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Female Participation in Technical, Vocational Education and Training Institutions (TVET) Subsector: The Kenyan Experience

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Abstract
Economists widely agree that there is a high positive relationship between education and development. This relationship is even more pronounced when women receive education as it not only benefits them but also all those they nurture. Despite the progress made over the last decade in enhancing access, equity, retention, quality, completion rates and gender parity in education and training in Kenya, the Technical, Vocational, and Education Training (TVET) subsector continues to experience low female enrolment in Science, Technology, Engineering and Mathematics (STEM) based courses. This paper is a desk-review focusing on establishing the status of female participation in TVET and factors contributing to the prevailing status –quo. The paper recommends that encouraging and supporting fair and equal opportunities for girls and boys to perform in TVET -related subjects at school would translate to more girls and women in TVET fields of study and even to the world of work. There is also need for the educators to use more gender-responsive approaches at all levels of education; increase role models such as more female teachers and attach young female scholars to practicing women engineers in the country. At policy level, gender responsive strategies such as having a certain percentage of girls being admitted and encouraged to do technical-based subjects in form one every year are some of the interventions that may help shield this vulnerable group from persistent exclusion from TVET education.
Keywords: Female participation, TVET, , inequality, STEM.

1. Introduction

Technical and Vocational Education and Training **(**TVET) leads to improved quality of life since it helps individuals to become economically productive and thus escape poverty and marginalization. When individuals are equipped with skills, they become entrepreneurs, employable and informed citizens thereby contributing to economic development of a nation (Anaele, Isiorhovoja, Dele &Asoluka, 2014). Therefore, human resource development through TVET not only contributes to economic development and reduction in unemployment, but also leads to enhancement of social inclusion. It is estimated that women total to one half of the world's population. Additionally, they represent two thirds of the world workers, but, ironically, earn one tenth of the world's income and own one hundredth of property (Adelakun, Oviawe, &Barfa, 2015. These inequalities can be linked to unequal access to training opportunities. For instance, a study conducted in Nigeria found out that female participation in TVET and Science, Engineering and Technology (SET) show that females are still underrepresented and occupy the middle and lower status, in spite of the recent steady progression from this status over time (Udeani, &Ejikeme, 2011). This is confirmed by another study which reported that a large number of women are found mainly in poorly paid jobs and several others go into early marriages, prostitution and child labour (Adelakun, Oviawe, &Barfa, 2015). Further still, a study by UNESCO (2010) concurs with this by pointing out that male students outnumber the female students in 91 per cent of countries globally, despite increased parity in enrolment in higher education and in Science Technology Engineering and Mathematics disciplines. Moreover, in the developed world, countries such as United Kingdom experience low rates of female participation in STEM related subjects and occupational choice (National Academies Press, 2007).This gap is attributed to gender bias in the curriculum, classroom pedagogy and failure by the system of education to offer support for development of self-esteem, confidence and aspiration of female learners at the formative stage (Johnsen& Kendrick, 2005 cited in Watermeyer, and Stevenson, n.d.). Female underrepresentation in TVET is therefore an issue both in developed and developing countries, Kenya included. Despite progress made over the years, many gaps, barriers and inequalities still persist, hence making this paper critical in analyzing the level of female participation in TVET within the Kenyan context and suggest solutions.

Technical, Industrial, Vocational, and Entrepreneurial Training (TIVET) is the Kenyan version for the globally known TVET (hereafter STEM and SET on one hand and TVET and TIVET on the other will be used interchangeably). Similarly, this subsector continues to play a crucial role in social -economic development of any nation (Seng, 2007). Educated and skilled people spur the economic growth and development. The widely recognized role of TVET was to furnish skills required to improve productivity, raise income levels and improve access to employment opportunities (Bennell, 1999). Moreover, developments in the last three decades have made the role of TVET more pronounced in the globalization process, technological change, and increased competition due to trade liberalization. This necessitates the requirements of higher skills and productivity among workers in both modern sector firms and Micro and Small Enterprises (MSE). Manda,

Mwambu&Kamenyi, (2002) and Nyerere (2009) agree that TVET delivers core entrepreneurial, communication, financial and leadership skills which translate to increased wage and self employment opportunities.

Kenya recognizes the role of education and training in contributing to the Gross Domestic Product (GDP) with particular emphasis on TIVET (Republic of Kenya, 2003). The subsector has been identified as one that will be able to spur economic development within the next 13 years and help achieve Vision 2030. To this end, the paper pays attention to the level of female participation in TVET in Kenya. Importantly, TVET is the foundation of any sustainable technological development (Medugu&Bappah, 2013). It helps in human capital development of any nation and is regarded as workforce education that facilitates the adjustment of the skills and knowledge to the changing demands of the society. Technical and Vocational Education and Trainingis essential to the world of work and is an effective means of empowering the society to engage in productive and sustainable livelihoods (Simiyu, 2009). Recently, Kenya revitalized the subsector in order to locate herself strategically in the international scene (Republic of Kenya, 2012). Notably, this may not be achieved while women are lagging behind their counterparts in technical courses and fields.

Provision of TVET education in Kenya takes place in different technical training institutions including Youth Polytechnic (YPs), National Youth Service (NYS), The Kenya Technical Teachers College (KTTC), Institutes of Technology (IT), Technical Training Institutes (TTIs) and in some universities. In addition, some ministries like the Ministry of Agriculture have vocational training centres. Currently, Kenya has two fully chartered technical universities offering degrees in TVET disciplines with a range of technical training relevant to the manufacturing industries (Republic of Kenya, 2005, Nyerere, 2009; JAB, 2011). According to Nyerere (2009) and JAB (2011) female enrolment in Science, Mechanical and Technological related courses in TVET institutions are extremely low. In 1998, it stood at only 1.4 percent in Mechanical Engineering, 4.4 per cent in Electrical and Electronic Engineering, and 5.0 per cent in Building and Civil Engineering (Republic of Kenya, 2007). The concern is why there are few women as opposed to men pursuing STEM related courses.

Some of the challenges facing the TVET sector in Kenya according to Sessional Paper No. 14 of 2012 include an insufficient number of trainers with pedagogical competency and inadequate number of TVET centres. Other challenges include poor geographical distribution of TVET institutions, negative perception of TVET among the high school students and the general Kenyan population and low enrolment of females in SET courses. There is also lack of policies on gender mainstreaming as pointed out during the national workshop organized by the Ministry of Higher Education, Science and Technology in May 2008 (UNESCO-NCST Report, 2010). National Commission for Science and Technology (NCST, 2010) further emphasizes on the need for such policies since they promote empowerment, equal and full participation of women in science, technology and innovation activities. Further, the same report notes that underutilization and underdevelopment of women's capacity in science and technology can be traced from their poor performance and participation in Science, Mathematics and Technology subjects right from primary education level. In addition, the report also points out that women have been outperformed by men in TVET (UNESCO-NCST Report, 2010). Therefore, this paper addresses possible reasons and solutions to this persistent low participation of female students in science, engineering and technology in Kenya.

