrial development skills and technology capacity acquisition but falls short of identifying the key elements of the curriculum and the factors affecting the operations of TVET and its effects to the society. The chapter gives TVET in Sub-Saharan Africa, and global perspective of engineering and technology education. The study is not exhaustive as the scope of the research has been limited. Therefore based on the gaps identified through the critical review, this study sought to bridge the gap by assessing the capacity of tertiary technical institution with a view to determining the relevance to the processes of industrial development skills and technology acquisition in the engineering training; an analysis of selected courses in technical training institution in the North Rift Region of Kenya.

CHAPTER THREE:

3.0. RESEARCH DESIGN AND METHODOLOGY

3.1. INTRODUCTION

This chapter describes the research design and methodology that was used in the study. It describes the research design, determination and identification of the population size, sampling design, sampling procedure, the instruments of data collection, validity and reliability of data collected, sources of data, method of data collection and method of data analysis.

3.2. RESEARCH DESIGN

The study investigated the opportunities, the strengths and challenges of engineering training capacity in tertiary training institutions, if integrated with production skills. This study used the qualitative descriptive research and diagnostic design to investigate the capacity of technical institution to support industrial production skills integrated into the training. The Descriptive and Diagnostic is a kind of inquiry aimed at collecting facts and interpreting it so as to suggest remedial measures. The design was suitable to establish the facts and suggest remedial measures or alternative course of actions for the future. Gay, (1981) defines descriptive research as a process of collecting data in order to answer questions concerning the current status of the subject in the study. The research design of the study adopts Gays view as the findings accurately portray the characteristic of the situation. Qualitative descriptive research aims at providing a clear, accurate description of the process or event (Gall, Watter, Joyce, Borg, 2005) .The design enabled the

researcher to established the relationship between the adequate training in principles, practical acquisition of the know how and the availability of adequate workshops and equipment through the intervening variables; dynamic curriculum and well trained and industrially exposed trainers and this relied on objective responses.

3.3. THE AREA OF STUDY.

Technical training institution offers engineering training programs at certificate and diploma levels and this research study was focused on the electrical and electronic engineering Programmes. The study involved five out of six Government Technical and Vocational training institution in the North Rift region of Kenya. The Institutions were purposely selected because they offer the selected program and were located in both rural and urban set up. The Institutions involved were Rift Valley Technical Training Institute-Eldoret, Rift Valley Institute of Science and Technology-Nakuru, Kitale Technical Training Institute, O'Lessos Technical Training Institute and Eldoret Polytechnic. The respondents were trainers and administrators in the five technical training institutions. The respondents were asked to identify the strengths and challenges, and make recommendation on the integration of production skill in the training process.

3.4. THE TARGET POPULATION

The target respondent in this study comprised of trainers and administrators in tertiary technical training institutions offering electrical engineering. A target population of sixty two trainers and twelve administrators in Electrical and Electronic Department were targeted to respond to the questionnaires. This population was targeted because they were knowledgeable in the field of study in the identified institution. Forty three of the targeted

population fully responded, giving approximately sixty five percent. The purposely selected Institution was limited to five Technical Training Institutions available in the region. This enabled the researcher to keep closely in touch with the participants in order to validate the collection of data. The data in table 1 shows the target population and the number of responses from the various institutions. The tabulated data indicates that more than fifty percent of the trainers in tertiary institutions were in their areas of specialization and the remaining handled supporting fields of study such as soft skills.

Sample size

The purposely selected institution where target population came from is listed in this section. The institutions are situated in the north rift region of Rift valley of Kenya.

Table 1: Sample Size.

Respondents	Target pop.	responses	Percentage Ratio
Eldoret Polytechnic	10	5	50
O'Lessos T.T.I	6	4	66.7
Kitale T.T.I	12	6	50
Rift Valley T.T.I-Eldoret	10	5	50
Rift Valley I.S.T, Nakuru	28	13	46
Total	66	43	65

3.5. SAMPLING PROCEDURES

Introduction

Sampling is a process of obtaining information about an entire population by examining only a part of the population. Sampling study saves time and money, and produces results at a relatively faster speed (Kothari, 2005). The purposely selected respondents consisted of qualified trainers and administrators involved directly or indirectly in the training.

3.5.1. Sampling Size and Strategy.

Sampling is a procedure of selecting a part of a population on which the research can be conducted, which ensures that conclusions from the study can be generalized. The sampling strategy was to select all the Technical Training Institutions offering Electrical Engineering at the same levels of training; in the same region; North Rift. The purposely sampling strategy was used to select the institutions. This was to allow the researcher's operational base at close proximity to permit frequent trips to the institutions to collect validated responses. The participants were also purposively selected typically from the administrative and training staff in the electrical and electronic engineering department. This technique allowed the researcher to use the cases that had the required information with respect to the objective of the study (Mugenda & Mugenda, 1999).

3.6. DATA COLLECTION INSTRUMENTS

Data collection instrument refers to the tools to be used for collecting data and how the tools will be developed. This section dealt with the instruments of data collection, the

validity and the development of reliable tools, and the procedure of data collection. This section also discusses the variables of measurement.

3.6.1. Questionnaire

This study employed questionnaires for data collection. The questionnaire was designed by the researcher to seek information from the trainers only. This methodology of collecting data ensured anonymity of respondent and it offered an appropriate opportunity for them to feel free to express their views regarding the training system and their shortfalls. The tool was convenient for fast collection of data. Questionnaires were best because it not only ensured anonymity of respondents but provided more scope for reliable responses. The questionnaires were used to seek responses on: whether technical training institutions effectively equips trainees for the world of work and to established the strengths and weaknesses of the resources in technical training institutions to enhance the integration of practical industrial production skills with the training. The instrument was also used to investigate the gains and benefits of sandwich industrial placement in engineering training. The questionnaires were used since the study targeted literate respondents and the information required could be described easily.

3.6.2. Development of research instrument

The construction of the questionnaire was based on the critical resources needed for technical training institution to deliver quality education and training. The capacity was measured in terms of the physical capacity; space and the equipment available. The human resource capacity was assessed in terms of the quality of trainers and the technical support staff and the capacity of the administrative personnel (Kenny & Foster,

1986).The Structured questionnaires were used to collect data from the trainers, administrators and technicians whereas the unstructured parts were used to collect the views and opinions of the participants on the specific issues presented.

3.6.3. Validity of research instruments

A test is said to be valid if it measures what it is designed to do (Kothari, 2005). The validity test measure answers the question - are the findings true? The validity of test instrument used in this study was assured by experienced research specialist, and knowledgeable supervisors in the Department of Technology education of Moi University. These researchers identified for corrections the varied omissions and ambiguity that were likely to be encountered during data collection and analysis. The closed and open ended questions were constructed in simple, clear and attractively worded to increase validity. The questions chosen for the study adequately represented the domain of interest (Kenny & Foster, 1986) and thus the content-related validation was observed

3.6.4. Reliability of research instrument

A test is reliable if it is to the degree that is free of measurements errors (Gall et al, (2005). The pilot study was carried out using fifteen respondent randomly selected from Mombassa Polytechnic college and Mombassa Technical Training institute in the Departments of Electrical and instrumentation. The instruments were then revised to enhance its reliability. The questionnaire was revised using item response theory and the ambiguous and the omission were rectified. Item response theory assumes that individuals with different amounts of ability/experience will perform differently thus the

instruments must be tuned to accommodate all the abilities. Pre-testing of questionnaires in the field was used as a means of improving the quality of questions before the main study. The structured/control questions were included in the questionnaire to indicate the reliability of the respondent (Kothari, 2005).

3.6.5. Variables

The capacity of training institutions to deliver the training was measured in terms of the physical capacity which entails training equipment and the adequacy of workshops and laboratories available. The assessment was also measured in terms of skilled trainers. The curriculum was measured in terms of the nature of skills; generic skills, industrial production skills, and the emerging practical concepts of integrating computer information technology in designs and production, The integration of production skills in the training was measured in terms the similarity of equipment to those in industry and the extent of exposure to adequate practical skills leading to the development of problem solving skills for sustainable development. The sandwich industrial placement for work based learning measured the transition correlation to future work engagement.

3.7. DATA COLLECTION PROCEDURES

The researcher collected the data between the months of August ‘08 and February 2009, from the targeted population/respondents after receiving permission from Moi University authority to carry out the research in the identified area of study and the ministry of higher education, science and technology. The researcher visited the Institutions two weeks earlier and informed the respondents about the research study. An introductory letter stating purpose of the research was attached to the questionnaires at the time of

distribution. The researcher in collaboration with institution authority identified and requested trainers in each of the technical and vocational training institution to assist in the distribution and collection of the questionnaires from their colleagues. The researcher distributed the questionnaires to all the selected participants for them to voluntarily supply the solicited data. The researcher personally worked closely with the trainers who assisted in distribution and collection in order to ensure the reliability.

3.7.1. Ethical Considerations

The researcher was bound to search for data relevant to the study from the respondent and without undue pressure on them. The identity of the respondents was kept out of this documentation and the data availed to the researcher was used for the purpose of this study. The findings of the study will not be published without the express authority of the author or Moi University. The researcher carried out the research study with full consent of the authorities and any data collected was treated with the confidentiality it deserved. The major ethical issues of concern were informed consent so as to remove job insecurity, privacy and confidentiality on information supplied, anonymity to safeguard the identity of the respondents and researcher's sensitivity to human dignity (Oso & Onen, 2005).

3.7.2. Data Analysis

The questionnaires were checked for completeness and consistency of information at the end of every field data collection day. Data was captured using Microsoft excel software. The data was coded and entered into the computer using Statistical Package for Social Sciences (SPSS). The data was presented in form of tabulation, percentages, bar graphs

and pie charts to facilitate easy description of data. Both descriptive and inferential statistics was employed to analyze the data. Inferential statistics assisted the researcher to make inferences about a population based on the descriptive statistics that are calculated on data from a sample that represents the population (Gall et al, 2005). The non parametric statistic Chi- square was used to test statistical significance of the results. The data was coded and entered in to the computer and analyzed using statistical package for social science program (SPSS). The value of chi-square calculated was tested within the 0.05 level of significance testing. These techniques enabled the researcher to make conclusions about the association between respondents' opinions and the variables. The presentation, analysis and discussion of the findings are presented in chapters that follow.

3.8. SUMMARY

This chapter on research methodology describes research designs through validation of the instruments, data collection procedures and analysis. The questionnaire was validated by pre-testing in Mombasa; at Institution with equivalent status. The instrument consisted of thirty structured and non structured items. An open item 'others (specify)' at the end of a major sections of facet questions invited respondents to express concern or opinion. The capacity of the technical training institution was measured in terms of the availability and sufficiency of workshops, laboratories and library, and facilities in the Institutions. On human resource the measurement was on their capacity to relate training with industrial experiences, as a link between the world of work and curriculum based tasks. The sandwich industrial placements were investigated on the benefit towards the success of training. The analytic methodology identified is descriptive statistic and non parametric technique.

CHAPTER FOUR:

4.0. DATA PRESENTATION, ANALYSIS AND INTERPRETATION.

4.1. INTRODUCTION

This chapter reports data presentation and empirical analysis of the findings of the study.

The data obtained was analyzed in tandem with research questions and objectives to:

i). Establish the opportunities/resource capacity available in Engineering Training Institutions for the integration of practical industrial production skills.

ii). Determine the resource capacity levels/strength of the Engineering Training Institutions to integrate practical industrial production skills.

iii). Investigate challenges of integrating practical industrial production skills effectively in engineering training at Technical Training Institute.

iv). Investigate whether Technical Training System is effectively responsive to industry skill demand for national development leading to industrialization.

v).Determine the benefits/gains of industrial attachment for appropriate acquisition of technical skills.

The data was presented in tabular form; organized in a frequency distribution and analyzed using descriptive statistics and cross tabulated in order to identify and examine the responses in terms of space and equipment, and human resource capacity. A section

of the data on education qualifications was presented in a pie chart diagram which is extremely easy to understand. The data on the capacity of resources and course specialization were also presented by the use of bar charts which clearly illustrates relative measures.

To answer these questions, the data presentation and analysis adopted the following format.

i). background information of the respondent and the analysis of human resource capacity.

ii). training infrastructure and materials provisions.

iii). curriculum analysis and relevancy of the training.

iv). challenges and strategies of improving technical trainings.

v). the capacity of Industrial Attachment Placement.

iv). Summary of the findings.

4.2. ANALYSIS OF DATA ON BACKGROUND INFORMATION

The data collected on the background information covered gender, age, education qualification and teaching experiences of the respondents. The respondents' ages were grouped into five categories whereas trainers teaching experiences in year's service were grouped into six sets. The data was analyzed to establish the capacity of human capital.

The raw data presented in Table 2 indicates the age brackets, academic qualification and experience in teaching and training frequencies.

Table 2: Presentation of Background Information Data

Characteristic	Frequency response(f)	Percentages
Gender		
Male	37	86.0
Female	6	14.0
Age	(f)	%
Below 20	1	2.3
20-29	6	14.0
30-39	11	25.6
40-49	18	41.9
50-59	7	16.3
Education Qualification	(f)	%
Diploma	13	30.0
Higher National Diploma	9	21.0
Degree	16	37.0
Masters	5	12.0
Doctorate degree	0	0
Teaching Experience	Frequency response	%
0-5	9	20.9
5-10	8	18.6
10-15	6	14.0
15-20	10	23.3
20-25	6	14.0
Above 25	4	9.3

N=43

Table 2 presented frequency and percentage of respondents grouped according to gender, educational qualification and teaching experience. Out of sixty two purposely sampled trainers forty three were able to adequately respond to the questionnaires, which represented a response of sixty nine percent. Six respondents represented females which translate to fourteen percent.

The data presented in Table 2 showed that most of the respondents 16(37.21%) had degree qualification while 13(30%) had Diploma Qualification, 9(21%) higher Diploma and 5(12%) had Masters' degree qualifications. The set of trainers' aged between 30 and 49 years were 33(80%). There was one respondent under 20 years of age with Higher diploma. The respondent between the ages of 30 and 49 years old were 29(67.44%).

Figure 4 illustrates the proportion of respondent with Diploma, Higher Diploma, Degree, and Masters Degree Qualifications. The highest population of the respondents had degree (37%) followed with those with diploma qualification (30%). Large proportion of trainers had first degree thus the ratio of masters' degree holders and those with diploma qualification is 2:5 meaning for every trainer with masters degree there were five with diploma. The ratio of personnel with Masters to Degree holders to Higher Diploma

holders to Diploma Qualifications were equivalent to 1 to 3 to 2 to 3 respectively.