The main aim of TVET sector policies is to provide for quality and inclusive participation in TVET, especially for disadvantaged groups which include learners with disabilities, rural populations and marginalized groups besides. However, improving gender equality in TVET programmes is still riddled with many challenges. The solution to this as noted in Republic of Kenya (2012) is to enhance participation of women in TVET and gender mainstreaming through policies such as affirmative action. Other recommendations made by UNESCO-NCST (2010) include flexible work arrangements and lobbying for scholarships for female students and staff who wish to pursue studies or training in science and technology. UNESCO also recommended the establishment of gender focal points and non-discrimination policies in the work place, equality, institutional strengthening and training in science and development of gender indicators. However, despite the proposed recommendations, low female participation still existed by 2015.

The table below shows the total TVET enrolments by sex from 2010-2014 in Kenya according to the Kenya Economic Survey of 2015. The enrolments comprise of those students in the public TVET institutions in the education sector. Table 1 shows the total TVET enrolment by sex from year 2010-2014.

Table 1. Total Enrolments by Sex from Year 2010-2014

YEAR	2010	2011	2012	2013	2014
Male	41,973	53,58	77,260	88,064	89,765
(%)	(50.78)	(52.66)	(60.50)	(59.49)	(60.59)
Female	40,680	48,173	50,431	59,945	58,377
(%)	(49.22)	(47.34)	(39.5)	(40.51)	(39.41)
Gender Gap	1293	5413	26829	28119	31388
(%)	(1.56)	(5.32)	(21.01)	(19)	(21.19)
TOTAL	**82,653**	**101,759**	**127,691**	**148,009**	**148,142**

Source: ***Economic Survey 2014/2015***

Table 1 shows that the total enrolment in TVET institutions increased from 82, 653 in 2010, to 101,759 in 2014 which amounts to 23% increase. This is followed by an increase in enrolment of 25% in 2011 to 2012, 15% in 2012 to 2013 and 9% between 2013 and 2014. However, the table shows great disparities in enrolments according to gender with males dominating over the years. For example, in 2012, 60.5% of total enrolments in TVET were male while 39.5% were female, in 2013 59.49% were male while 40.51% were female and in 2014, 60.59% were male and 39.41% were female. It is therefore evident that women lag behind with regard to enrollment in technical courses and fields. The gender gap has also been on an upward trend as indicated on the Table between year 2010 (1.56%) to 2014 (21.19%). These statistics underscore the question why female participation in engineering courses persistently remains low. Figure 1 is a further graphical presentation of the enrolment trends by sex from 2010-2014.

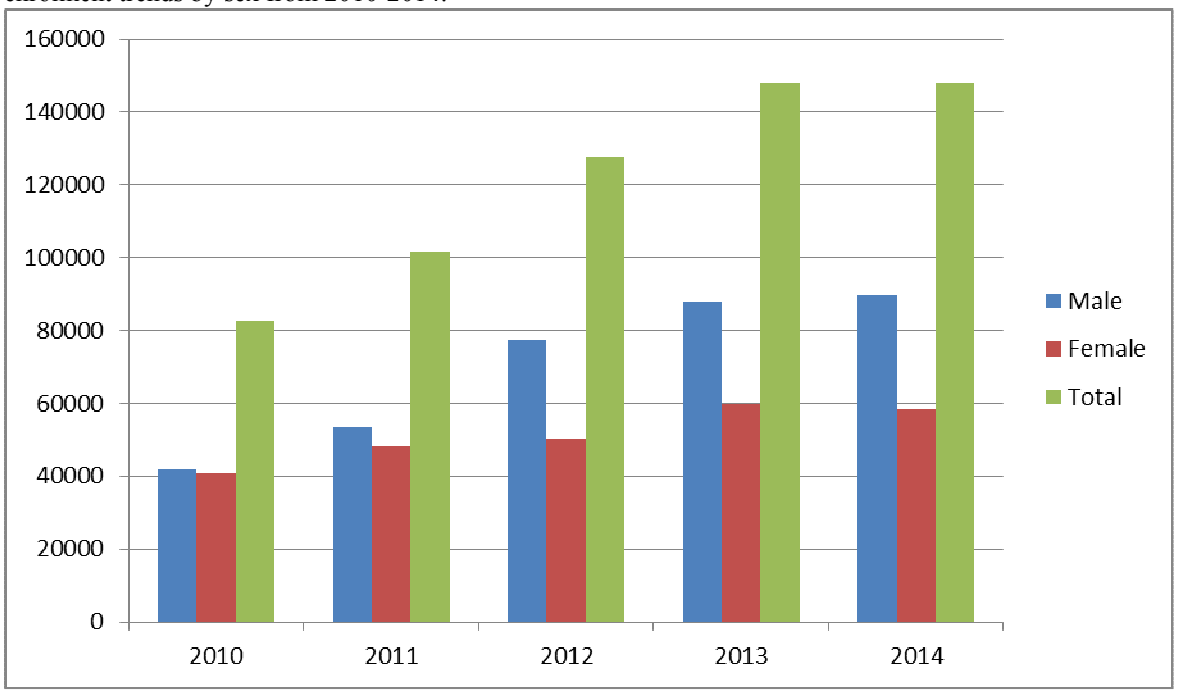

Figure 1: Enrolments in TVET between 2010 and 2014

Figure 1 further illustrates enrolments in terms of sex between year 2010 and year 2014 in form of a graph. It is clear that total enrolments have continued to increase overtime for both males and females. However, the proportion of female as compared to their male counterparts has remained low.

Since, Technical, Vocational and entrepreneurial skills are widely recognized as a hallmark to improved productivity, raised income levels and improved access to employment opportunities, TVET plays a crucial role in social economic development of any nation. The level of participation of female in TVET having remained lower than that of their male counterparts over time is an issue of concern. Therefore, gender inequalities due to various challenges make the focus of this paper pertinent. This is a desk review of various policy documents for Kenya in relation to TVET and secondary data gathered from studies conducted locally and globally. The focus of the paper is to provide the current status of female participation in science, technology and engineering in the TVET sector by documenting historical Development of TVET Policies in Kenya and identify factors influencing the low participation of female in science, engineering and technology courses in TVET institutions in Kenya and globally. This paper also aims at establishing interventions to help shield this vulnerable group by documenting the factors that have contributed to increased female participation in TVET elsewhere, globally.