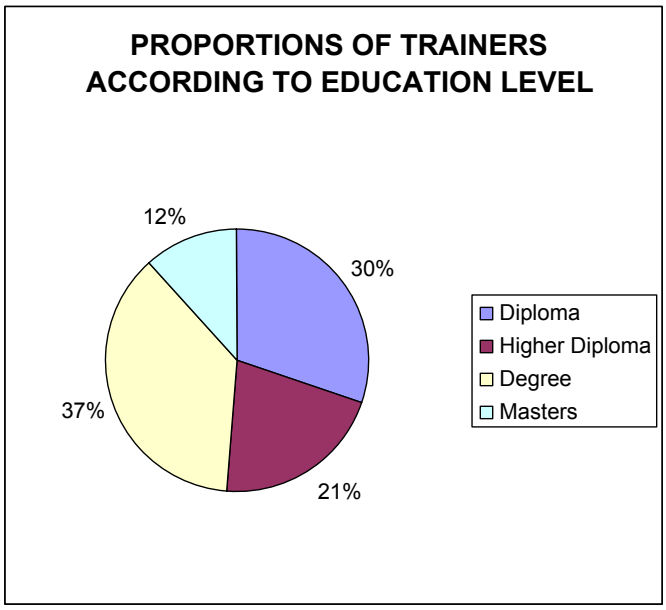


Figure 4. The proportions of respondent's qualifications

4.2.1. Cross Tabulation of Age, Qualification and Teaching Experience Analysis

The cross tabulation of age, education qualification and teaching experience is shown in Table 3. It shows the distribution of the human resource relative to the age, educational

background and the years they have been in the service. This data may be useful in studying the trends of human capital development in the recent years and in projections of human resource capacity for the future, the capacity of human resource. This data provided analysis sufficient to draw conclusion on the rate at which the trainers join the service and the rate of leaving.

Cross tabulation of the three characteristics in the table revealed that the respondent with experience of between 15 and 20 years were 10(23.23%) and out of which 6(46.2%) had Diploma qualifications and 2(6.3%) had degree certificate and both groups within the age bracket of 40-49 years. In the same category of experience 3(60%) had Masters Qualification and were above 39 years of age. The respondent with teaching experience above 25 years were 4(12%); 2(6%) with Higher National Diploma and one each (3%) with Degree and Masters Qualifications.

The study also indicated that the respondents with ages between 40 and 49 years were 18(41.86%) and out of which 10(76.9%) had Diploma, 3(33.3%) Higher Diploma, 2(12.5%) Degree and 3(60%) had Masters Qualifications. The respondents in this age bracket and had experience of 15 to 20 years in the teaching and training service. The respondents with experience of over 25 years in teaching profession were 4(9.3%) out of 43 lecturers and they were between 50 and 59 years of age.

Cross tabulation of age and education revealed that the highest holders of diploma 10(79.6 %) were between 40 & 49 years , Degree 9(56.3%), were between 30 &39 years higher diploma 3(33.3 %) were between 40 &49 and the same numbers for the age set of 30&39 years, and those with masters 6(60.0%) were between 40 &49 years. Most of

the degree holders 6(37.5%) had been teaching for five to ten years. Three out of five master's degree holders had worked in the profession for fifteen to twenty years. The cross tabulation revealed that trainers with Diploma qualification were thirteen in total and 10 (76.9 %) aged (40-49) years with 6(46.2%) of them having had experience of 15 to 20 years. The respondents holding diploma qualification and with experience of 10-15 years were 4(30.8%). A total of thirteen trainers out of fourteen with Diploma Qualification holder had over fifteen years experience which accounts for a good percentage of their life time in the same academic grade. This may contributes to low morale and demoralizing situation also signifying lack of academic progression. There was no respondent in the level of Diploma education with an experience of over twenty five years.

There were nine trainers with Higher National Diploma qualification, out of which 3(33.3%) aged between 20 and 29 years, and had experience of less than five years, and 5(55.5%) were over 40 years. The tabulation also revealed that 4(44.4%) were over 50 years of age while 3(33.3%) were over 40 years old but less than 49 years. The trainers with experience of less than five years were 4(44.4%). In the category of higher Diploma there was no trainer within the experience bracket of 10 to 20 meaning they were either young in the profession or old.

Table 3: Cross tabulation of age, experience and education data

EDUCATION				EXPERIENCE						Total
				0-5	5-10	10-15	15-20	20-25	ABOVE 25	
DIPLOMA	AGE	30-39	Count			1				1
			%			7.7%				7.7%
		40-49	Count		1	2	6	1		10
			%		7.7%	15.4%	46.2%	7.7%		76.9%
		50-59	Count			1		1		2
			%			7.7%		7.7%		15.4%
	Total		Count		1	4	6	2		13
			%		7.7%	30.8%	46.2%	15.4%		100.0%
HND	AGE	<20	Count	1						1
			%	11.1%						11.1%
		20-29	Count	3						3
			%	33.3%						33.3%
		40-49	Count		1			2		3
			%		11.1%			22.2%		33.3%
		50-59	Count						2	2
			%						22.2%	22.2%
	Total		Count	4	1			2	2	9
			%	44.4%	11.1%			22.2%	22.2%	100.0%
DEGREE	AGE	20-29	Count	3						3
			%	18.8%						18.8%
		30-39	Count	2	6	1				9
			%	12.5%	37.5%	6.3%				56.3%
		40-49	Count			1	1			2
			%			6.3%	6.3%			12.5%
		50-59	Count					1	1	2
			%					6.3%	6.3%	12.5%
	Total		Count	5	6	2	1	1	1	16

			%	31.3%	37.5%	12.5%	6.3%	6.3%	6.3%	100.0%
MASTERS	AGE	30-39	Count				1			1
			%				20.0%			20.0%
		40-49	Count				2	1		3
			%				40.0%	20.0%		60.0%
		50-59	Count						1	1
			%						20.0%	20.0%
	Total		Count				3	1	1	5
			%				60.0%	20.0%	20.0%	100.0%

AGE * EXPERIENCE * EDUCATION Cross-tabulation

The cross tabulation of trainers with Degree qualification were distributed in all the age and experience brackets. The highest number had experience of between 5 and 10, and aged within the bracket (30-39) years , and in the same age bracket the trainers were 9(56.3%) had experience of less than 15. The trainers who had master's degrees were five with long experience of above fifteen years. This implied that none had qualified with masters in the teaching or none had joined the training sector in a period of fifteen years. The technical training was not offering opportunities for further training or the sector was no attracting highly qualified staff. There is need to carry out further research to establish and explain the phenomenon.

4.3. TRAINERS LEVEL OF EDUCATION IN RELATIVE TO TRADE AREAS

This section examined the trainer's areas of specialization and the distribution of their level of education so as to ascertain their level of competency and the trend of opportunities for advancement. Table 4 shows that the highest number of respondent 15(34.88%) specialized in General Electrical Engineering and 5(11.62%) had Diploma and 10(23.26%) had Degree qualifications. The respondents who had specialized in

micro-processor were 2(4.64%). Trainers with Masters' degree certificate and who had specialized in electrical engineering power option were 1(2.32%), electronic engineering (specialist in industrial electronics) 2(4.64%) and micro-processor were 2(4.64%).

Table 4: The level of Education vs Trade area.

COURSE	Diploma	Higher Diploma	Degree	Masters	Total
Electrical Eng(General)	5(11.62%)	0	10(23.20)	0	15(34.9%
Electrical power option	3(6.97%)	4/9.30%	0	1(2.33%)	8(18.60%)
Electronics industrial option	3(6.97%)	3(6.97%)	4/9.30%	2(4.64%)	12(27.91%
Telecommunication option	1(2.32%)	1(2.32%)	2(4.64%)	0	4(9.30%)
Electronics microprocessors	0	0	0	2(4.64%)	2(4.64%)
Instrumentation and control	1(2.33%)	1(2.33%)	0	0	0
Total	13(30.23%	9/20.9	16/37.2%	5(11.62%)	43(100%)

4.3.1. Representation of the level of education cum area of specialization

Figure 5 shows the bar charts on the areas of specialization against the qualifications namely Diploma, Higher Diploma and Masters Degree. The respondent had specialized

either in Electrical power, General Electrical-Electronic, Telecommunication, control, Industrial, Electronic or microprocessor Engineering.

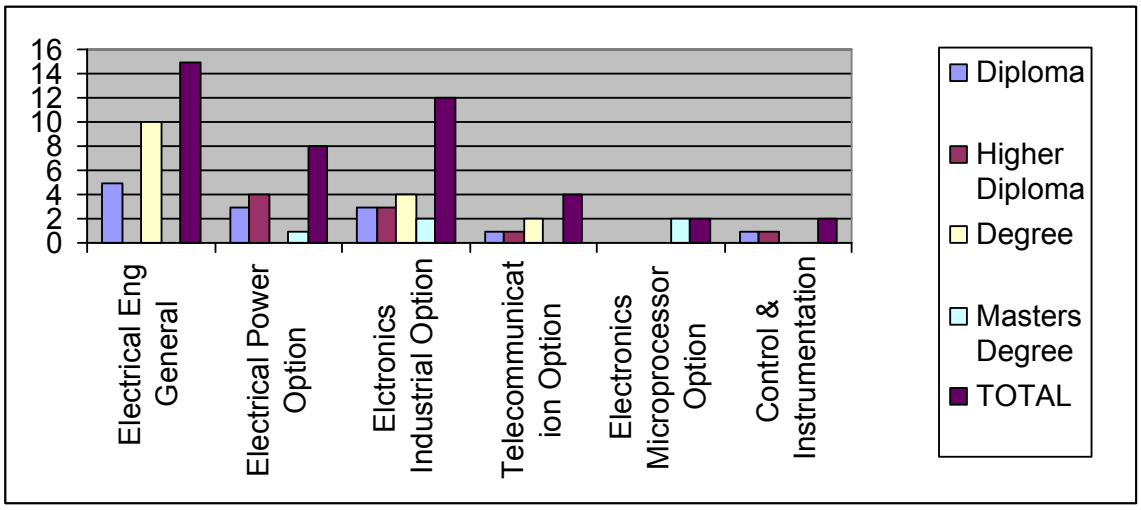


Fig 5: Respondent course specialization against academic qualification

Figure 5 shows the bar charts, a presentation of the level of education against trainers areas of specialization. The findings from the study showed that Electrical Engineering

(General) had the highest number of respondents, followed by Industrial Electronic specialist. Electronic engineering, Telecommunication engineering option, and Instrumentation and Control had trainers to the level of degree qualification only. The rest of the areas had respondents with Masters' level degrees except the general course of electrical-electronics. Apparently, this was a clear indication that technical education has progression pathways to higher education; not a dead end to itself.

The academic low status of the trainers lowers the aspiration of the trainees to pursue further, the trades they have chosen as it is believed to an extent, to be so in some technical training institutions (Claudio de Moura, 2008). Engineering education should be enriched and broaden so that those technically grounded graduates will be prepared to work and academically advance in a constantly changing global economy. Technical training sector does not attract highly qualified staff. This could be due to the low status of the sector, remuneration, the high cost of training or lack of opportunities for further studies. The low academically status of the trainers limits or narrows the context of enhancing the status of the engineering profession and the public understanding of engineering. Due to the continuously changing technology and the process of production the trainers must be in-serviced from time to time in order to cope with the situation.

The failure of any system to respond to demanding situations amounts to deskilling status. The trend to simplify the use of equipment in training results in deskilling of the trainers because the technology reduces the need for much of the mental and physical work needed to conduct daily work as reported by Bartel and Lichtenberg (1987).

4.4. DETERMINING THE CRITERIA OF ENGAGINGTHE TECHNICAL SUPPORT STAFF.

It was paramount to seek this information to find out the criteria for determining the technicians and the number of workshops. This section presents the possible options of determining the size of the support technical staff. The responses were tabulated in frequency tabulation as shown in Table 5.

Table 5. Responses on Criteria for determining the number of technicians'

Criteria	Frequency	Percentage	C/Percentage
Number of workshops/Laboratories	21	50	50
Number of classes	6	14.3	64.3
Diversity of programs	15	35.7	100
Number of practical sessions	0	0	0
Ratio of Academic Trainers to Technicians	0	0	0

N=42

It was established from the study that 50% identified number of workshops/laboratories as a criteria for determining the number of technicians, 14-3% indicated number of classes criteria while 15(35.7%) mentioned the number of practical sessions and academic programs criteria while no respondents mentioned practical sessions and academic trainers-technician ratio. The rest of the options; number of practical sessions or the ratio of academic staff to Technicians received no responses.

The findings showed that the number of technician was determined by number of workshops 21(50%). The results of the study that half the respondent identified other criteria's contrary to those who identified the number of workshop criteria are an indication that there was no clear policy in use for determining the same. The contribution of technicians seems not to have been given the attention it deserves. Technicians are the immediate source of trainees' aspirations and a model of scientific knowledge translation to productive practical kills.

4.5. THE GENERAL STATUS OF THE WORKSHOPS AND LABORATORIES

It was necessary to seek this information on the general status of the workshops and laboratories so as to ascertain the resource capacity for engineering training in technical and vocational training institutions in Kenya.

4.5.1 The Status of Workshops as Evaluated by the Respondents

This section listed the status of the workshops and laboratories based on the size, the utility, the nature of equipment and how equipped they are, and the number of responses assigned to each. The data collected is shown in Table 6.

A cross tabulation of the status of the workshops and the similarities of the equipment with those in industries indicated that 18(41.86%) of the respondents indicated that the workshops were equipped with old and unserviceable equipment not similar to those in industries. However 23.26% of the respondents showed that the workshops were spacious but have been equipped with furniture for theoretical classes. The respondents who said the equipment in the workshop were similar to those in industries were 2(4.65%).

Table 6: **The assessment of the status of workshop**

Status of the workshop/laboratories	**Frequency**	**Percentages**
Well equipped with adequate equipment	0	0
Spacious workshop without equipment	10	23.26
Equipped with modern training equipment	0	0
Equipped with furniture for theoretical classes	13	30.23
Equipped with machines/equipment	0	0
Suitable for industrial Practices & services	2	4.65
Equipped with adequate and unserviceable equipment	18	41.86

Total	43	100

The results indicated that the workshops lacked modern training equipment and the workshop space had been utilized as lecture halls. Therefore the ability of TVET to transfer technological skills from skillful personnel to the trainee learners was minimal. It is highly critical to ensure that what TVET institutions were teaching and training coincides with the needs and opportunities in the labour market (Fluitman, et al, 1999). The link between training institutions, practical industrial skills and the industrial needs of this country were disconnected resulting on non strategic objectives towards industrialization.

4.5.2. The General Utility of the Workshops and Laboratories

It was considered important to establish the common of uses the workshops for practical purposes as it determines the effectiveness of skill development and competency in practical performance during and after training. This section of the study assessed the daily general use of the workshops. The workshop uses ranged from being utilized for practical, theoretical classes, hire, maintenance, and for production of goods and services. The result in this case reflected the emphasis of the training as based on the purpose use of the facility. The establishment of the workshop and laboratory was for skill transfer and development. The responses are shown in table 7**.**

Table 7: General utility of the workshops

Workshop utility	Frequency	Percentage
Idle when there are no workshop practice	5	11.63
As instructional rooms	29	67.44
For industrial production of goods and services	3	6.98
Maintenance, repairs and services (as plant maintenance site)	4	9.30
Hired out to other institutions for training	2	4.65

Apparently majority of the respondents 29(67.44%) indicated that the workshops were used as lecture halls when not in use for practical training. This may also be interpreted that there was a shortage of classrooms or lack of workshop/laboratories facilities but the space was available. Cross tabulation of the status of the workshops and the formal level of education of the trainers training showed that 21(48.84%) of the respondent indicated that the workshops were equipped with old and unserviceable equipment which are not even similar to what is used in industries. Amongst the trainers who responded in support of the opinion that the workshops were equipped with obsolete equipment not equivalent to what industries uses were distributed as; 29(66.67%) had first degree qualifications, 8(19.05%) with masters degree and 6(14.29%) with Diploma qualifications. Seven out of nine trainers with Higher Diploma indicated that the workshops were without useful equipment. This revealed that the level of competency varies according to the nature of training and qualification levels. The study revealed that the workshops were not equipped sufficiently to prepare the trainees for the current technologically changing industries faced with competitive processing procedures. An industry only engages technicians or skillful personnel who add value to their processing activities in order to cope with competition. The workshops were then not serving the intended purpose, hence

contributing to staff low morale and rendering training personnel incapacitated in practical training. The modern and relevant Training equipment is the underpinning facilities in skillful technical training.