2. TVET Policies in Kenya: A Historical Account

In pre-colonial period, learning was through traditional apprenticeship where learners observed masters and gradually developed abilities to execute required tasks. This way, a community's knowledge, values as well as practical skill were passed on from generation to generation.

From 1924, the missionaries began introducing formal education to various communities in Kenya as a strategy for their evangelical campaign. The missionaries dominated the provision and administration of education throughout the colonial period (Eshiwani, 1990). They had low regard for African traditional education, a notion that was meant to disorganize the Africans in order to convert them to Christianity. Some of the goals of missionary education aimed at enhancing social stratification (Kiruva, 2002) for the different groups in the country. Hence, education was utilized in preparing people of different races for their appropriate roles in the society. However, this scenario changed with the attainment of independence in 1963 as indicated in a number of commissions of education reviewed in this paper.

Sifuna (1992) also notes that industrial training in basic skills had started by 1921. To facilitate the realization of expanded human resource, the United Nations Economic Commission for Africa and UNESCO jointly sponsored the May 1961 Addis Ababa Conference of African States on Human Resource Development and Training. The conference recommended that Africa's priority in human resource training and development should be accorded to ensuring that an adequate proportion of the population receives at secondary and post-secondary levels the kind of skills required for economic development. Sifuna (1992) however, points out that the above recommendation had its basis on the previous government efforts to emphasize non-formal education, which were elaborated in various forums such as:

1) The International Labour Organization Mission Report on employment, income and equality: a strategy for increasing productive employment of 1972.
2) The recommendations of the National Committee on Educational Objectives Policies of 1975.

Ominde Commission Report of 1964 recommended that the curriculum be revised to make it more relevant to the Kenyan child and emphasized on practical subjects. In order to provide the manpower that was needed, the commission recommended that education should be planned in relation to employment opportunities (Oketch 1992). Technical secondary schools were thus established in the 1960s following the Commission's recommendations. This was initially achieved by converting existing two-year vocational school (Trade schools) into 4- year technical secondary schools from 1966. Moreover, additional institutions were then built across the country to bring the total number to about 20 schools towards the second decade after independence.

In 1976, Gachathi Commission Report addressed the issue of national development and educational objectives. The report raised need to revise the general school curriculum to make it more practical oriented. It also emphasized on the teaching of vocational subjects in the technical agricultural and business fields. A large number of youths who completed primary education and could not find secondary school joined village polytechnics. Those institutions were located close to the rural communities for easy access and provided skilled training to meet the needs of the society. Courses like building construction, trades and auto mechanics and welding were taught. Others included fabrication, electrical wiring, dress making, designing and agriculture among others.

In 1981, the Mackey Commission recommended the establishment of a second university in Kenya that would be technology based, which was a useful step towards rationalizing vocational education and training. Further, the commission recommended far reaching changes to the education structure from 7-4-2-3 to 8-4-4 system of education which was implemented in 1985 and is still the system in place. A major goal of the system was to produce self-reliant individuals who would fit easily into any working condition with emphasize on TVET related kind of education. One of the aims of the 8-4-4 system of education was to provide practical oriented curriculum that would offer a wider range of employment opportunities. The students graduating at every level were expected to have some scientific and practical knowledge that could be utilized for either self-employment, salaried employment or for future training.

The foregoing shows that TVET has a long history in Kenya. The government of Kenya (Republic of Kenya, 1981) further recommended the establishment of technical Training Institute (TTIs) from former technical schools as tertiary institutions for teaching of practical skills to facilitate direct employment, self-employment and employment in the informal sector. A few years later, following another educational review, a report of the presidential working party on education and manpower Training for the next decade and beyond (Republic of Kenya, 1988) stipulated the need to:

a) Expand and streamline vocational and technical training institutions to cater for the training demands of the 8-4-4 system of education.
b) Provide greater opportunities for training primary and secondary school graduates.
c) Produce more categories of trained manpower for the economy.

Globally, the Beijing declaration and platform for action in 1995 had an agenda for empowerment of women. It encouraged gender perspectives in all programs and policies as well as arriving at measures to address

the concern globally. Kenya on the other hand, through the Koech Commission of 1999 observed that there was need to refocus on Technical and Vocational Education and Training. The British government used this type of education to produce critical human resources needed to develop the then Kenya colony.

The Kenya's Sessional Paper No.5 of 2005 proposed a progression structure for TVET that was intended to offer TVET learners equal opportunities to advance to the highest level of learning either through academic or TVET channel. The structure promises a youth polytechnic graduate to climb up to a doctorate level. There are now four technical universities in Kenya which offer degree programmes in TVET field alongside constituent university colleges This is a great milestone as it promises female TVET graduates avenues for progression in training which leads to higher incomes. Figure 2 presents the current education and training organization in Kenya.