4.6. DETERMINING THE NATURE OF SKILL IN THE CURRICULUM

It was paramount to seek this information to find out the extent to which the curriculum of the technical training adequately prepared student for their subsequent job responsibilities. The respondents were asked to asses the nature of skills in the curriculum and the responses are shown in table 8. The curriculum was analyzed by dissecting and identifying the nature of the skills and classified as generic, basic skills or production skills.

Table 8: Respondents' response on the skills in the curriculum

Nature of Skills in the Curriculum	Frequency	Percentages
Generic skills	5	11
Principles of equipment operations	3	6.97
Practical Industrial production skills	9	20.93
Skills to demonstrate Electrical/electronic principles	26	60.47

The response of 26(60.47%) trainers was of the opinion that the curriculum content covered the fundamental principles of the trade and 9(20.93%) considered the curriculum

to have practical industrial production skills. This implied that most respondents were dissatisfied with the curriculum content of engineering training in technical and vocational institutions. The trainees were not receiving elaborate skills essential to create critical focus on productive thinking and innovative brains for industrialization. Therefore technical training institutions had insufficient capacity to prepare the trainees for the world of work as they lacked sufficient and adequate training equipment

4.7. ASSESSING RESOURCE CAPACITY FOR ENGINEERING TRAINING

The respondents were asked to asses and rate the institution resource capacity in terms of its availability and adequacy in general. This information was necessary to identify the resources which were seriously in short supply and comparatively to what extent. The results are shown in Table 9. The respondent rated the laboratory facilities 36(83.72%), workshop equipment 33(76.73%), adequacy of lecture halls 27(62.79%), funding 28(65.12%) and library facilities 29(67.39%) as poor. This implied that the available equipment was either obsolete or non-functional and funds were not available for the purchase of new equipment. However, the majority (76.69%) rated the availability of teaching staff from good to excellent.

The availability of technical support 26(60.4%) was also similarly rated good and the adequacy of classrooms 16(37.15%) as poor. The result on inadequacy of classes explains why institutions had resorted to the use of workshops as classrooms. However, 12(28.2%) of the respondents thought that the equipment was good otherwise the majority rated poor. The technical support was rated adequate and this could be so as the

number of workshops was limited and the criteria of hiring technician was based on the number of workshops and found out in the section on the size of the technical support.

Further analysis using spearman rank correlation shown in Appendix 4 indicated that the correlation was significant for most of the resources at the level of 0.05. The training capacity to effectively prepare trainees for the world of work was deficient and it was the opinion of the respondent that the resources be improved.

Table 9: The ratings of the resources

RESOURCE CAPACITY	**RATINGS**					
	Excellent	**Very Good**	**Good**	**Fair**	**Poor**	**Very poor**
Teaching materials	0	2 (4.6%)	10 (22.2%)	18 (40.7%)	12 (27.8%)	1 (3.7%)
Laboratory facilities	0	1 (2.3%)	6 (13.95%)	15 (34.88%)	17 (39.53%)	4 (9.3%)

Workshop Equipment	0	2 (5.6%)	10 (23.2%)	16 (37.2%)	11 (25.58%)	6 (13.95%)
Library facilities	1 (2.32%)	4 (9.3%)	9 (20.9%)	19 (44.19%)	8 (18.6%)	2 (4.6%)
Adequacy of trainers	5 (11.63%)	10 (23.2%)	18 (41.86%)	6 (13.95%)	4 (9.3%)	2 (4.6%)
Technical support staff	2 (4.65%)	10 (23.2%)	14 (32.56%)	12 (27.9%)	4 (9.3%)	1 (2.3%)
Adequacy of lecture rooms	0	6 (13.95%)	10 (23.2%)	20 (46.51%)	4 (9.3)	3 (6.98%)
Adequacy of funding	2 (4.6%)	3 (6.98%)	10 (23.2%)	21 (48.84%)	7 (16.28%)	0

N=43

This revealed that in order to achieve satisfactory level of training, the training material supply rated as must be enhanced. In order to achieve training capacity requirements, the laboratory resource should be modestly increased; the adequacy of laboratories directly contributes to the institution having the capacity to effectively provide quality training.

The respondents rated workshop equipment as poor implying that there is insufficiency of training equipment, and that in order to achieve capacity level needs, the workshops should be increased by a very high degree. The respondent view that the library resources

are insufficient and that it is improvement directly enhance the provision of quality training. The adequacy of trainers was rated good which means the number of trainers was reasonably sufficient.

4.7.1. Ranking the Adequacy Capacity of Resources.

The resources were ranked according to its adequacy. The resource with highest bar is indicative of relatively adequate.

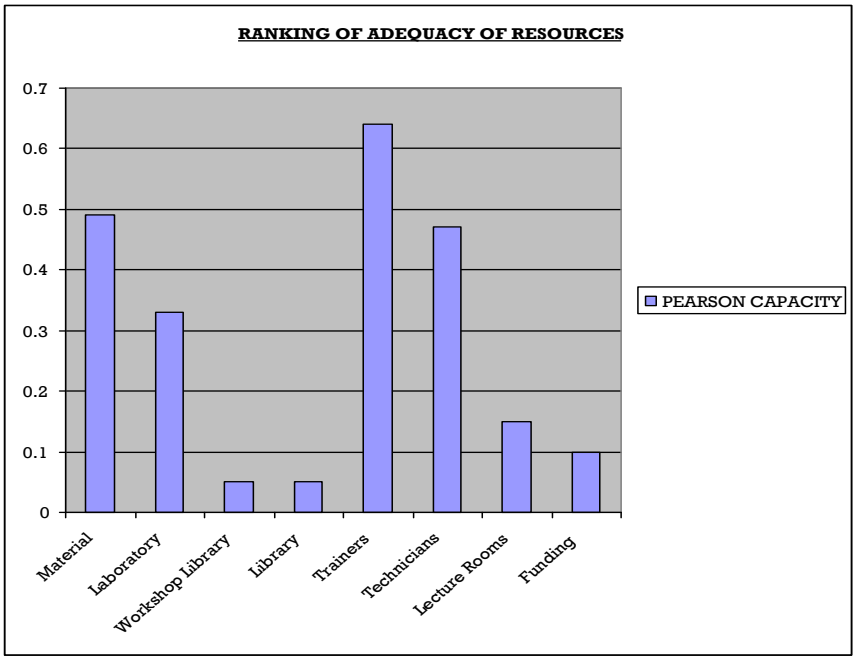


Fig 6: Bar chart showing measures of adequacy.

Figure 6.shows the training resources against the scale of adequacy as evaluated by the trainers. The bar chart suggested that though none of the resources was adequate that is the Pearson correlation was not equal to 1.The numbers of trainers were relatively adequate while the libraries and workshops were inadequate. The Pearson correlation which is closer to +1, shows resources approaching adequacy but, the chart shows that the number of trainers, technical support staff and training materials were relatively sufficient but laboratories, workshops, library services, lecture rooms and funding were quite insufficient. The resources required for effective and quality training were generally insufficient. The workshops, library, laboratories, lecture rooms and funding were insufficient and therefore ways and means of improvement was essentially required. This was in line with a view that public TVET institutions do not have the necessary resources for effective and quality training, maintenance, updating and modernization (Farstad, 2009).

The findings indicated that the resources are not enough to support quality technical training. It was therefore necessary to consider mobilizing the resources and began re-vamping them on equal footing in order to improve the quality of training if vision 2030 blue print was to be stimulated. Lauglo (2005) stated that: “In the absence of minimally adequate workshops, equipment, consumables, and trained teachers vocational subjects easily degenerate into being taught ‘theoretically’ with inadequate attention to practical skills learning”. To effectively teach TVET in schools, proper workshops, laboratories, equipment, and learning resources (including stationery, raw materials, textbooks and

teaching aids) must be provided. Governments must secure funding and technical assistance from industries and donor agencies to supplement their own funding. As TVET was seen as the master key to the achievement of vision 203*0*, finance must be allocated accordingly.

Therefore the factors training materials, laboratory facilities, workshop equipment, library facilities, adequate number of trainers and funding determines to a large extent the effective transfer of technical skills. The lecture room and the support staff create an enabling environment. The pre-requisite for good engineering training involves adequate provision of practical exposure, through provision of training equipment, highly qualified staff, excellent library services and adequate training in engineering principles, concepts and design (Zymelman, 1993).

4.8. THE RELEVANCE OF ENGINEERING TRAINING TO THE MARKET

The trainers were asked to asses the various aspects of training to ascertain engineering training has adapt to pressures of changing technology through industrial linkages and disseminating the acquired knowledge and skills by the design of short term trainings. The responses were recorded in Table 10. The preparation of trainees for the world of work is not complete with provision of resources and putting into consideration other aspect of training. This section considers the similarity of equipment to what is found in industry, the preparedness of trainers, the exposure of both trainees and trainers, and the participation of industries in training.

Table 10: Evaluation of different aspect of training.

CHARACTERISTICS	Responses			
	Yes		No	
	Freq	(%)	Freq	(%)
Similarities of Equipment to those in industry?	18	41.86	25	58.13
Are Trainees exposed to skills which prepare them for Occupational activities?	19	44.19	24	55.81
Is there Need to integrate commercial & industry based skills in the training program?	19	44.19	24	55.81
Adequacy of skills in the curriculum appropriate to	13	30.23	30	69.77

the industrial Needs?

Is Industry Involved of in training through industry based part Time trainers?	17	39.53	26	60.47
Do your Institution offer short term industry based courses?	8	18.6	35	81.40
Are the practical skills taught meeting the industrial needs of the Country?	13	30.23	30	69.77
Ever attended any specialized skills development Training (Workshop or seminar)?	10	24	33	76

The study revealed that the technical trainings institutions do not have short term tailor made in -service courses to offer to tradesmen in the informal sector 35(81.40%). This may be interpreted as training institution do not have the capacity to develop one, or less willing to offer training to small business owners; to re-engineer industrialization due to the cost of organizing and customizing the training (Kitching & Blackburn 2002). The respondent 30(69.77%) assessed the practical skills being taught as short of the Industrial needs of the country. This item was used to show the respondents effective reactions to the level and direction of training towards practical and economical occupational activities leading to industrialization.

The study showed 33(76%) of the trainers had never attended any in service or skill re-tooling workshop/seminar since they graduated after formal training. The respondents were asked to assess the adequacy and the appropriateness of the training to the industrial needs. The results indicated that 30(69.77%) of the respondent responded that the training does not prepare the trainees to the world of work. This was in line with other researchers who have described the higher technical education system in Africa as irrelevant and

incapable of producing skills which are required for technological and economic development and does not inspire in them the culture of entrepreneurship (Nielsen 1995, Adekola and Obbe 1995, and Afonja et al 2005. A portion of 25 (58.13%) of the respondent said trainees were not adequately exposed to skills which prepare them to the world of work.

The study revealed that 30% of the trainers had industrial attachment; specifically from survey question, telecommunication engineering and industrial electronics, after formal education but 30(69.77%) have not had any skill capacity building. Most of the trainers had never had any exposure to practical engineering in industry. They only demonstrate the principles of operations. Afonja (2005) described it as the "theory of practical".

The study also revealed that the technical training institution attach their trainees to relevant industries, though there's little engineering interaction between institutions and industries; hence the institutions generally are not familiar with the skill demand of the industry. The respondent were asked to asses, the equipment whether they are similar to those used in industries. A fraction of 25(58.13%) of the respondent said they are dissimilar. The study showed that 17(39.53%) of the programs utilize industry based trainers whereas 26(60.47%) do not involve industry based lecturers in appreciation of the importance of being in tune with the latest industrial based technology while equipping the trainees for the world of work and enhancing interaction between institutions and industries.

In a study on strengthening cooperation between engineering institutions and industry, Fish wick, (1983) identified the use of practicing engineers as part time teachers to

lecture on real industrial problems, industrial organizations, management, up-to-date technology and similar topics amongst others.

The survey questions elicited other challenges faced by individuals or groups of trainers which included the rapid change in technology and the unsupportive non dynamic curriculum. Traditional methodologies dominated the implementation of the curriculum in spite of computer based techniques of teaching available such as computer aided design techniques and simulation equipment. The survey also revealed lack of specialized and diversified workshops/laboratories such as microprocessor, control and instrumentation laboratories. The unreliable provision of training materials and lack of reference reading materials; books and journals was identified by the survey as part of the challenges.

4.8.1. Assessment of the Adequacy and Relevancy of the Practical Skills Taught for Sustainable Development

This section sought to seek the responses of the trainers in order to establish the adequacy and the relevance of the skills transferred to the trainees. This assessment provided an indication as to whether the products of engineering training were equipped with useful, marketable and attractive skills for productive self or wage occupations. The responses are recorded in table 11.

The results showed the assessment of the trainers on whether the practical were adequate and relevant to the skill requirement of this country towards industrialization. Specifically, there were more trainers 30(69.77%) disagreeing that the practical were not adequate than those who rate the practical as adequate 13(30.23%).

Table 11(a): Responses on the adequacy and relevance of the skills transferred

Introduction

Characteristics	Adequate (yes)	Not Adequate(no)	Total
Are practical skills taught Adequate and Relevant to the needs of the country?	**13**	**30**	**43**

The data was analyzed using chi-square statistics and Table 11(b) below summarizes the results.

Table 11(b): Summary of Chi-square analysis respondents' opinion on the adequacy and relevance of skill training transfer.

Variable	N	df	X2c	p=0.05
Are practical skills taught Adequate and Relevant to the needs of the country?	**43**	**2**	**6.905**	**p‹0.05**

The results of chi-square statistics computed indicated chi-square of 6.905, significant at 0.05 at one degree of freedom. The findings showed that there was significant relationship between the skills taught and job placement for sustainable development

4.9. CHALLENGES OF ENGINEERING TRAININGS FOR THE WORLD OF WORK

The trainers as the agents of technology transfer ranked some of the key challenges of engineering training for economic occupations. The major sections of electrical engineering provided the ranking as shown in table 12. This in formation was essential to ascertain whether the two sections of Electrical Engineering equally faced by the same difficulties.

4.9.1 The order of challenges/weaknesses of the training system

Introduction

The two major section of electrical engineering were asked to rate and ranked the insufficiency of resources and other related challenges of technical training. This section gave the challenges ranging from lack of equipment, insufficient funds for maintenance and purchase of new equipment to rapid technological change.

Table 12: Ranking of the challenges/weaknesses

CHALLENGES	SECTIONS	
	Electrical	**Electronic**
Insufficient workshop facilities	7	5.5

Lack of training equipment in the Workshops/ laboratories	6	5.5
Lack of modern equipment relevant to the demands of industries	5	6
Insufficient financial resources to service equipment	4	3
Scarcity of resources to purchase new equipment	1	4
Mis-merge in technology	3	2
Lack of capacity to maintain equipment	2	1

Table 12 presented the data collected on the opinion of the trainers on the challenges listed as viewed by the two electrical sections. Electrical section viewed as a matter of priority the inadequacy of equipment as the least challenging, whereas the electronics respondents saw the unavailability of modern equipment similar to those found in industries as least challenging for effective skill training. The mis-merge in the technology being taught and the technology in industries was ranked as among the first three challenging links towards training to the world of production. The findings indicated that the most weaknesses of technical training were the scarcity of resources to purchase new equipment for training and also the lack of capacity to maintain what was available. Meer (2007) argued that students with practical abilities were better off with a VET degree than academically oriented individuals and vice versa.

Further analysis using Pearson Correlation showed that the relationship between Electronic resource variables and Electrical resource variables ranking was significant and positive. The coefficient of correlation was 0.667 which means the variables were linearly related. The Technical Institution capacity to offer engineering training leading to

industrialization was at a level likely to slow the achievement of vision 2030 if stringent measures were not given due attention, as the sector of trainings was experiencing deficient workshops and laboratory, inadequate funding for refurbishing of equipment, and non dynamic curriculum which do not merge up with the changing technology.

The findings showed that resource capacity of engineering trainings was not sufficient and poor training equipment maintenance. The trainees graduate with theoretical, and scientific knowledge but unskillful. The TVET system had been reported to demonstrate declining relevance in years, particularly with regard to informal sector (Gill et al, 2000) and growing need for self employment (Grierson, 2000). Decreasing employment opportunities in the public sector had contributed to the increased irrelevance of TVET (Gill et al, 1999) trainings.

4.10. ENGINEERING TRAININGS COMPATIBLE WITH INDUSTRIAL DEVELOPMENT

The data on improvement of training resources was to ascertain the resources highly required and prioritized for acquisition in order to orient the training towards the provision of relevant skill capacity development for productive occupation. The researcher sought to rate the resources for improvement by asking the respondent to score the resources ranging from a score of (1); highly preferred for improvement to score (6); least preferred for improvement. The improvement mean rating with greater than 5.5 was considered least for improvement but between 5.5. And 4.50 were fairly preferred for improvement. A factor with mean score greater than 3.50 and less than 4.50 was considered moderately preferred for improvement. Factors with score less than a mean of

3.50 were considered highly preferred and pressing for improvement. The results are tabulated in Table 13.

4.10.1 Analysis and interpretations.

The results in Table 13 were the frequency responses of the trainers on the assessment of the resources and prioritization of the improvements required. The objective of the improvement was to orient the engineering training towards relevant skill capacity development aimed at satisfying the industrial needs. The resources considered were workshop equipment, training materials, human resource, and library services. The other factors were fostering the relationship between the institution and the industries and how to utilize the resources well towards the same goal.

Table 13: Resource Capacity Improvement Needs.

Variable	Mean	Percentage	Ratings
Improvement of equipment	2.00	8.94	Highly preferred.
Improvement of training materials	2.68	11.99	Highly preferred.
Upgrade the staff	2.50	11.19	Highly preferred.

Improve Library services	4.67	20.89	Fairly preferred.
Enhance industries linkages	4.33	19.37	Moderately preferred.
More utilization of resources	6.17	27.61	Least pressing.

This section shows areas which needs improvement and the trainers' ratings of the variables. The study indicated that improvement of training equipment; upgrading or in-servicing of staff and improvements of training materials were rated highly for improvement. The utilization of resources was rated poorly can be interpreted to mean the resources are at the minimum level not capable of supporting effectively the training need.

According to Hughes, et al, (2002), cognitive psychologists argued learners learn more effectively if they are taught skills in the context in which they will use those skills. This kind of learning would be emphasized through provision of training equipment relevant to industries and also establishing closer links with industries so as to fill the 'gap' created by equipment not readily available for training or the scarcity of funds to purchase such equipment/machines.

The findings also indicated that the Improvement of equipment and provision of training materials together with highly qualified; practically oriented staff, as highly rated by the respondent was crucial in ascertaining that engineering trainings was tuned to provide industry oriented practical skills necessary for industrial growth and sustainable

development. Learning by hands on practice lies at the heart of industrial practical training.

The model of technical training where practical industrial skills integrated in the training through the provision of sufficient training facilities emphasizes the benefits of acquiring skills and knowledge. The missing link between learning and production skills had greatly contributed to information failure. This implies that the poorest youth without essential exposure consistently underestimate the returns to technical education, thereby reducing their willingness to invest in this direction (World Bank, 1996). Technical trainings require theoretical and scientific knowledge but a greater proportion of time was spent putting this theory into practice. This model of training where there is integration of practical industrial production skills improves the theory and practice through better understanding of scientific principles and processes of deduction implied in the various job specific tasks. It assists in learning the role of different technologies and new methods of production.

4.11. APPROPRIATE STEPS TOWARDS PROVISION OF ADEQUATE TRAINING

It was necessary to seek this information to establish the steps the trainers proposed towards provision of adequate training to the trainees. The responses were recorded in Table 14

Table 14: Respondent Responses on effective training requirements

Effective Training Provisions	Freq(f)	Percentages (%)

Emphasis on practical skills and time duration	9	20.93
Review curriculum to merge the current technology	13	30.23
Provision of industrial oriented practical skills	7	16.28
Provision of sufficient reading materials	4	9.30
Development of research skills	2	4.65
Enhancement of industrial linkages	4	9.30
Provision of in service training for trainers	4	9.30

The respondents were to assess and determine the most appropriate provisions for effective engineering skills trainings. The results in Table 14 indicated 13(30.23%) respondent's agreeing that the curriculum should be reviewed to merge the current technology. The respondents 9(20.93%) said emphasize should be laid on practical skills and allocation of sufficient time durations 9(20.93%). According to 2 (4.65 %) of the respondents, the development of research skills was appropriate for the industrial development needs of the country.

The results of this study showed the respondent 13(30.23%) recommended that the curriculum should be reviewed to integrate emerging technology and to make it more relevant to the market demand. This agrees with Fluitman et al. (1999) that technical training offered does not match with the skills needed in the market. There was need therefore to orient practical skills to industrial production skills. According to UNESCO (1991) technical and vocational education should integrate trainees into the workforce and expose them to a range of experiences and skill of everyday life.

The findings in Table 14 indicated that the majority of the respondents preferred the review of Curriculum, provision of industry oriented practical skills and allocation of more time for practical, provision of library materials, fostering of industrial linkages and provision of in-service training to the trainers. The development of research skills was the least identified; therefore this was a reflection of the least emphasize put on research both in trainers training institutions and in such technical training institutions. This confirms the finding of Claudio de Moura, (2008) that none experienced and least exposed professionals/Lecturers cannot give students/trainees a true professional training in whatever area of trade, they are facilitating.

4.12. STRATEGIES FOR PROVISION PRACTICAL OF TVET TRAINING.

It was paramount to seek this information to establish the general strategic plan of action aimed at offering skill training to effectively prepare the trainees for the world of work. The respondents were asked to organize the training for preparation of trainees for the world of work by prioritizing the improvement as suggested. The data collected is tabulated in Table 15 below.

4.12.1. Analysis and interpretation of the responses on strategic improvement steps.

The researcher decided that it was feasible to assume that the work strategic step with a rating mean scale greater than 9.5 be considered slightly pressing improvement need. The scale, moderately pressing was used for those steps where the mean was less or equal to 5.5 and greater than 7.5 while those strategic steps where the mean rating was less or equal to and greater than 5.5 were considered highly pressing. The respondents were considered to be demoralized by the deficiencies being addressed by the strategic steps

which had a rating of less than 5.5. According to the researcher's interpretation, a mean score of 5.5 (that is, the mean of the ten-point scale) indicated neither urgent nor pressing for improvement but may be considered after the low rated factors.

The mean score above 5.5 indicated less pressing and a mean score below 5.5 indicated urgent and essentially required attention for effective training for the world of work. The element in the strategic steps centers essentially on the pre-requisites for effective training for economic occupational activities. The trainers view the improvement as envisaged in the strategies as a vehicle towards production of industrial oriented graduates. The respondents prioritize the strategies as explained below.

Table 15: The prioritized strategic steps for preparing the trainees for the world of work

FACTORS ESSENTIAL FOR PROVISION OF TVET TRAININGS	combin	I.RANK	O.RANK

	ed MEAN		
Upgrading of training techniques (methodology)	3.13	1.5	10
Upgrading workshop equipment	4.75	8	6
Expansion of workshop and acquisition of equipment	5.79	4	5
Review curriculum to integrate practical industrial productions skills	3.75	9.5	8
Put in place machines/equipment maintenance system	7.04	5	7
Replace industrial attachment with workshop based industrial production	8.83	2	2
Diversification of workshop for diverse specialties	5.96	1	1
Transform curriculum more time and practical as opposed to current training mode dominated by demonstration.	4.42	3	4
Integrate practical production skills in the training	4.88	6	9
Re-tooling of human resource	6.04	7	3

Key: O.rank=electronic ranking, I.rank=electrical ranking.

4.12.2. Strategic steps which needs urgent attention.

The strategic steps which needed urgent attention were the Upgrading of training skill techniques (mean=3.13) and review of curriculum to integrate practical industrial production skills (mean=3.75). The transformation of curriculum to allow more time and practical as opposed to current training mode dominated by demonstration (mean=4.42)

was also rated critical for attention. The Upgrading of workshop equipment (mean=4.75) and the Integration of practical production skills in the training (mean=4.88) were also rated to be important steps.

4.12.3. Moderately pressing improvements.

The factors that the respondent viewed as not moderately pressing for improvement according to the mean rating were the expansion of workshop and acquisition of equipment (mean=5.79). The provision of workshops for the various areas of specialization (mean=5.96) and the re-tooling of human resource (mean=6.04) were moderately rated. In this category also was putting machine/equipment maintenance system in place' (mean=7.04).

4.12.4. Correlation analysis.

The Spearman's rank correlation coefficient was used to determine the direction and the relations of the strategies as perceived by the trainers for the two major specialized sections; electrical engineering and electronic engineering. The ranking yielded a positive Spearman's rank correlation coefficient of 0.7727 at significance level of 5%.This means that the priorities for the two sections were positively correlated and that the deficiencies of the resources affect equally the two section without exceptions but the effects may differ slightly .The order of priority from the two groups were different other activities came earlier for one group but later for the other group , but the overall improvement amounts to the same standard. This was determined by the nature of the requirements. The strategic practical enhancement plan or practical training improvement priority plan

will assist the stakeholders or TVET planners prioritize the improvement and come up with development plans.

4.13. FACTORS FOR THE INTEGRATION OF PRACTICAL INDUSTRIAL PRODUCTION SKILLS IN THE ENGINEERING TRAINING

The respondents were asked to asses and rank the factors which can support the integration of practical industrial production skills development in the training. The respondent itemized factors identified, as essential to be put in place in order to make trainings meet the industrial development needs. The results are recorded in Table 15 below.

4.13.1. Interpretation of the ratings

The researcher's interpretation was that a rating of a mean of 4.5 enhances improvement on a fair scale. The rating of mean scale greater than 4.50 and less than 6.50 was considered essential in support of the training model, but factors with mean rating below 4.50 and greater than 2.50 were essential and critical. The activities with mean rating less or equal to 2.50 were considered very essential and critical to the integration of production skills and needed urgent attention if the intended objectives are to be achieved.

Table 16: respondent's ranking of strategic activities towards improvement of resources.

Activities to be enhanced in support of skill development	Mean Rates	Percentage	I. Ranks	O. Ranks
Establishment of linkages with industries	3.67	10.54	6	7.5
Acquisition of modern equipment for practical training	3.67	10.54	7	7.5
Diversification of workshops	5.83	16.74	3	1
Constructions of modern work shops/laboratories	4.00	11.48	4	4
Improvement of staff skill training capacity	2.5	7.18	8	5
Exposure of staff to practical industrial production skills	4.33	12.43	5	6
Integrate practical industrial skills in the curriculum	5.00	14.36	2	3
Creation of industrial production centers as transition link to industrial set up	5.83	16.74	1	2

The respondent considered the improvement of staff training capacity as very essential and critical (mean 2.50).The respondents rated the following as essential and critical in support for the integration of production skills:

i). Establishment of linkages with industries (mean 3.67).

ii). Acquisition of modern equipment for practical training (mean 3.67)

iii). Construction of modern workshops and laboratories (mean 4.00)

iv). Exposure of staff to practical industrial production skills (mean 4.33).

4.13.2. Test of Correlation Between the Two Trainers Ranked Responses.

The Spearman correlation coefficient indicated strong correlation (+0.7790) at 5% level of significance. This interpretation is that integration of practical industrial production skill in the training essentially needs equally the same improvements in facilities, enhancement of industrial linkages and human resource development for the two sets of trainers. The findings showed that to enhance the integration of practical industrial productions skills workshops on specialized areas and the setting up of production unit centre was a priority as a vehicle to acquisition of practical production skills.

4.14. BENEFITS OF INDUSTRIAL PLACEMENT (IAP) TO ENGINEERING TRAINEES

The researcher sought to establish the benefits of industrial placement so as to ascertain the nature of skills provided for in the engineering curriculum. It was established from the study that the benefits of the industrial placement as ranked by the respondents relate closely to translation of learning and knowledge. The study also established that all the institutions involved in this study, value the industrial placement, as all the five sent their trainees for the attachment.

The trainees are normally attached to industries and service providing organizations for at least three months. The aspects evaluated ranged from the benefit realized by the trainees to those touching on institution and learning process. Table 17 shows the list of the benefits and the results of the rankings.

Table 17: Respondents assessment of industrial attachment benefits

BENEFITS/GAINS	mean	ranking
It concretizes the skills and principles learnt in classroom.	4.00	1
Provide a link between training institutions and industries	4.17	2
It provides specific work based on learning	4.5	3
Trainees learn new skills and gain experience.	4.67	4
It provides an opportunity to learn practical industrial production skills.	6.33	5
Cultivate interest in trainee towards the world of work.	7.00	6.5
Industrial placement influences the skills and method used in industry through research findings	7.00	6.5
Trainees are exposed to real life situations	7.17	8
Trainees exposed to potential/prospective employers	7.33	9
Guides the institution on modern technologies to be integrated in the training.	7.67	10
Exposes the trainees on entrepreneurial skills	8.33	11
It enables institutions withdraw from some form of high cost workshop provision.	9.17	12

Industrial placements provides feedback channel for institution to compare and contrast the technologies being passed on and the nature of the training equipments. While the students are in the industry, they are exposed to practical entrepreneurial skills and production processes. The benefits with mean rating scale less than 6.5 were considered highly valued and these included attachment placement believed to concretize the skills and principles learnt in theoretical discussions (mean=4.00). The exposure of trainees to real life situation provides work based learning (mean 4.17), apart from creating a link between the industries and the institution in terms of relevancy of the training. The trainees during attachment learn new skills and gain experience, and in this context they

are exposed to practical industrial production skills (mean=6.33). The factors with mean rating scale less than 7.5 and greater than 6.5 were moderately valued. The factors which are moderately valued but are also important in the creation of trainee's interest to the world of work (mean 9.00), as they get introduced /exposed to prospective employers (mean=7.33). The benefits with mean scale rating of less than 8.5 but greater than 7.5 were rated as fair.