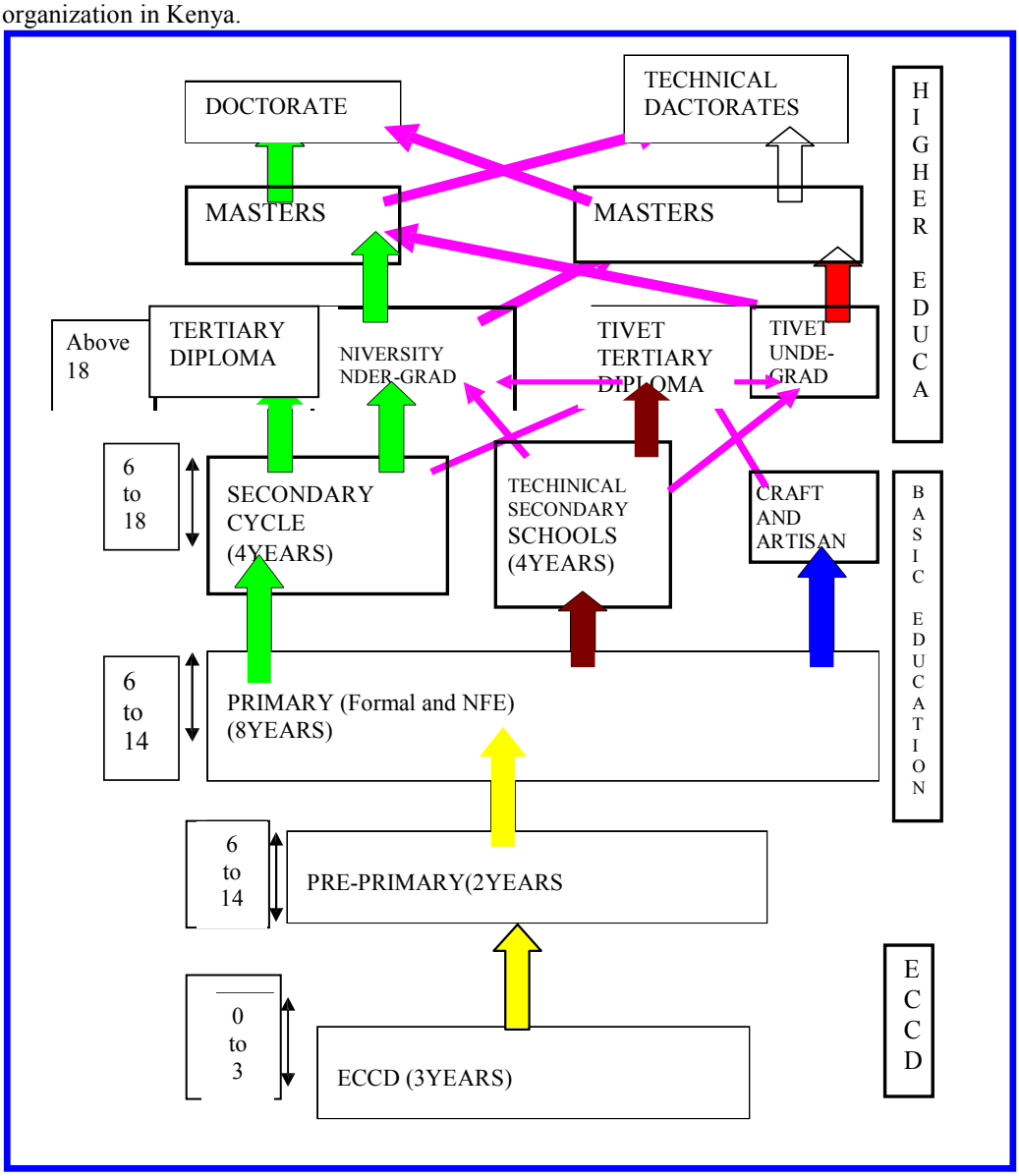

Figure 2. Current Progression Structure for TVET

Additionally, the Kenya's Gender Policy in Education (Ministry of Education, 2007) addresses issues relating to gender and education as well as emphasizing implementing of gender responsive initiatives at the training and research levels. The Kenya Vision 2030 promotes the need for strengthening of education initiatives with focus on science and technology without ignoring the need to improve social welfare and democratic governance (Republic of Kenya, 2007). This social welfare is for both women and men at all levels including the decision making levels. However, this blue print points that despite expansion of equity and access, high disparities in access to education at all levels remain a challenge with severity of the problem being immense in technical, industrial, vocational and entrepreneurship training institutions and at university level. Therefore, increased funding towards technical capabilities of the workforce, as well as raising the quality of teaching Mathematics, Science and Technology in schools, polytechnics and universities is emphasized by the document.

3. Development of TVET Institutions in Kenya

3.1. Enrollment Trends

The growth in number of female enrolments in TVET institutions has been slow. In 1998 female enrolments in technical training institutes stood at only 1.4% in mechanical engineering, 4.4% on electrical and electronic engineering and 5.0% in building and civil engineering (Republic of Kenya, 2007). In 2003, the total enrolments in public TVET institutions in Kenya increased to reach 79,000 (Republic of Kenya, 2004). Female student's enrolment consisted 44% of the total, but there existed serious gender disparities in terms of overall enrolment in science and technology related professions. Majority of female students (52.4%) were enrolled in business studies related courses compared to less than 5% in engineering programmes. Further, Ngerechi (2003) observes that gender participation in TVET enrolment showed that women comprised of 30 % of the total enrollment but only 5% of the 30 % are in vocational areas such as engineering and building construction. Later in 2004, the highest female enrolment in technical training institutes was 45.7%, though still the total number of the enrolled in engineering courses was relatively small. Therefore, female enrolment in national polytechnics had not surpassed 39% between 1999 and 2004, which is arguably far way below average.

Statistics indicate that TVET enrolments in Kenya have increased from 71,167 in 2006 to 82,843 in 2011, representing 16.4 percent rise according to the Republic of Kenya (2011). That notwithstanding, the enrolment in these levels vary, for example, the enrollment in YPs increased by 44.0 percent between 2006 and 2010 and TTIs and ITs increased by 22.63 percent and 20.16 percent respectively during the same period, while NPs and TVET University Colleges declined by 28.35 percent(Muthima,2015). Besides, the gender disparity still persists.

Afeti (2006) an African writer on TVET suggests that technical and vocational education status can be enhanced by upgrading polytechnics as that is the trend world-wide in order to strengthen polytechnic institutions and their role in industrial and technological development. This will as well re-engineer the training programmes for greater relevance and higher quality, and generally raise the status of TVET. The Government of Kenya has decided as well to follow this positive trend of revitalizing polytechnic education and promoting skills training to the highest level possible especially by opening up technical universities. Despite all these efforts, female participation has been wanting. For instance, the enrolments in TVET institutions increased from 71,167 in 2006 to 76,516 in the year 2007. Kenya polytechnic with a student population of 9,922 continued to have the highest enrolments among the national polytechnics, followed by Mombasa polytechnic, while Kisumu Polytechnic recorded the least enrolments. Conversely, at the lower TVET institutional levels, female student's enrolment has been higher than that of males, raising the question as to why more females are at the lowest levels and not in the middle or higher level (Republic of Kenya, 2011).

3.2. Physical Infrastructure

It's noteworthy that there has been quantitative growth in terms of the number of institutions. Sessional Paper No. 14 of 2012 on reforming education and training in Kenya Points out that the country had 2 polytechnic university colleges, 2 national polytechnics, 14 institutes of technology, 1 technical teacher's training college and 26 technical training institutes. They are all under the Ministry of Higher Education and Technology (MoHEST). In addition, there are 697 youth polytechnics distributed throughout the country being managed by the Ministry of Youth Affairs and Sports. However, only 350 of the youth polytechnics receive government assistance. The private sector operates close to 1,000 commercial colleges that offer courses in computer and non-technical areas of training. In addition, the Ministry of Labour and Human Resource Development (MoLHRD) manages three (3) industrial training centres (ITCs), one (1) vocational training centre (VTC), and the Kenya Textile Training Institute (KTTI). There are also other training institutions spread in other Ministries and vocational training institutions under private, commercial, civil society and faith based organizations including some company-based training schools.