4.14.1. The Challenges IAP Scheme

The survey questions on the challenges of attaching trainees to industries were tabulated in Table in 18. The responses gathered from open ended question were important to establish the perceptions of industrial attachment by industries and ascertain whether the low rate of absorption of the trainees by industries was as a result of the mis-match of the skills.

Table 18: Attachment placement challenges

CHALLENGES OF ATTACHING THE TRAINEES	Frequency	Percentage
Challenges on the facilitation of the follow up	3	25
Industries unwillingness to attached the trainees	5	41.67
Access to the relevant attachment places	2	16.76
The competency of trainees underrated by industries	1	8.33
Attachment period too short (Three months sandwich).	1	8.33

The result of the survey in Table 18 showed that there were challenges of assessing the trainees 3(25%) and also the unwillingness of industries 5(41.6%) to accept the trainees for industrial placement. The researcher interpreted the reluctance of industries to accept trainees for industries placement as a negative attitude by the enterprise towards them and this closely related to inexperience incompetence of trainees. Secondly enterprises were only interested in productive and economic contribution of the worker. In order to improve Institutions link with industry, the staff handling industrial placement needed to understand the nature of the industry so as to form a bridge beneficial to both parties. The trainers should be competent to handle both practical and theoretical teaching, and the practical part must include the capacity to service and repair relevant equipment.

CHAPTER FIVE:

5.0. DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS.

5.1 INTRODUCTION

The research study assessed the engineering capacity of technical, vocational education and training with a view to determining the training process and the transfer of skills for sustainable development.

The objectives of the study were:-

i). to investigate the resource capacity opportunities available in Engineering training Institutions for the integration of practical industrial production skills.

ii). to determine the resource capacity of the engineering training institutions to integrate practical industrial production skills so as to enhance translation to the world of work.(curriculum, funding, staffing, laboratory, workshop and library facilities).

iii). to investigate challenges of integrate practical industrial production skills effectively in engineering training at Technical Training Institutions.

iv). to determine whether the current training systems in force at Technical Training Institutions effectively respond to market demand.

iv). to determine the gains/benefits of trainees industrial attachment and the modalities for acquisition of appropriate technical skills.

The findings of the study were discussed under each objective and conclusions drawn. The chapter also gives the recommendations and suggestions for further research.

5.2. DISCUSSIONS

5.2.1. Introduction

The capacity of engineering training was evaluated on areas touching on the teaching process, workshop and laboratory activities, the quality of trainers, the adequacy and the utilization of resources and the extent to which the institution and the training is linked to the industry. The discussion centered on resource capacity and training related opportunities.

5.2.2. The Opportunities and Strengths in Engineering Training

The study investigated the opportunities available in Engineering training Institutions for the integration of practical industrial production skills.

The Curriculum: The curriculum being followed in engineering training Institution had been developed by the government through Kenya Institute of education. The private sector is involved at the final stage of curriculum development. The finding indicated that the curriculum needed to be reviewed to integrate industrial skills. This was in line with the evaluation by ICCO, Edukans and Woord En Daad on TVET in Kenya, India, Etthiopia and Albania between 2003 and 2006 which recommended that countries should

develop capacity building strategy on four areas; curriculum development; trainers training and human resource policies in order to maintain well qualified staff. This was an opportunity positively supportive of research findings that industrialist be involved in curriculum development. The analysis provided in research reports on learning TVET in Australia, published in 2006 reinforced the statement that the vocational education and training systems needs a capability building approach that focuses on quality, professional judgments and growth rather than simply on compliance.

This process of involving industrialist was meant to ensure that the needs of industry were taken into account in every TVET programme developed. The set backs in TVET programme development in Kenya was the overlooking of the need to carry out assessment at regular intervals with the participation of the industrialists or professional organization. According to UNESCO recommendation of 2001; laying a firm foundation of knowledge, skills, and attitudes prepared individuals for productive livelihood that contributes to sustainable development. The UNESCO conference of 2005 noted that skills' training for sustainable development goes hand in hand with reviewing, structuring and harmonizing TVET programs regularly to respond to the changing technologies and demands of industry and commerce in globalizing the world of work. On the implementation of the curriculum the professional in industry were insufficiently involved in the training neither in acquisition of training materials or equipment relevant to the market skill demand.

Workshop space: The finding of the study indicated that the workshop space was available, the limitation being the shortage/lack of equipment. The spacious workshop;

lacking equipment had been converted into lecture halls (instructional rooms). The demand for the use of the workshop for technical practices were minimal instead the workshops were being used to transfer the theoretical knowledge. This therefore was an indication that the workshop space does not pose any challenge as at now until and when purchase and supply of equipment has been acquired.

TVET Training personnel: The five institutions teaching staff were government employed. The numbers of trainers were found to be sufficient. Kenya's current development policy is aimed at achieving a newly industrialized status by the year 2030, as outlined in several public policy documents; vision 2030 and, in particular, Sessional Paper No. 2 of 1996 (Republic of Kenya, 1996) and the National Development Plan 1997-2002. Critical to the attainment of this status is the availability of a well-educated and relevantly trained workforce. The trainers according to the study had relevant qualifications which ranged from Diploma to Masters Degree in the relevant specialties which agreed with the Zymelman (1993) that it was the engineer who by training was to provide the thrust for acquisition, adaptation and diffusion of technology. According to researchers Jacob, Brian and Lefgren (2002) there was little impact of trainers on learning of the trainees. The World Bank report (2005) argued that if there were fiscal constraints then staff in-service training was especially effective and was sometimes less costly.

Industrial Attachment Scheme.

The five Technical Training Institution studied had a three months sandwich attachment scheme but its effectiveness was questionable. The trainees spent the time in industry as a training site so as to enhance interest and attitude. The attachment was meant to improve

trainees employability skills and adaptability to different production set. According to Ferej (1996) industrial placement exposes the trainees to industrial production line setup. On the other hand attachment scheme were meant to close the 'cultural gap' between the workshop equipment and real life industrial production tools and equipment. This was in support of scheme Greffe (1997) that classroom work and attachment reinforce and compliment each other for better acquisition of knowledge and skills towards adapting to the world of work.

5.2.3. Weaknesses and challenges of the TVET institutions

The study investigated the strengths, and limitation of Technical Training Institution to offer engineering training integrated with practical industrial skills for sustainable development.

Workshop and laboratory equipment: The study revealed that the workshops were not adequately equipped. The workshops were equipped with old and unserviceable equipment. The findings indicated that the workshops were equipped with furniture for theoretical classes; hence were used as instructional rooms. The average number of separate workshops in these Technical Institutions were not more than two; namely general workshop and electrical installation laboratory. Despite the limited number of workshops, they were still not effectively used due to lack of facilities but instead used as for theoretical teachings. The available tools and equipment in the workshops had no similarities with what industries uses. This was a challenge facing both the trainers and the trainees.

The absence of industry experienced teachers/trainers and the insufficient industrial equivalent equipment and facilities contributed immensely to poor training. The disconnect between the worlds of technical education and work clearly demonstrated the beginning of graduates failure to secure industrial engagements/occupations, confirming that unemployment was due to training program‘s failures to expose trainees to the world of work (Cheng, 2007). This was contrary to UNESCO (2001) that laying a foundation of knowledge, skills, and attitudes prepares individuals for productive livelihood that contribute to sustainable development.

The study revealed that the greatest challenges of effective technical training were:- insufficient workshop facilities, insufficient financial resources to service equipment or replace, mis-merge in technologies being passed on and lack of Library facilities. The other practical difficulties included insufficient work placements and rapid change, in technological advancement across all industries; limiting the relevance the vocational preparations institutions could provide.

Curriculum content: The study indicated that curriculum content was not adequate and lack industrial skills appropriate to the needs of this country. There was need therefore to orient practical skills to industrial production skills. According to UNESCO (1991) technical and vocational education should integrate trainees into the workforce and expose them to a range of experiences and skills of everyday life. The European Commission (2003) recommended that an ideal Technical Education Curriculum should include the development of closer and mutually beneficial links with Industry. The recommendation went on to say that the development of practical activities should be set

within real life scenarios; the development of literacy through consideration of the impact of technology on society; and the introduction of topics relevant to industry in the 21st century.

A report by the United Nations (1998) was critical of the curricula and orientation of African education system which makes the products helpless unless they can secure employment. It stated that it is economically unwise for countries to structure their educational systems in a way that the graduates of the programs cannot be self reliant or self employed but are totally dependent on white collar jobs. The research findings of United Nation found out that an effective program for creating a real practical vocational dimension in training would involve a curriculum which values learning from work rather than one which attempts to train for limited occupational outcomes (UNDP, 1998).

Quality of trainers: The findings also showed that all the programmes had not been utilizing part time lecturers working from the industry. Fishwick, 1983 identified the use of part-time lecturers from industry in training to strengthen institution/industry cooperation. According to the findings of Soren and Margerata (2007) trainers in modern system were professional educators and key change agents. The study identified only two programmes which utilized part time lecturers – Telecommunication Engineering and Industrial Electronics, and this was simply because of the shortages of teaching staff in these fields. The engagement of industry based trainers should be supported and guided by a training policy developed in consultation with all the stakeholders; both public and private sector. The use of part time lecturers would creates partnership with industries and at the same time provides response to Industry critics questioning the quality and

experience of teachers, the standard and relevance of school facilities. Workshop Technicians who work closely with the trainers during practical lessons were sufficient; the ratio was one to one workshop. This was contrary to the findings of Afonja, (2005) in Nigeria, South Africa, and Zimbabwe where it is determined by staff students' ratio (STR)

Limitations of Industrial Attachment

The sandwich industrial attachment was to bridge training and the world work. It was meant to address youth's needs for work experience to curb the severe skill mismatches. The main limitation of this scheme was the duration which was not sufficient for the trainees to fully participate, and the attitude of industries towards the trainees who were seen to be lacking capacity to add value the firm's production.

The Germany's "dual system" combined part-time schooling with work and apprenticeship. The Employer involvement in this system ensures that the skills offered fit the needs of employers, reducing the likelihood of skill mismatches. The researcher Cherkov (2005) argued that in developing countries apprenticeship had diminished due the current training set up, because of the small share of employment in the modern wage sector, the slow growth of wage employment and jobs for new apprentices, and the weakness of institutions

The research report of Emerson (2005) found out that some developing countries have tried the dual system, but with no clear pattern of success. The Mubarak-Kohl initiative in Egypt, launched to introduce the dual system in 1995, but was faced by numerous

challenges. The report of Emerson, Carl, Frayne and Mcnally indicated prevailing resistance in the public training system, and the absence of private sector umbrella organizations to manage joint training courses.

The linkages and collaboration with industries: The study revealed that for effective integration of practical industrial production skill the following reforms must be put in place. Training institutions should prioritize the establishment of strong linkages with industries, exposure of staff to industrial production skills and diversification of workshops. The institution should also acquire modern equipment and continuously upgrade the staff skill training capacity.

5.2.4. Appropriate and effective training towards industrialization

The study investigated to determine the responsiveness of training system to market demand for effective training towards national development leading to industrialization

Training Model Adaptable to the Work of work: The TVET training had not provided training to adapt to enterprises/working environment due to non provision of job-related training. The transition process had not been supported fully by industries/enterprises as the training environment and the trainers were disjointed from the working environment rendering the trainees unable to translate the knowledge acquired into productive engagements. Involving enterprises in setting the content of training was regarded as crucial because this form of collaboration makes it possible to train young people more effectively for the workplace. In order for Technical Education to be successful, according to Brunette (2006), the training must be responsive to market demand skills.

UNESCO (2005) argued that Education and Training for sustainable development should be implemented with focus on the programs that are locally relevant and culturally appropriate. The findings showed that the current training model is knowledge based acquired through the theoretical training; minimum practical learning. This findings indicated that the training do not measure up to the recommendation of Brunette (2006) that academic knowledge and technical skills are of equal importance in the new technological Education model; and it be integrated to a knowledge and skill based economy rather than only a knowledge economy.

5.2.5. Benefits and gains of industrial attachment

The research study also determined the modalities of enhancing benefits and gains of industrial attachment for appropriate acquisition of technical skills

Industrial Attachment placement: The findings showed that all the technical all the five institutions sent their students for attachment. The study revealed that the benefit of industrial attachment was that it provided linkages between industries and institutions, specific work based learning and the trainees learn new skills and gain experience. Industrial attachment also concretizes the skills and principles learnt in the classroom. The scheme itself was not working well because of lack of cooperation by the industry in providing places and appropriate training schedule. This agrees with the findings of previous research studies carried out by Ferej (1996). The industrial placement difficulties included insufficient attachment places, rapid technological change and changing production techniques as opposed to the current technical trainings. The

emerging technologies do not merge with the traditional technical training with the limitations of relevance and preparations of trainees to the world of work.

5.3. CONCLUSIONS

The conclusion was based on the findings of the general objective this study. The assessment of the resource capacity strengths, weaknesses and the opportunities for TVET training institutions to integrate industrial production skills in the training resulted in the following conclusions :-

Funding: Under funding by the sponsors had made it problematic for institutions to teach the practical content of curricula effectively. TVET training was being undertaken under poor conditions such as shortage of classroom, old or unserviceable equipment or none at all. To effectively implement TVET programmes proper workshops, laboratories, equipment and all learning resources (stationery, raw materials, textbooks and teaching aids) needed to be provided. A well developed master plan for upgrading facilities, equipment and to enhance collaboration with industry in provision of equipment and other learning materials was highly recommended.

Trainees' Industrial placement: The student industrial works experience scheme was not efficiently working mainly because of lack of cooperation by industry in providing appropriate training schedule, work sites and supervision for the trainees. The findings that technical training does not adequately prepare the trainees for the world of work reflected lack of relevance and mismatch between the supply of TVET and the labor market. One very effective way to ensure the relevance of the content was to involve the

stakeholders from the world of work both at policy levels as well as implementation levels (NEIR, 2007). Research findings of Smith (2000) indicated that students learnt transferable skills better in their part-time work, and that they differentiate it from vocational placement experienced in school programs.

At the implementation stage of the curriculum it was considered necessary to create linkages between Institutions and Industries in order to facilitate work experience for TVET trainees. The establishment of IAP office was expected to play that role but at negligible levels.

TVET Curriculum: The TVET curricula had missing links between the skills trained and the demand of the industries as dictated by the labour market. The demand for new innovative skills and adaptive approach had been brought about by globalization, advancement in technology and entrepreneurial competitiveness which had impacted negatively in the Technical Trainings in Kenya. The curriculum needed to be dynamic and it should be reviewed from time to time in order to cope up with the ever emerging technological changes.

TVET Trainers: Trainers were the right agents of skill transfer, they directly deal with trainees. They were also the implementers of TVET policies developed upon by relevant Ministry or Governments relevant departments. Regular in-service training and industrial practice was necessary to keep their knowledge about new technologies such as integrated computer technologies (ICT) and work process up to date. According to the study the trainers were trained at the time computer technology had not been introduced or emphasized in the curriculum comparatively as at this time of robotic engineering. The

lack of industrial experience of the trainers was a major handicap to performance and this had led to severe cultural gap that this study confirms to exist between industry and academia. There should be deliberate policy on the continuing education of technical trainers, adequate exposure to real industrial environment life during training and after, through excursions to industry and industrial interaction out of attachment placements.

Training equipment: The training equipment forms an important component in technical training as a media of translating concepts into practical skills. The 'hands on concept' was the foundation of the development of competent based training. Technical Training Institutions do not have adequate equipment to support the integration of industrial practical skills. Deliberate effort was required to have the equipment relevant and sufficient for practical industrial production training. This step would enhance training oriented towards achieving vision 2030 and be in line with the recommendation of the National Industrial Training Council (NITC) that the Government gave priority to the harmonization of TVET and to balance the training of technical manpower where the ratios of technicians, craftsmen and artisans should be around 1:10:30 respectively (NITC, 1988).

TVET Policies: The major shortcoming of TVET is the ineffectiveness of the training and lack of Institution administrative autonomy. The individual Institution cannot take decision on key issues such as curricula review, training modes and this limit their capacity to change and adapt. The management of institution in collaboration with engineering firms be given the mandate under National guideline to develop and implement the competent based curriculum as practiced by the Asian Tigers. In the

system under study the measurement of quality was through end of programme testing on competency; practical testing on skills and employability. The administrative of exams in the system on study without the participation of industry in the design and administration posed a challenge in terms of the preparedness of the trainee to join the world of work.

Quality training methods: The competency of trainees was largely Institution-based; depending on the nature of equipment available as there were no established National standards and globally linked Training equipment, hence no standard trainings. There had been greater efforts made to develop systems that use more industry attachments, but more industry participation was needed more than before if TVET was to deliver quality skills relevant to labour market demands.

There was a general lack of practical training opportunities available to TVET students in Kenya. The emphasis remained on theoretical and out dated teaching methods rather than on practical teaching. TVET teachers and trainers tended to have an academic background and lack relevant practical work experience. The lack of suitably qualified and experienced TVET trainers exacerbated weaknesses in the TVET system, and was linked in part to the low level of salaries and morale. The Researcher observed social status and career progressions were poor for TVET trainers. However, the development of job-related vocational training as a paid service required Institutions to adopt new teaching methods and organizational changes. This adjustment process raises a number of problems. Various initiatives have been launched in recent years to modernize and modularize curricula but without a framework linking the professional organizations, industries, changing skill market demand and employment trends for now and the future.

Industrial Attachment Scheme

The sandwich industrial attachment acted as a transition vehicle to the world of work. The study revealed that industries could not provide sufficient worksites at the same time the duration for the attachment seemed to be too short for any useful learning to take place. In order to reduce the mismatches between supply and demand for training, employers should be given a stronger voice in the decisions of training institutions. The idea of using the job environment as a learning place and the use of established craftsman as trainers in industry remained as valuable today as it was in the past.

As mentioned in the literature review, in Germany, a classroom component was added to the learning by doing and by watching system, giving rise to the expression "dual system" to the practice of alternating between classroom and work environments. The fact of the mater was that the workplace was also a learning place. All policies that encourage workplace learning should be encouraged. Training institutions must review some of their curriculum and introduce prototype institution based enterprise in order to cater for the new skills on demand which constitute the increasing complex Technology.

Modern training required many bridges between school and enterprise. Traditionally, there was an abrupt transition between training and the job market. Even when internships were offered, they tended to be formal afterthoughts, not true links between school and work. With the increasing complexity of technologies, training institution cannot provide sufficient capacity required for practical learning and enterprises cannot offer the theoretical and scientific preparation to cope up with new emerging technologies.

Therefore, various bridges between training and work have to be established, particularly in the case of more complex forms of occupational training. This can be achieved through technical training institution integrating training with practical industrial production activities within the learning environment.

5.4. RECOMMENDATIONS

The research investigated the major benefits and gains of industrial placement and further research should be conducted to investigate the ability of training institutions to respond to the industry needs. Under IAP scheme the 'trainees' suffers from cultural shock' as a result of the industrial activities and the incomparable equipment used in industry, and those used in the poorly equipped workshops. A longer period for attachment will suffice if 'knowledge apprenticeship' was introduced to take the place of the three months period. To arrive at the most appropriate duration and the implementation procedure the contribution of stakeholders such as the Industrialists, Institutions, Education Planers and curriculum developers needed to be involved. The outcome of such elaborate consultation would arise to a more accommodative programme.

The study found out that many of the teaching staff has never had any practical and Industrial experience beyond what they had as students or trainees. This was a major deficiency which could be corrected by encouraging staff to spend their leave period in industry and an incentive scheme could be developed just like voucher training conducted by world bank. Many training staff had never visited relevant local industries or participated in Consultancy activities. This was considered a major deficiency in their capacity to provide adequate training and career counseling to students on lifelong

education necessary for continuous improvement of skills and adapting of the changing technology.

Regular industrial excursions with the trainees would greatly improve the teaching capacity of staff. Industries should be encourage to closely be interacting with training institutions and even make their equipment available for practical training. The engineers working in industry needed to be involved in training as part-time trainers. This can be possible if industries and training institution partners in the organization and development of training program.

The appropriateness and responsiveness of training can conclusively be said that economic modernization required increasingly complex forms of training. All training institutions should monitor closely the market for their graduates. A tracer study of former trainees is one of the easiest and most effective means to keep track of market evolution. Informal and formal contacts with former students and close interaction with the enterprises which typically hire the graduates could work quite well. These techniques could provide the essential data towards the maintenance and preparation of changing skills data bank for purposes of integrating it in the curriculum.

The course structure showed that there was adequate basic practical skill building content but much of it was not taught because of lack of facilities and instead demonstrations were preferred. Sufficient funding or provision of relevant equipment should go along way in solving this problem. Machines and equipment used in the workshops in Technical and Vocational Training Institution should be geared to the needs of the

workplace, and should simulate as closely as possible. Trainees should be capable of operating and maintaining the equipment.

About eighty percent of the trainers had neither participated in the training of unskilled or semi skilled industry based workers or participated in the development of any short term tailor made courses for the unskilled working labour force. There was need to develop technical and vocational training system that provides specialized vocational training in traditional and in newly-emerging technology needed for existing jobs production practices, and which encourages self/wage employment and targeted to improve productivity. Engineering training should be looked at, on how it contributes to people's better living and in line with changing times; able to react and survive better in the changing market situations. The trainers in order to prepare craftsmen and technicians for the world of work, they themselves should have a thorough knowledge and appropriate practical experience measurable far above the trainees expected levels.

Curriculum review should be structured to include more practical industrial production skills and be done from time to time. Industrialists should be included in the review and implementation through part time lecturing.. A system should be put in place to periodically carry out evaluation and review of the curricular in accordance to the trends of development and emerging technology. The TVET curriculum should be dynamic and lays emphasis on lifelong learning and learning to learn capacities rather than narrowly defined vocational competencies. The implementation of a dynamic curriculum involves sustainable resources for continuous appraisal of the programs, facilities and practical

industry based teaching skills and the participation of all the stakeholders in market demand and development dynamics (Industries, training providers).

Where lack of resources was a serious constraint, priority should be given to developing programmes for areas experiencing skilled human resource shortages such as telecommunication and micro-electronics (microprocessor techniques), taking into consideration the projected needs for national economic development and the corresponding labour market growth. In order to determine the areas of skilled shortages, the levels and skilled manpower requirements regular and continuous skill appraisal requirements needs to be developed. All programmes of technical and vocational training as preparation for occupational field should aimed at providing scientific knowledge and a cluster of core competencies and generic skills required for rapid adaptation to new ideas and procedures for steady career progression

The managers of training institutions should encourage engineering departments to foster closer relation with relevant industries. The challenge facing technical and vocational education in the twenty first century demands learner-centered innovative and flexible approaches and a reoriented curriculum to take account of emerging technologies in this era of computer age. Adequate staff should be available to provide maintenance of specialized instrument, apparatus and equipment in the laboratories and workshops with the assistance of adequate technicians for the various fields.

The study indicated that the library facilities were not adequate. To alleviate the scarcity of reading materials institutions should consider the development of a common facility as one way of securing funding on the same. Institutions should also endeavor to facilitate

the use of technology; the internet, interactive multimedia materials, audiovisual aids and mass media. Such initiatives enhance accessibility of study materials, cost effectiveness, quality and richness of programmes, especially in the promotion of self learning.

There was need to encourage more females as trainers in technical education which will also influence an increase in female enrolment for training. This could be done through an expansion of the government policy of affirmative action, and by providing special scholarships for female engineering trainers.

The student transition to employment environment through sandwich industrial attachment received cold reception from potential enterprises or the industries were faced with a not knowing what to do situation simply because the industrialist themselves were not aware of training content coverage or the capabilities of the trainee. This calls upon closer interaction between the two institutions in order to facilitate effective trainings of the trainees. Close interaction between the institutes and the industry/enterprise was seen as the platform for showcasing best practices, latest technological advancements and their implementation and impact on the Industry. It was basically considered to improve the quality of technical and vocational education adequately to meet the needs of the industry and economy. Having a close interaction in place, industries are able to participate in technical and vocational education programs, with the goal of cross-fertilizing ideas for systems improvement. To integrate industrial training and other inputs from the industry with the teaching-learning processes, interaction was necessary as it developed students' awareness on job functions in the industry, attitudes to adapt to industrial environment, proper practical and relevant knowledge, skills and competencies in preparation to

becoming self employed. The industries should be encouraged through policy formulations to integrate training duties for their industry engineers as a way of closely interweaving training and production at the time ensuring relevant technology transfer. The management of engineering training institutions and government agents needed to take lead in bridging the gap between the agents of training and the employers.

In conclusion the various support stakeholders in TVET; curriculum developers, examining bodies; Kenya National Examination Council (KNEC), Directorate of Industrial Training (DIT), and the ministry departments' sometimes present overlapping/operations zones which reduce the overall effectiveness. Employment monitoring, curriculum development**,** training advice, the provisions of human capital and financing of training constitute roles which are often difficult to link. In addition, they partly have little effect at the level of the establishments. A better co-ordination of these organizations, a shortening of the decision- making circuits and, above all, the granting of more responsibility to the recognized training institution/organizations for the collection of data on skill shortages and the analysis of the local market are probably necessary in order to improve the efficiency of these mechanisms. The researcher views that the gap between sound policy intentions and instruments and poor results may be due to the fact that not enough attention was being paid to contextual environments and to the implementing capacities of national institutions.

5.5. SUGGESTION FOR FURTHER RESEARCH

Through this study the researcher gained a deeper insight on the capacity of TVET Institutions with a view to determining the relevance to the processes of industrial development skills and the technology acquisition in the training. There were some areas in which the researcher believes more research was needed to fully understand. It was necessary to carry out a further research on the following:

i). The study revealed that curriculum should be reviewed periodically a study on the analysis of generic or core skills for technical and vocational educational to distinguish between job-specific skills and competent (core) work skills. Further research needed to be carried out to establish the emerging skills shortages crisis in order to integrate it in the training curricula.

ii). The research investigated the major benefits of industrial placement and further research should be conducted to investigate the ability and capacity of training institution to respond to industry needs through adjustment in their approach to engineering training. The research should answer queries such as what policy mechanism should be put in place to facilitate the dynamism of the curriculum, and the skills required by the trainers or training providers to build and maintain partnership.

iii). A study should be conducted to establish the opinion of the employers on the performance and competency of the products of technical institution, the training

programs, skill supply and market demand status and what possible reforms in the training sector.

iv). There was need to find out what factors contributed to the few numbers of trainers with Doctorate qualifications in Technical Training Institutions

REFERENCES

Adekola, S. O., & Obe, O. I. (1995*). Engineering Education in Nigeria*. In (Eds.). Maduemezia, Okonkwo, A. S. N. C., & Okon, E. Science Today in Nigeria. The Nigerian Academy of Science, Lagos.

Adult Community Education-Europe, (2006). *Evaluation of TVET Policy and Practice*; ICCO, Woord EN Daad and Edukans. Netherlands.

Afonja, A. A., Sraku-Lartey, K., Oni, S. (2005). *Engineering education for Industria Development: Case studies of Nigeria, Ghana, Zimbabwe*. Published by The Afican Developmen Technology Studies Network, Nairobi.

Africa Union, (2007). *Strategy to revitalize Technical and vocational Education and Training (TVET) in Africa*. AU Publications.

Alam, (2008). *The role of TVET in national development of Bangladesh research and evaluation division,* BRAC, Dhaka. Bangladesh. Asia-Pacific journal of cooperative education 2008,9(1), 25-44.

ASEE, (1995*). Engineering Education for a changing world. Joint report of engineering deans and corporate roundtable*, ASEE, Washington, D.C., USA.

Bartel, A.P., & Lichtenberg, F.R. (1987).*The comparative advantage of educated workers in implementing new technology*. Review of economics and statistics.

Berger. (1987).*Productivity: why it is no one underachiever*. Business weekly.

Brian k. & Mlotkowski P, (2009). *An overview of vocational Education and Training in Australia and its links to the labour market.* NCVER publishers,Adelaide

Bright J.R. (1996). *The relationship to Automation to skill requirement*. U, S Government Printing Office, Washington. D.C.

British Council, 2009.*Training and skills in U K meeting the Global skills challenge*. www.british council.org.

Brunette H. C.,(2006). *Technical Education in Namibia. Past trends, present circumstance and future prospects*. PHD Thesis ; faculty of Humanities, department of curriculum. University of Free State.

Cherkov O.,(2006). *Pro-rector for students Affairs*. Moscow, plekhanov academics seminar.

Cheng. T. L. (2007). *From school to work: A multi-stakeholder approach to youth employment.* Tokyo, Japan

Cinterford/ILO. (2001). *Modernization in Vocational Education and Training in the Latin American and the Caribbean Region*. Montevideo: Cinteford - ILO

Claudo. de Moura C. 1998. *The Stubborn Trainers vs the Neoliberal Economists: Will Training Survive the Battle?* Sustainable Development Department. No. EDU-106. Washington, DC: Inter-American Development Bank.

Claudio de Moura C., (2000). *Vocational and Technical Training*. An IDB strategy publication, education unit, inter-american development bank 1300 new york,avenue,n.w Washington,dc 20577.

Claudio de Moura C., (2008). *Unevoc Forum*, UNESCO-UNEVOC International Centre For Technical and Vocational Education and Training www.unevoc.unesco.org/bulletin**.**

Dar, A., & Gill. (2000). *Based on reforming the training systems in South Africa: constraints and innovations.* World Bank and International Labour Office study on constrants and innovation in reform of VET. World Bank .Washington

DeVore, P. W. (1964). *Technology: An intellectual discipline*. Bulletin No.5 Washington, D C: American Industrial Arts Association.

Emersion, Patrick M., Carl, Frayne C, McNally, & Silva O, (2005). *Evalution of Aimhigher: Excellence Challenge; An Economic Evaluation*. London: British Department for Education & skills.http:www.aimhigher.ac.uk.