3.3 Policy Interventions to Ensure Access and Equity

Further, the Sessional Paper No. 14 of 2012 outlined clearly some of the strategies it hoped to implement as policies for enhancing access and equity in education and training standards of TVET as follows:

a. Establish a central admission service for TVET government sponsored students.
b. Expand TVET facilities targeting national priority sectors
c. Provide TVET training while ensuring affirmative action with respect to vulnerable groups, gender, hard to reach minority and marginalized groups
d. Establish at least one Vocational Training Centre (VTC) at constituency level and at least one Technical College (TC) at county level to increase equity
e. Increase the number of Technical Teacher Training Colleges (TTTC) from one to five, National Polytechnics (NPs) from five to eight and Technical Universities (TUs) to five at the national level;
f. Make training delivery flexible through modular delivery process and, incorporate electronic

technologies in TVET provision;

g. Enhance participation of women in TVET and gender mainstreaming through affirmative action;
h. Provide career guidance and placement services to support students in career planning and guidance;
i. Integrate aspects of Vocational Education and Training at all levels and;
j. Streamline the management of industrial attachment.

Despite the above proposed strategies, female enrolment remains low in the TVET sector. However, most of the above strategies have been implemented. For example, on establishing admission service for TVET government sponsored students, the Kenya Universities and Colleges Central Placement Service (KUCCPS) was established under the Universities Act 2012. In the performance of its functions, the Board seeks to promote equity and access to university and college education, develop criteria for affirmative action for the marginalized, the minorities and persons with disabilities among other services. Additionally, the government is in the process of ensuring that there is a technical institute in each of the 47 counties.

From the foregoing, the female participation in TVET institutions is still low despite all the efforts that have been put in place to change the scenario. However, a few parts of the world have managed to increase female participation in TVET sub-sector of education. This therefore creates the need to establish factors that have led to it with the aim of coming up with suggestions that can be used to improve the situation in Kenya.

4.0. Factors Hindering Female Participation in TVET

4.1. A Global Perspective

The factors that hinder women from participating in TVET related courses are similar for both the developed and developing countries. These factors range from social, cultural, institutional to curricula related factors. To begin with, a multitude of social and cultural norms can influence the choices of young women whether or not to venture STEM fields. Such factors have been identified as one major cause behind the lower proportion of women in STEM fields (UNESCO-UNEVOC, 2010).These social and cultural norms, especially those that are biased against women, can therefore greatly determine their opportunities in access and participation in STEM fields. For instance, there are stereotypes that depict STEM related courses as masculine thus creating an expectation that women should not pursue them. In addition, many cultures still hold on to the stereotype of a woman as a person who is expected to take care of the home and children. This means that even when women are employed, they are expected to balance work and home responsibilities. According to a regional report by the World Bank (2012), social norms, especially with regard to the perceived role of women as caregivers, can impact their chosen fields of study and careers. For instance, the higher rate of women choosing to pursue professions such as teaching may be due to the perception that such professions allow more flexibility to balance family and work responsibilities (World Bank, 2012).

Back at the secondary school level, science subjects which are a prerequisite of joining engineering field, are given the masculine image of science (Moletsen& Reddy, 2011). This indicates that psychosocial construction has defined it as a masculine subject and this begins in secondary school level, before making of career choices. Further up in the world of work, a common perception is that because engineering is a technical area, it is, as such, more suited to males. Hence women are taught to think that they cannot become engineers. This is also as a result of a function of differences in the ways in which boys and girls are treated in our society, whereby girls are expected to be more accomplished in linguistic and social skills, and boys are supposed to be better at mathematical, mechanical and other problem-solving tasks as pointed out by Minton & Schneider, in Nguyen (2000). This stereotyping should be eliminated at all costs. Such perceptions can be countered by having role models and encouraging more females to enroll in these fields. There is also need for teachers to be supportive and encouraging to those female students in TVET related fields. This is because women can particularly bring a different dimension, qualities and skills to engineering, yet at the same time contributing to economic development, an aspect that needs attention.

All these are culture based factors that could negatively affect the participation of women in STEM fields (Moletsen& Reddy, 2011). Additionally, the same study indicates that sexual harassment; the lack of confidence; job stress and burnout; women's Previously Disadvantaged Individual's (PDI) status, gender discrimination and masculine organizational culture greatly contributes to low female participation in TVET related courses.

The working environment is also another factor that promotes lower female participation in TVET fields. The work place can be a stressful environment and lead to lack of confidence among the female workers as a result of lack of acceptance by faculty staff and male counterparts back in college when training (Nguyen, 2000).Nguyen's study was conducted in Australia among Engineering Faculty members of a university which houses the UNESCO International Centre for Engineering Education. The study observed that women often do not feel a sense of belonging, or have not developed the confidence to work, in such a male –orientated environment. Many females find engineering Schools to be stressful environments in which they experience a sense of isolation and a lack of acceptance on the part of the faculty staff and the male students (Nguyen, 2000).

This confirms Moletsen& Reddy (2011) observation that gender discrimination and masculine organizational culture informed by gender-blind workplace policies and casting women into supportive roles is the cause for low female participation in TVET in America. We argue that this is the case in the Kenyan context, in spite of the governments having policies in place to take care of gender mainstreaming. Therefore, this confirms what was opined by another study done in South Africa that the government has failed to make efforts of retaining women in engineering profession which has also contributed to low participation (Lourens, 2014). Consequently, such policies need review and constant monitoring to ascertain that policies in gender mainstreaming are being adhered to as a critical component of changing the present scenario.

Curricular based issues are another dimension which may encourage or disadvantage female students from pursuing TVET related fields. The curricular is designed in a way that it suits male students' needs, hence grossly neglecting the needs for female student. For instance, in India, girls undertaking engineering disciplines admitted that they were slightly handicapped due to less physical strength when working in some of the laboratories and workshops (Nguyen, 2000). Therefore, the curricula should be revised and developed in a way that it favors female students. Note worth is the fact that as a discipline, engineering has been almost entirely isolated from the humanities and has, as such, been taught outside the social context. This is a general failure of the engineering curricula to include topics, concepts and ideas from the humanities perspective (Nguyen, 2000), which would otherwise make engineering more relevant to society as a whole. Therefore, there is need to revise the curricula for engineering courses.

Therefore, at global level, female participation in TVET is affected by psychosocial constructions such as gender stereotyping both at work place and training levels. Other psychosocial constructions include the masculine concept accorded to engineering as well as cultural and social practices. Another challenge is related to the curriculum which lacks concepts and ideas from humanities perspective as already highlighted herein.

4.2. The Kenyan Perspective

Just like many other countries globally, Kenya is yet to achieve gender parity in engineering field. According to Sessional Paper No 14 of 2012; the main challenges facing the education sector in Kenya include access, equity, quality, relevance and efficiency in management of educational resources. Further, there is also limited capacity to cater for access to university and TVET institutions with the aim of reducing gender and regional disparities. As a consequence, female participation in the TVET sector has remained low in Kenya. Studies have shown varied reasons as to why this is the case. Some of these reasons include negative perceptions or attitude towards engineering courses, irrelevant curriculum and lack of facilities among other reasons as discussed elsewhere in this paper.

A study carried out by Githitu (2011) in Limuru, Kenya, captured the attitude of secondary school students towards the youth polytechnic. It also found out that gender, socio-economic background, age as well as the academic performance of the respondent affects his or her attitude towards youth polytechnics. The study revealed that the youth polytechnic (YP) is still important in training for skills that result to establishment of income generation avenues. However, the study found out that most of the respondents had a negative attitude towards the institution brought about by various factors such as the kind of courses the institutions offer. Further, personal aspirations of the respondents and the high value attached to academic education discouraged them from pursuing courses in the institution. In addition, the physical condition of St. Bosco YP and the lifestyle of the trainees have enhanced the negatively biased attitude towards the institution. The study further found out that there were some association found between, socio-economic background, gender and the academic performance of secondary school students and their attitude towards the YP. However, the relationship between age and attitude towards the YP was not significant. Therefore, the study recommended that the YP programme should be strengthened and modernized to cater for both secondary and primary graduates by providing modern tools and equipment as well as the introduction of new courses and trades. It is further noted that the name of the YP should be changed by affiliating it to a University and the institution should also hold open days with the stakeholders as a corrective measure for the negatively biased attitude towards the institution.

Still in another study, Simiyu (2011) investigated factors influencing career choices in institutions in Bungoma County. The study aimed at assessing the influence of physical facilities, gender and job opportunities on career choice. Further, the students' background and government policy on career choices of youth polytechnics were assessed. The study, however, found that peer pressure, gender, and students' background had a higher influence to students' choices compared to other factors like physical facilities and job opportunities. The study recommended that measures be undertaken to reduce the current problems caused by poor career choices which include advising the Ministry of Education to set up bridging courses, workshops and seminars in tertiary institutions. This is aimed at helping the students' project on careers which would match with the job market upon graduation.

The experience for both genders in terms of access to TVET fields of study has generally been riddled with various challenges. Most of the studies have however associated it to low government's funding, which has

a ripple effect on poorly trained teachers, poor of lack of appropriate equipment resulting to inadequately trained graduates to face the industry (Nabwile, 2011;Mbugua, 2012; Kamau, 2013& Ahmed, kisilu and Ooko, 2012). These studies recommend that there is need for putting measures in place so that there is link between graduate outputs from these institutions and the industry, besides increased funding to these institutions by the government.

A study conducted by Muhonja (2012) on factors influencing low female students enrolment in science based courses in tertiary institutions in Western Province, Kenya, showed that curriculum coverage in tertiary colleges is wanting. The study revealed that students did not seem to have covered the syllabus in the past adequately. Majority of them had dealt with much theoretical aspects of the courses and very little practical component were covered. This affected the competence of the locally tertiary level trained graduates. In addition, the socio-economic factors such as fathers' levels of income, income of the parents and the number of siblings were the main socio-economic factors affecting the enrolment in science based courses among the female students. The perception of female towards science based courses was generally positive and many opted for the course because they had confidence in it.

A list of abstracts presented in the Rift Valley Technical Training Institute (RVTTI) 2nd International Conference held on 19-21 June, 2013 (RVTTI, 2014) discloses several studies done in TVET institutions. A study conducted by Makari and Ochierio on youth polytechnics in west Pokot County showed that lack of modern training equipment, inadequate number of qualified instructors, and low enrolments brought about by lack of funds are the key challenges. However, the study recommended that the government should allocate more funding to TVET and that YPS should be upgraded to offer skills for both the formal and modern sector. Additionally, according to Ogola W.O., Thumbi G.M., Ondieki, C.M., Nyagoa, H. &Akumu,C.T. in RVTTI (2014) most of the current challenges includes; gender imbalance, poor remuneration, poor treatment by the professional body and lack of proper training facilities in their study on Re-Orienting Engineering Professional Bodies towards Industrialization for Sustainable Development (SD) in Kenya. The major recommendation was that Kenya should train more engineers, technologists, technicians and crafts persons and artisans in order to achieve vision 2030. In the same book of abstracts, a study done by Serem on the 'Analysis of Gender Enrollment Trends in Youth Polytechnics: a case of Cheptarit Youth Polytechnic' showed that enrollment for courses was based on what was seen by the society traditionally to be for either male or female. Despite the fact that most of the girls traditionally enrolled in home economics and dress making, more of the girls are now enrolling in plumbing, motor vehicle and masonry. Notably, boys were more conservative in doing courses perceived to be for females.

Further, the same list of abstracts themed 'Greening technical and vocational education and training (TVET) for national development' revealed in a study done by Sheila Kasao on 'Women and Technical and Vocational Education and Training in Kenya that women are faced with many challenges in the process of acquiring right skills and knowledge from technical and/or vocational institution (RVTTI, 2014). Such challenges include negative perceptions of TVET, lack of gender mainstreaming strategies for TVET, socio-economic challenges to women's integration into TVET, feeling of physical incapacity, lack of encouragement and prejudices among several others. The study recommended that through reform programmes there is need to design non-gender curricula catering for a variety of potentials hence sustaining the interest of women/girls and men/boys. Moreover, there is need to design a policy to stipulate that students must study at least one technical or vocational subject at all levels of education.

A study done by Lauren (2014) revealed that Career patterns are influenced by a variety of forces, among them, gender-role stereotype. The study had purposed to determine factors influencing female students' enrolment in technical courses. Some of the factors included financial, cultural and sociological factors. Although, the study also showed that girls perform equally well on many technical skills and attitudes assessment in the elementary school years, majority of the respondents in the study indicated that technical courses are masculine and are meant to be pursued by boys. Therefore, what they need are role models to encourage them to pursue the technical courses in their tertiary education programmes.

In conclusion, polytechnics are meant for educating youth on the important technical skills required for development. It is therefore necessary that the public be educated about the usefulness of youth polytechnics as they are not for failures. Curriculum based, institutional related factors, attitude related issues, government policy and inadequate funding of TVET institutions in Kenya are the key factors affecting these institutions. Subsequently, these factors have an influence on the general enrolments of learners in these institutions. However, female participation levels are wanting due to attitude and other social cultural factors such as stereo-typing among other factors as aforementioned in this paper. Conversely, this paper aims at addressing ways of changing this scenario and looking at countries that have improved female participation in TVET institutions.