European Commission, (2003). *Increasing Participation in Maths, Science and Technology*: http:/europa.eu.int/education policies/pdf

Farstad H, (2009). *UNESCO strategy on technical and vocational, and training. Conference presentation.* Bonn, Germany.

Ferej A. (1996). *The use of traditional apprenticeship in Training for self- employment by vocational training institutions in Kenya*. In Grierson P and Mkenzie: Training for self employment through vocational training institutions. ILO. Turin centre.

Fishwick W., (1983*). Strengthening Co-operation between Engineering Schools and Industry* .UNESCO, Paris.

Fluitman, F, (1999). *The roots and the natureof reforms in vocational education and training:* an analytical framework and some examples-proects xxix (1):55-65.

Foster, A. (2006). *Realising the potential.* A review of the future role of further education colleges, London, Department of Education and Skills.

Gall, M. D., Watter R., Joyce P., & Borg. (2005). *Applying Educational Research.* A

Practical Guide (5th Ed), Pearson Education,Inc. Boston.

Gay, L.R. (1981*). Educational Research: Competencies for application*. Charles E. Mairill Publishing Company A. Bell & Howell Company. Collumbus, Toronto, London

Gill, I. S., Fluitman, F., Dar, A. (1999).*Constraints and Innovation in Reforming National Training Systems*: CrossAce.

Gill, I. S., Fluitman, F., Dar, A. (2000). *Vocational education and training reform – matching skills to market and budget*s. New York, Oxford Press.

Greffe, X. (1997). *La mise en place de formations initiales en alternance* : enjeux, problèmes et solutions. Paris: UNESCO/IIPE.

Grubb W.N ,(1984). *The bandwagon once more: Vocational preparation for high tech occupations*. Harvard Educational Review.

Grierson, J.P., & Mackenzie. (EDS.) (1996). *Training for self-employment Through Vocational Institution*, ILO, Geneva.

Grierson, J.P. (1997). *Where there is no job*. SKAT, St Gallen.

Grierson, J. (2000*). Vocational Training for Self –Employment: Learning from Enterprise Development Best Practice.* Small Enterprise Development 11(3): 25-35.

Hatsopoulos, G.H., Kruguan, P. R., & Summers, L.H (1988). *US Competitiveness.* In: Journal of curriculum studies, 1991.

Haan, Hans Christiaan, and Nicholas Serriere. (2002). *Training for Work in the Informal*

Sector: Fresh Evidence from West and Central Africa. Turin: International Training Centre of the International Labour Organization. Available online at http://siteresources.worldbank.org/INTLM/214578-1103217503703/20295542/TrainingforWorkWCA.pdf.

Hoppers, W. M., & Komba, D. (1996). *Production work in Education and training : a state of art in Eastern Africa*. The Haque, centre for the study of Education in developing countries, 240 pp.

Hughes, K.L., Bailey, T. R., & Karp, M. M, (2002). *School to work:Making a difference in education*.Phi Delta Kappan, 84(4),272-279.

IDB, (2000). *Vocational and Technical Training*: An IDB Strategy. Washington, D.C.

ILO, (2006). *The End of Child Labour: Within Reach*. Geneva: International Labour Office. Available online at http://www.ilo.org/public/english/standards/relm/ilc/ilc95

Isoun, T. T. (1987). *Evolution of Science and Technology in Nigeria.* Riverside Communications, Port Harcourt, Nigeria.

Jacob, Brian A., & Lefgren L.,(2002). '*The impact of Teacher training on achievement: Quasi-Experimental. Evidence from School Reforms-Effort in Chicago'*. Cambridge, M.A. National Bureau of Economics, Research working paper series 8916.

Johanson, Richard K., and Arvil V. Adams. (2004). *Skills Development in Sub-Saharan Africa.* Washington, DC: World Bank.

Johnson S.D, Forster W., & Satchwell, R. (1989***).*** *Sophisticated technologies, the Workforce and Vocational Education*. Springfield, IL: Department of Adult. Vocational and Technical Education, Illinois board of education.

Kafka N., & Stephenson, J. (2006). *Learning together for tomorrow: Education for sustainable development*, APEID conference paper, Bangok.

Kenny, G., & Forster, K. (1986). *Managing space in Colleges.* The staff College, Blagdon.

Keating, J. (2006). *Greatly Promoting TVET in Guang Dong Province During the '11th Five Year Period'*,report to the Asian Development Bank, Manila (unpublished).

Keating, J. (2007). *Matching supply and demand for skills: International perspectives.* Published by NCVER, 33 King William Street, Adelaide.

Knight, B. (2008). *Vocational education and training in schools and school-based apprenticeships and traineeships 10 years on, VOCAL*, vol.7, 2008–09, pp.130–42, VETnetwork Australia.

Kothari C.R. (2005**).** *Research Methodology, methods and Techniques.* (4th.eds). Wiswaprakashan: New Age international (P) Ltd, publishers.,Dharmesh printers, Delhi.

Kerre, B.W. (1990). The University's Future Role in Vocational Education in Kenya. In Achola, P. Grag, K.,& Kerre, B.W (Eds). *Trends and the Future of University Education in Kenya*. Masaki Publishers, Nairobi.

Kerre, B.W. (1997). Challenges *and prospects in the training of technical and vocational education/Teacher/Trainers in African training of Teachers/ Trainers in technical and vocational education*. UNESCO-UNEVOC studies no 11, Paris.

Kerre, B.W. (2000). *Technical and Vocational Education in Africa: Challenges and*

opportunities in the 21st century. Paper presented to Education Colleges Conference in Cape Town S.A. Moi University, Kenya.

Kerre, W. 2001. *National monograph on TVE in Kenya*. Draft. Paris: IIEP.

King, K. (1996). *Jua Kali Kenya*. James curry, London.

Kitching., & Blackburn, J. (2002).*The nature of training and motivation to train in small firms*.Research Report RR330,Department of Education and skill,HMSO,London.

Klein L.R (1988). *Components of competitiveness.* Science. Pp-241

Lauglo, J. (2005). Vocationalised secondary education revisited. In Lauglo J & and Maclean R (eds). *Vocationalisation of secondary education revisited*. Springer, Netherlands, pp 3-49.Ministry of Education, Republic of Palau.

Little, A. N., & Leach, F. E. (1999). *Development and education,cultures and economics* Dilemas for development.Brighton, UK; Falmer.

Lohmar Kunhle., & Cornelia. (1992). *occupation oriented training and of the federal ministry for economic cooperation of the federal Germany*, bon.education for target groups from informal sector Research reports.

LSDA, (2005).*Skills in the UK: the long-term challenge Leitch Review of Skills*, Interim Report, London, LSDA

Magoha, P. W, (2003). *Multifarious roles of modern Industrial Technical Training.* A Sub-regional Conference paper on Engineering Education. Lagos Nigeria.

Meer. J. (2007). *Evidence on the returns to secondary vocational education*. Economic of

education Review, vol. 26, pp 559-573.

Mugenda, O.M., &. Mugenda A. G. (1999). *Research Methods; Quantitative and Qualitative Approaches*. Acts Press.

NITC, (1988). *The rationalization and harmonization of TVET programmes*, Ministry of Technical Training and Applied Technology (MTTAT), Mombasa, Kenya.

NCVER, (2008b). *Australian vocational education and training statistics: VET in Schools 2005*, NCVER publishers, Adelaide.

NCVER, 2007b, *Australian vocational education and training statistics: Employers' use and views of the VET system 2007,summary*. NCVER publishers, Adelaide.

NIER, (2007)**.** *From School to Work***,** Department for International Research and Co-operationNational Institute for Educational Policy Research (NIER*)*.Tokyo, Japan

Nettle, A. (1986). *A high tech future.* London, England: London University, Institute.of Education

Nielsen, D. (1995). *Trends and Issues in Science Education in South East Asia.* Kenneth King Ed., Science Education and Society: Perspectives from India and South East Asia. IDRC Report 104e.

Oso, W ,Y., & Onen, D, (2002). *A practical guide on how to write research proposal and report.* Options printers and publishers, Kisumu. Kenya Republic of Kenya, (1996). *Kenya Sessional paper No. 2. On Industrial Transformation to the Year 2020*, Government, printer, Nairobi.

Republic of Kenya, (2005*). Sessional Paper No. 1; A Policy Framework for Education, Training and Research. Government Printers, Nairobi.*

Republic of Kenya, (2003). *Kenya Vision 2030: a competitive and prosperous Kenya* . Government Printer, Nairobi, Kenya.

Scott, J.D, Forster, W.T., & Satchwell, R (1989). *Sophisticated technologies, the workforce, and vocational education.* Springfield, IL:Department of a Adult, Vocational and technical Education, Illinois State Board of Education.

Sen, A. (1999). *Development as freedom.* Oxford, UK,Oxford University press.

Savage, E., & Sterry, L., (1990). *A conceptual framework for technology Education.* Reston, VA: International Technology Education Association.

Soren Nielson & Margerata Nikolouska, (2007). *Quality in Vocational Education and Training: Modern Educational Training Policies and Learning Process*. ECU. European Training Foundation Villa Gualino, Viale. Torino

Staron, Jasinsk, & Weatherly, (2006). ***A*** *strength based approach for capability development in vocational and technical education***.** Life based learning, p10, Darlington, NSW. TAFE,NSW.

Savage, E. & Sterry, L. (1990). *A Conceptual Framework for Technology Education. The Technology Teacher, 50*(1), 6-1

Smith C. V. Jnr., (1996). *Engineering Education for Global Competitiveness in the 21st Century.* Proceedings, World Congress of Engineering Educators and Industry Leaders, Paris, July, 1996. UNESCO.

Smith, E. (2000). *One foot in the World place.* Australian training review vol 34 june/may.

Singh M., (1998). School *: Enterprises Combining Vocational Learning With Production.* UNESCO-UNEVOC Publications: Berlin, Germany.

Staron,Jasinsk & Weatherly, (2006). *,Life based learning :A strength based approach for capability development in Vocational and Technical Education.Darlington* NSW. TAFE, NSW.

Tan, Hong W., and Geeta Batra. 1995. "Enterprise Training in eveloping Countries: ncidence, Productivity Effects, and Policy mplications." Washington, DC: World Bank, Private Sector evelopment Department Working Paper 15373.

Thomas, A., Potter, D., & Allen, T. (1992). *Development, capitalism state and the Nation:Poverty and development in 1990s*. Milton Keynes: open University Press.

UNDP, (1998). *Partnership for Development*. New York

UNESCO, (1991). *The role of Technical and Vocational Education and its part in contribution to the efforts undertaken towards basic education for all*. Geneva Conference Twenty sixth session, Paris .

UNESCO, (2005. *Skills for sustainable livelihood, A sub-regional seminar for TVET policy makers and UNEVOC coordinators in central west Africa and east Africa*. Nairobi, Kenya.

UNESCO,(2005). *Draft International Implementation Scheme for the United Nations Decade of Education for sustainable development (2005-2014).* Document 172,EX/11. UNESCO. Paris

UNESCO, (2001). *Statistical yearbook*. Paris: UNESCO.

UNDP, (2002). *Human Development report*. New York. UNDP.

UNESCO, (2006). state of the world cities 2006/7. Grubb W.N (1984). *The bandwagon once more: vocational Preparation for high tech occupation*. UN Habitat Publication: New York USA.

UNDP, (1994). *Human Development Report*. New York

World Bank, (1991). *World Development Report.* Washington..

World Bank, (1991). *Vocational and Technical and education and training world Bank Policy paper*. Washington, D.C.

World Bank, (2000). *African Development Indicators 2000.* The World Bank Washington.

World Bank, (2004). *WDI Data Enquiry*. (Online) Available from hh ://devdata. worldbank.org/data-querry.

World Bank, (2005k). *Implementation completion report on a credit to the Republic of Guyana for the Secondary School Reform project*. Washington, D.C WB.

World Bank, (2006). *world development Report 2007.* http: World Bank.Org/INTWDR 2007-Resource.

World Bank, (2007). Development and the next generation. World Bank, 1818 street Washington D.C.

.

Young, J.A. (1988). *Technology and competitiveness:* A Key to the economic future of the U.S.A. Science.

.

Zuga K. F (1998), Interdisciplinary approach. In W.H. Kemp, 8A.E Schwaller (Eds), *Instructional strategies for technology education*, Mission Hills, C.: Glencoe Publishing Company.

Zymelman, M. (1993). *Assessing Engineering Education in Sub-saharan Africa* The World Bank Technical Papr no. 197, African Department Series, xi.

APPENDICES

Appendix 1: Introductory Letter

Dear Respondent,

I'm a postgraduate researcher from Moi University undertaking a research entitled **'Integration of industrial production skills in the Engineering Training for sustainable development: An analysis of selected technical courses in Tertiary Technical Training Institution in the North Rift."**

The purpose of the study is to investigate the opportunities and constraints of integrating industrial production skills in engineering training. This study will identify critical sectors for improving the efficiency of training in the off-the-job courses system. You are requested to respond to the attached Questionnaire as objectively as possible. The Information you supply will be treated with utmost confidence, without disclosing it to anybody whatsoever.

Thanks for your cooperation

Dan Cheruiyot

Sms-0720662114

Appendix 2: Questionnaires

QUESTIONNAIRE

Introduction.

The objective of this study is to find the capacity of Technical Tertiary Institution to integrate industrial production skills in Electrical and Electronic Engineering training and recommend the way forward.

Instructions.

Respond to the questionnaire by ticking /filling appropriately in the spaces provided.

Data Collected.

Your responses will be absolutely confidential and will not be disclosed to anybody under any circumstance, you're therefore not required to indicate your name anywhere.

Questionnaires

1. Nature of the institution ----------.
2. Indicate your gender male [ ] Female [ ]
3. Your age in years
   - i) Below 20 [ ]
   - ii) 20 - 29 [ ]
   - iii) 30 - 39 [ ]
   - iv) 40 - 49 [ ]
   - v) 50 – 59 [ ]

4. What is your highest level of formal training? (*Tick only the highest*)

   i) Diploma [ ]

   ii) Higher Diploma [ ]

   iii) Degree [ ]

   iv) Masters Degree [ ]

   v) Others (specify) _____

5. How many years have you been teaching?

   i) 0 – 5 [ ]

   ii) 5 – 10 [ ]

   iii) 10 – 15 [ ]

   iv) 15 – 20 [ ]

   v) 20 – 25 [ ]

   vi) Above 25 [ ]

6. What is the total number of the teaching staff in the department of Electrical Engineering?

   Number of Electronic Lecturers _____

   Number of lecturers teaching Electrical_____

7. What is the distribution of your electrical &Electronic engineering teaching staff in terms of Academic Grade?

Qualifications	Numbers
Diploma	__
Higher Diploma	__

Degree __

Masters __

PhD __

Any others (specify) _____ __

8. State the number of technicians /workshop assistants in the department of Electrical/Electronic engineering. [_____]

9. What is the basis for determining the number of technicians/workshop assistants?

i) The number of workshops/laboratories available. [ ]

ii) the number of classes. [ ]

iii) Diversity of programs. [ ]

iv) Practical sessions per course. [ ]

v) any other (specify) _____

10. What is the nature of skills provided for in the curriculum and taught in the electrical engineering department?

i) Generic skills [ ]

ii) Principles of Equipment Operations [ ]

iii) Practical Industrial production skills [ ]

iv) Skills to demonstrate Electrical and Electronic Principles [ ]

v) Others (specify)_____

11. What would you suggest should be integrated in the curriculum in order to Orient the training into the world of work (self or wage employment)?

i) Industrial production skills be integrated in the training Curriculum [ ]

ii) Review the curriculum to reflect occupational based skills [ ]

iii) More time for commercially and industrial based tasks. [ ]

iv) the practical work to include the capacity to service and Repair equipment [ ]

v) Skills related to specific jobs be integrated with generic skills. [ ]

vi) Any other (specify) _____

12. a) In your opinion do you consider the practical skills taught adequate and relevant to the Industrial needs for occupational activities (self or wage)?