5. Factors Contributing to Increased Female Participation in TVET

While the participation of female in TVET has been relatively low in comparison to that of male in many parts

of the world, a few countries globally have been successful. These include the Philippines and some parts of Asia such as Malaysia and Mongolia, where a reversed 'gender gap' has been observed as enrolment rates at secondary and higher education, are now higher for girls than boys (UNGEI, 2012 in UNESCO, 2015). For the sake of this study, a few parts of the world are going to be used as examples to show the success stories which may indicate advancements that other countries, Kenya included, may borrow from. Although TVET is a male-dominated field of specialization as found out in a study conducted by UNESCO-UNEVOC (2010); there are some distinct practices that could trigger changes in the enhancement of women's competence in TVET. One of the focuses by this study is mainly on reinforcement of equal opportunity by institutional support systems, community life as well as governmental measures, and programmes that address social and human equality. These include putting the structures and policy framework in place as was observed in the aforementioned successful countries in improved gender parity. Hence, for any country whose aim is to enhance female participation in TVET, establishing policies and the structures aimed at promoting gender equity in this sub-sector is critical. This confirms what was proposed earlier on in this document that there is need to re-design a policy to stipulate that students must study at least one technical or vocational subject at all levels of education (RVTTI, 2014).

At the outset, raising awareness of gender issues at the institutional level of TVET, can achieve greater social benefits to individual students and trainees thereby increasing their human capital, a component that leads to economic development of a country. This is because knowledge and skills are embedded in human capital and are acquired in the social process of learning, which takes place in families, schools, workplaces, local communities and civil society networks. When an individual is affiliated to these entities, they are typical expressions of social capital stock. This confirms what UNESCO (2015) points out that gender inequality has been heightened by socio-cultural and labour market preconceptions. Consequently, human and social capital in these cases can be seen as mutually reinforcing and producing beneficial effects on economic growth, as well as in other crucial areas such as social control, inclusion, health, governance, institutions and democratic empowerment. Hence, when raising awareness of gender issues is addressed at TVET institutional level, then female participation will be enhanced thereby leading to overall improved economic growth of a country. Arguably, the psychosocial constructions due to gender stereotyping and cultural inhibitions can therefore be controlled hence contributing to economic growth and development, a factor that was noted to influence the low female participation in TVET fields in Kenya.

A case study was conducted in Asia on seven countries. These countries include: - Republic of Korea, Viet Nam, Indonesia, Malaysia, Mongolia, Nepal & Cambodia. The study found out that there is a high level of female participation in countries such as Malaysia, Mongolia and the Republic of Korea (UNESCO, 2015). For instance Malaysia recorded overall, higher enrolment and graduation rates of female students than those of their male counterparts with female students representing approximately 63 per cent of total student enrolment across all fields of study as of 2012 (MoHE, 2013). In comparison to other countries, female representation in engineering in the three countries remains better than other countries involved in this study (UNESCO, 2015). The study has attributed these improvements to a number of factors which are discussed herein.

To start with, having more women in TVET fields has been attributed to the high participation level of women in all TVET fields from training through to work environment. Schechter (2010, in UNESCO, 2015), points out that women make up 50-60 per cent employees in computer industry with a majority of them in management levels. This has been attributed to government's commitment to specific policy initiatives and perceptions rooted in social cultural norms since computer industry constitute indoors "profession". Still in the Republic of Korea, there has been a shift where more women are joining STEM fields especially in line with digital revolution (UNESCO, 2010). Lee (2010 as cited in UNESCO, 2015) points out that this is a shift from the traditional belief that cultural factors influence career choice by female to pursue social sciences instead of natural science streams. Therefore, a government's commitment to specific policy initiatives, having role models in not only training but also in managerial positions can amount to great yields in enhancing female participation in TVET. However, to ensure effective implementation of policies related to education, gender and TVET, coordination between ministries should be strengthened as pointed out by UNESCO (2015).

Additionally, gender responsive teaching strategies have proved important in determining the level of participation of both female and male students in TVET fields (UNESCO, 2015). For instance teacher education should be equipped with gender responsive strategies with regards to mathematics and science in order to address the learning needs for both male and female students. Hence, teachers should be able to integrate gender equality through their teaching strategies. This is a factor that has been attributed to improved participation of female in TVET. Therefore, through design and implementation of gender responsive interventions, both male and female students may be able to follow their passion in TVET related fields.

In addition, these countries have observed that the TVET fields' curriculum is very costly; hence unless appropriate funding for equipment and resources is allocated to this subsector of education, students will lack interest and will be less motivated to pursue mathematics and science. Moreover, at school level, every year a

compulsory specific number of form one classes admits girls to do technical subjects so that they can start appreciating the subjects early and proceed with them at higher levels of education. Finally, allowing students to practically apply their learning in real-life situations as well as creative and hands-on experiments enhances quality of learning and increase student's interest in these subjects (UNESCO, 2015). Therefore, there is need for adequate funding for this subsector and affirmative action such as the aforementioned one on admission of girls to do technical subjects. This means that adequate funding and promotion of interest in the subject may increase female participation in TVET.

Elsewhere in Africa, South Africa has made progress in raising the level of participation of females in engineering courses, contrary to majority of the countries in the continent. This was through initiatives to attract and retain female learners into engineering studies whose results have been effective. Interventions such as cooperating co-curricular components into the engineering curriculum helps improve self efficacy and retention in the engineering program (Lourens, 2014). This confirms what (Usman&Gatabazi, (n.d.) point out in a study conducted in Rwanda that there is need to not only promote access of women to TVET, but to also address issues relating to how they are received and accommodated into the program once they are enrolled. This points out on the need to not only encourage and promote enrolment of females into TVET courses, but to also put measures in place to ensure that they are retained till the end of the program through such gender responsive strategies. Hence, gender mainstreaming across all initiative with the aim of ensuring women's equal participation, using specific courses of action will enrich their competence, experiences and potentials in TVET courses which are dominated by males.

In order to make progress in changing gender inequality, more female teachers in STEM-related subjects at secondary level are required. This will enable girls to develop an attitude to be self-motivated and learn independently. There is also need to put measures in place to improve students' and parents' attitudes so that they become more familiar with STEM fields in order to overcome the fear of their daughters obtaining a job in the future (UNESCO, 2010). Other gender responsive action includes teaching strategies and curriculum. This can be achieved through efforts addressing the social, cultural and work environment related factors that contribute to this. Studies indicate that when the girls become more familiar with the knowledge, technology and techniques used, they are even rated higher where intellectual and abstract skills were required in engineering courses. This shows that female engineering students could bring a range of new skills, attributes and attitudes to engineering education (UNESCO, 2010).