Yes [ ] No [ ]

13. In your own judgment, Rank the following according to the areas in which electrical teaching staff are most comfortable in the training?

i) theoretical instruction [ ]

ii) Practical teaching/training. [ ]

iii) Use of machinery and equipment. [ ]

iv) Maintenance of equipment. [ ]

v) Linking practical skills to production skills. [ ]

14. In your opinion, in which areas do your electrical/electronic lecturers need further Training for effective teaching? (**In your own judgement rank the areas suggested below)**

i) practical and technical knowledge. [ ]

ii) Equipment maintenance skills [ ]

iii) Industrial production skills [ ]

iv) Industrial experience. [ ]

v) management training. [ ]

vi) Others. (Specify) _____

15. In your opinion, which of the following measures would most improve the training offered in your institution*? (In your own judgment rank the following measures suggested;1-Highly preferred ----6 Least prefered)*.

i) Improve equipment. [ ]

ii) Improve training materials. [ ]

iii) Upgrade the trainers. [ ]

iv) Improve library services. [ ]

v) Establish closer relationship with industry. [ ]

vi) More utilization of equipment.

vii) Review curriculum to integrate practical industrial production skills.

viii) any other. (Specify)_____

16. Does your institution/ department of electrical engineering at times use part-time Lecturers from industry for teaching.

Yes [ ] No [ ]

If yes specify the areas. i) _____

ii) _____

17. In your own judgment what is the approximate ratio of the time spent on practical and the time spent on theory per week?

	Diploma	**Certificates**	
		Electrical	**Electronics**
1 parts practical, 3 parts theory	[ ]	[ ]	[ ]
2 parts practical, 2 parts theory	[ ]	[ ]	[ ]
3 parts practical, 1 parts theory	[ ]	[ ]	[ ]
1 part skill demonstration, 3 parts theory	[ ]	[ ]	[ ]

Any other (specify) _____

18. What workshops are available in your Electrical/Electronic department for training purposes?

i) _____

ii) _____

19. a) How well equipped are your workshops?

i) Well equipped with adequate training equipment [ ]

ii) Spacious workshops without equipment [ ]

iii) Equipped with old and unserviceable equipment [ ]

iv) Equipped with adequate modern training equipment [ ]

v) Equipped with furniture for theoretical class work [ ]

iii) Equipped with machines and instruments Suitable for Industrial/ commercial production for goods and services [ ]

iv) Any other _____

20. Other than the use of workshop facilities for teaching purposes indicate other use (s) of the workshops. (*Tick appropriately what describes the situation*)

i) Idle when there are no workshop practice. [ ]

ii) As instructional rooms [ ]

iii) For industrial production of goods and services [ ]

iv) Maintenance, repairs and services (as plant maintenance site) [ ]

v) Hired out to other institutions for training [ ]

21. In your own opinion,what is the state of equipment in the workshops as compared with those used in industry? Modern [ ] Outdated. [ ]

22. what do you consider as the challenges of preparing the trainees practically for the world of work? In your own judgment rank the following suggested challenges

i) Insufficient workshop facilities for practical training [ ]

ii) Lack of training equipment in the available workshop space [ ]

ii) The availability of modern equipment relevant to the demand of Industry is not feasible. [ ]

iv) Lack of the capacity to maintain, repair and service the equipment. [ ]

iv) Insufficient financial resources to service the equipment [ ]

vi) Scarcity of resources to purchase new equipment and Replace the outdated training facilities. [ ]

vii) The technology being passed on doesn't merge with the Emerging industry based technology. [ ]

23. What do you consider as the strategic step your institution should take in order to prepare the trainees for the world of work? (Rank *the following in what you consider to closely describes your suggestion*)

i) Upgrading of training skills/techniques to supersede/ merge with modern equipment and the advancing technological skills.

[ ]

ii) Acquisition of modern equipment for training (upgrading workshop equipment); that is to provide more equipment.

[ ]

iii) Construction of additional modern workshop space and acquisition of modern Equipment/machines for training. [ ]

a. Review of curriculum to integrate industrial production skills

[ ]

b. Integrate practical industrial production skills in the training

[ ]

c. Put in place machines/equipment maintenance system.

[ ]

d. Replace industrial attachment with workshop based industrial productions to enhance production skills. [ ]

e. Diversifying the nature of workshops to cater for diverse technological skills (digital, electronics, installations, machines) [ ]

f. Transform the curriculum to allow more time and lay more emphasis on practical work as opposed to the current method of raining mode dominated by skill demonstration.

[ ]

g. Re-equipping of Human Resource with latest technological skills

[ ]

24. Other than the use of workshop facilities for teaching purposes indicate other use (s) of the workshops. (*Tick appropriately what describes the situation*)

Idle when there are no workshop practice. [ ]

i) As instructional rooms [ ]

ii) For industrial production of goods and services [ ]

iii) Maintenance, repairs and services (as plant maintenance site)

[ ]

iv) Hired out to other institutions for training [ ]

v) Any other (specify)_____

25. Do you offer short term tailor made industrial courses in your institution/Department?

Yes [ ] No [ ]

ii) If YES indicate the courses you offer.

_____

26. Do you consider specific skilled commercial and industrial based courses essential for Integration in the curriculum you offer in the department training?

Yes [ ] No [ ]

Support your response above with reasons.

i) _____

27. Integration of industrial production skills in engineering training is a model suggested in this study to enhance quality technical training. What would you recommend for improvement in the department to facilitate the adoption of the suggested model for quality technical training? (In your own judgment rank the following *suggestions/recommendations you consider to be undertaken in your department to accommodate the proposed training model.)*

i) Establishing of linkages with industries and involve the in training [ ]

ii) Acquisition of modern equipment for production [ ]

iii) Diversification of workshops to cater for specialized skills [ ]

iv) Build modern workshops and laboratories . [ ]

v) Improve staff training skill capacity. [ ]

vi) Expose the staff to industrial production skills and industrial practices. [ ]

vii) Integrating industrial production skills in the curriculum [ ]

viii) Creation of industrial production centre in the institutions. [ ]

28. In your opinion asses the overall resource capacity of the engineering training in your institution according to the following scales.

1=Excellent , 2.=Very Good ,3.= Good ,4.= Fair , 5=. Poor, 6. = Very

Poor

	1	2	3	4	5	6
1. Teaching materials	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
2. Laboratory facilities	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
3. Workshop equipment	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
4. Library facilities	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
5. Trainers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
6. Technical Support staff	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

29. Does your institution/Department send students for industrial attachment/placement Yes [ ] or No [ ]

ii) If yes, for how long? _____

30. what do you consider as the major benefit of industrial attachment or placement In your own judgment rank the following suggested benefits.

i) Provide a link between training institutions and the industries [ ]

ii) Students learn new skills and gain experience. [ ]

iii) It provides specific work based learning [ ]

iv) Potential employees are exposed to (potential) prospective employers [ ]

v) Cultivate interest in trainee towards the world of work in appreciation of the Training [ ]

vi) Trainees are exposed to new life situations [ ]

vii) It concretizes the skills and principles learnt in classroom [ ]

viii) Exposes the trainees on entrepreneurial skills. [ ]

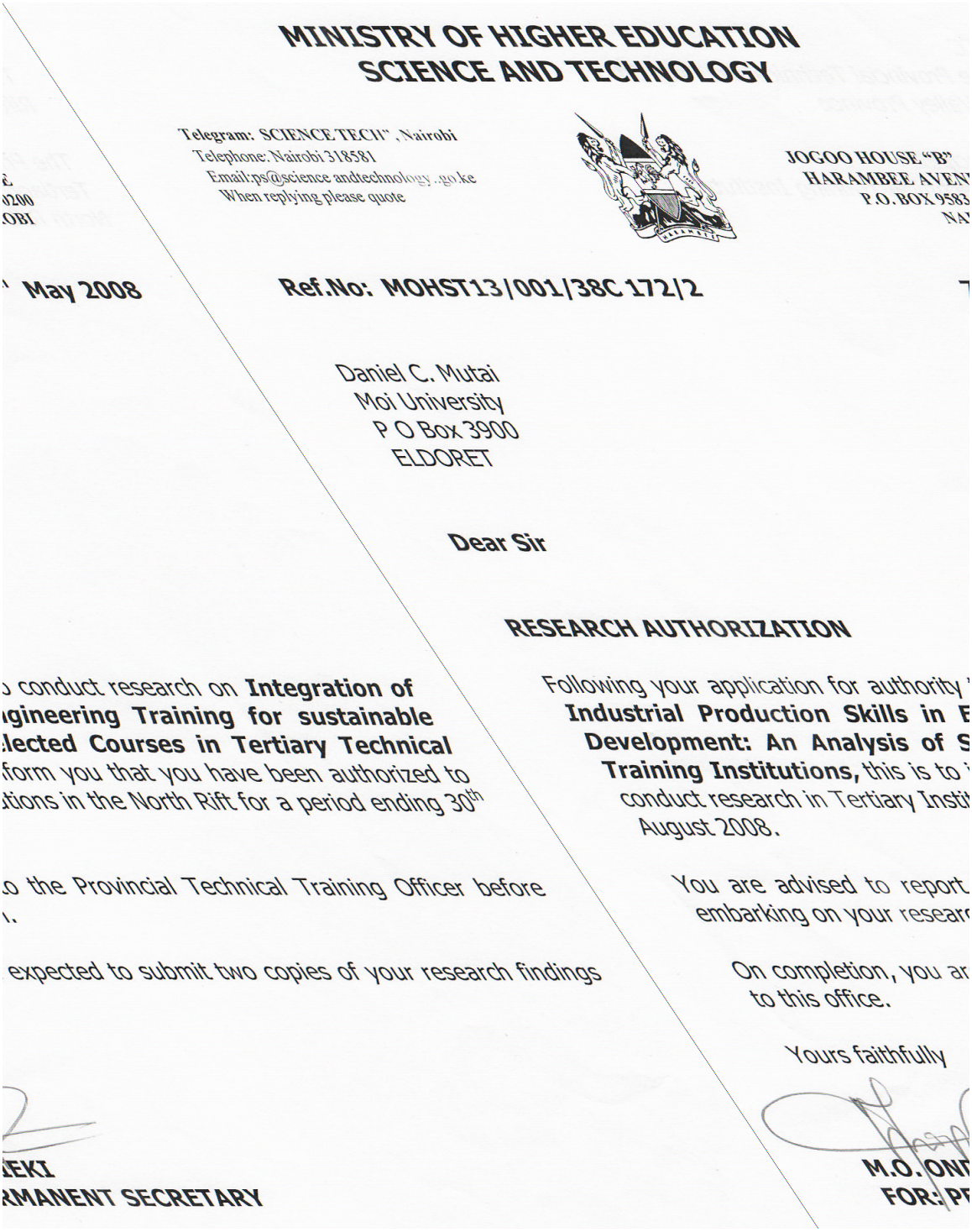
ix) Guides the institutions on the latest equipment/machines to be acquired for Training [ ]

x) Its a provision for trainees to learn industrial production skills [ ]

Thanks for your cooperation

END

Appendix 3: Research Permit



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0200
OBI

May 2008

Ref.No: MOHST13/001/38C 172/2

Daniel C. Mutai
Moi University
P O Box 3900
ELDORET

Dear Sir

RESEARCH AUTHORIZATION

o conduct research on **Integration of**
ngineering Training for sustainable
lected Courses in Tertiary Technical
form you that you have been authorized to
tions in the North Rift for a period ending 30th

Following your application for authority
Industrial Production Skills in E
Development: An Analysis of S
Training Institutions, this is to
conduct research in Tertiary Insti
August 2008.

o the Provincial Technical Training Officer before
.

You are advised to report
embarking on your researc

expected to submit two copies of your research findings

On completion, you ar
to this office.

Yours faithfully

EKI
RMANENT SECRETARY

M.O. ONI
FOR: PI

Appendix 4: Pearson Correlations

Table 4.9: Pearson correlation coefficients

Correlations

		CAPACITY	MATERIAL	LABORATO	WORKSHOP	LIBRARY	TRAINERS	TECHNICA	LECROOMS	FUNDING
CAPACITY	Pearson Correlation	1.000	.507**	.670**	.945**	.947**	.362*	.532**	.855**	.899**
	Sig. (2-tailed)	.	.001	.000	.000	.000	.017	.000	.000	.000
	N	43	43	43	43	43	43	43	43	43
MATERIAL	Pearson Correlation	.507**	1.000	.449**	.494**	.520**	.770**	.773**	.551**	.535**
	Sig. (2-tailed)	.001	.	.003	.001	.000	.000	.000	.000	.000
	N	43	43	43	43	43	43	43	43	43
LABORATO	Pearson Correlation	.670**	.449**	1.000	.709**	.635**	.243	.357*	.573**	.602**
	Sig. (2-tailed)	.000	.003	.	.000	.000	.117	.019	.000	.000
	N	43	43	43	43	43	43	43	43	43
WORKSHOP	Pearson Correlation	.945**	.494**	.709**	1.000	.895**	.342*	.503**	.808**	.850**
	Sig. (2-tailed)	.000	.001	.000	.	.000	.025	.001	.000	.000
	N	43	43	43	43	43	43	43	43	43
LIBRARY	Pearson Correlation	.947**	.520**	.635**	.895**	1.000	.382*	.562**	.903**	.949**
	Sig. (2-tailed)	.000	.000	.000	.000	.	.011	.000	.000	.000
	N	43	43	43	43	43	43	43	43	43
TRAINERS	Pearson Correlation	.362*	.770**	.243	.342*	.382*	1.000	.681**	.424**	.403**
	Sig. (2-tailed)	.017	.000	.117	.025	.011	.	.000	.005	.007
	N	43	43	43	43	43	43	43	43	43
TECHNICA	Pearson Correlation	.532**	.773**	.357*	.503**	.562**	.681**	1.000	.622**	.592**
	Sig. (2-tailed)	.000	.000	.019	.001	.000	.000	.	.000	.000
	N	43	43	43	43	43	43	43	43	43
LECROOMS	Pearson Correlation	.855**	.551**	.573**	.808**	.903**	.424**	.622**	1.000	.951**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.005	.000	.	.000
	N	43	43	43	43	43	43	43	43	43
FUNDING	Pearson Correlation	.899**	.535**	.602**	.850**	.949**	.403**	.592**	.951**	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.007	.000	.000	.
	N	43	43	43	43	43	43	43	43	43

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

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

NB: Resources with the asterisk **are also significant at 0.05 level.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
AGE * EXPERIENCE * EDUCATION	43	100.0%	0	.0%	43	100.0%