There is need to institutionalize affirmative action in institutions of learning and leadership positions in the world of work. Additionally, encouraging female role models and mentors programmes for young females as pointed out by a study done by Udeani&Ejikeme (2011), is also critical. This is also confirmed in the same countries that have reduced the gender gap. The study confirms that educational actions, such as the proportion of female role models in teaching at higher levels of education, as well as gender-responsive teaching strategies, curricula, career counseling and scholarship programmes, play a significant role in addressing gender disparity. Additionally, they have promoted a more balanced representation of women and men in STEM fields (UNESCO, 2015). Therefore, the gender gap that exists in TVET in the Kenyan context can also be reduced if such initiatives are put to practice.

6. Enhancing Female Participation in TVET Institutions

From the foregoing, this paper highlights the following suggestions as to ways of enhancing female participation in TVET institutions. The success of reducing gender gap in TVET is mainly pegged on the governments' initiatives and support. At national level, the individual governments of a country should address the institutionalizing of gender-responsive action in various sectors with focus to improving female participation in TVET. These levels may range from gender responsive strategies in education to the labour market policies. Other strategies may include enforcement of gender-related laws, as well as specific initiatives for advocacy and raising awareness. These are needed in order to attract more girls and women into TVET related fields. The government should also put measures in place to ensure the effective implementation and strengthening of policies related to education, gender and coordination between various ministries. By so doing, this will ensure that both human and social capital is taken care of in relation to support for equal opportunity for both male and female participation in TVET education and subsequently, in economic growth and development.

At educational level, the curricula and learning materials should undergo further rigorous review from a gender perspective to ensure that they do not perpetuate gender stereotypes. This would ideally involve a representative group of stakeholders with male and female experts in order to ensure different perspectives. In addition, gender responsive curricula, teaching strategies, career counseling and scholarship programs would be of importance in promoting gender parity in TVET. This would go along with having ensured that Teacher Education, be they pre- and in-service programmes, is transformed to ensure that teachers are trained in gender-responsive teaching strategies so that female and male students can develop their full potential in STEM-related subjects. Moreover, the curriculum for TVET should be reviewed to include topics, concepts and ideas from the

humanities perspective and incorporate co-curricular components.

Not only should teacher education and policies on recruitment ensure a fair representation of both male and female teachers in all subjects, but also at all levels of education. However, this should not only be confined to education but should also go further and beyond to the workplace. Conversely more focus should be at especially in higher levels of education where students look to their teachers as role models as they begin to shape career perspectives and choices. Moreover, promoting more female role models in TVET fields is critical. By having more female teachers in mathematics and science at the secondary school level, female students and faculty members in higher education, and more broadly by increasing women working in TVET fields, are important strategies to attract girls and women into TVET fields. This should also involve TVET related subjects and programs that later lead to career choice. Therefore, female students need value encouragement to join TVET fields and this will seem a lot more important especially when it is from their peers, teachers, parents or employers. This has effect on their psycho-social dimension which cannot be ignored in relation to promotion of gender participation in TVET field of study. Along with this is the important component of career counseling. This consideration should be structured gender-responsive career counseling programmes in order for both female and male students to have support and objective guidance as they begin to shape their career choices. Therefore the psychosocial dimension needs attention in order to appropriately address the gender gap that has continued to persist.

While there are a lot of concerted efforts towards promotion of gender parity in participation in TVET and STEM related education, without adequate financing of these programs, these efforts would be futile considering the costs associated with this sector of education. Hence, appropriate funding for equipment and resources should be allocated in order to stimulate student interest in mathematics and science, particularly among female students. In addition, allowing students to practically apply their learning in real-life situations as well as creative and hands-on experiments will not only contribute to enhancing the quality of learning but also increasing student interest in learning these subjects. Other gender focused action oriented programs such as Scholarship programmes targeted at girls and women in STEM would also contribute to increased opportunities for young women to pursue further study and eventually careers in STEM fields.

Finally, there is need to address occupational related issues that discourages female participation in TVET related fields. This should be done with the aim of exploring more possibilities for adequate support programmes and initiatives for female TVET professionals that would help to address some of the factors which can cause them to discontinue their careers e.g. family responsibilities. This will also help them be equipped with the most up-to-date knowledge and skills in a field which experiences fast-paced change and innovation. By so doing, not only will there be more women in TVET fields, but they will also be retained in the profession.

7. CONCLUSSION

Kenya has witnessed that the level of participation of females in engineering courses in tertiary institutions is still unsatisfactory. By exploring the female participation in TVET fields, this paper has served to expose the status of female participation in TVET fields as being low. This paper notes that multivariate factors inhibit the greater engagement of women in TVET. They include weak government policy on education; negative attitude attributed to the field; outdated curriculum and mismatch of skills with market demands; gender bias in the curriculum and classroom pedagogy; and failure by the system of education to offer support for development of self-esteem, confidence and aspiration of female learners at the formative stage. Therefore, more work is needed throughout the entire education system, beginning at the primary and secondary levels, to increase the entrance number of females in engineering at the tertiary level. In addition, educational actions, such as increasing the proportion of female role models in teaching at higher levels of education, as well as putting into practice gender-responsive teaching strategies, revision of the curricula, career counseling and scholarship programmes, could also play a significant role in addressing gender disparity and promoting a more balanced representation of women and men in TVET fields. Through design and implementation of gender-responsive interventions, female and male students may be able to pursue fields of study in which they can excel and exert genuine passion in TVET -related education and careers.

Arguably, by stimulating, encouraging and supporting fair and equal opportunities for girls and boys to perform in TVET -related subjects at school, this would translate to more girls and women in TVET fields of study in higher education and the world of work as found out in this study. Furthermore, in the world of work, there is need to institute practical ways of increasing, strengthening and consolidating the recruitment, retention and advancement of women in TVET sector.

Additionally, there is need to refocus on gender responsive strategies at educational level. Teachers need to be more responsive at secondary school level in the manner in which they convey the message about engineering for instance. This should be inculcated during the pre-training of the teachers. This is very instrumental as it involves the introduction of engineering courses. Therefore, the need to be supportive and encourage female students in preparation for and those already studying engineering is pivotal. Additionally, at

tertiary level, more effort needs to be taken in designing engineering curricula to include the humanities and non-technical content and to remove those aspects of curricula that deter women from undertaking engineering courses. Engineering departments should devise more aggressive strategies to attract female students to engineering courses, for instance by organizing special seminars for secondary school students, making themselves familiar with the technologies and processes used, as well as research achievements.

At policy level, engendering education is vital to a nation's development programmes in order to reduce the wide male - female gaps in education. To begin with, this can be done by paying specific attention to gender mainstreaming across all initiatives using specific courses of action in order to ensure women's equal participation. For instance, through role modelling by having more female teachers in TVET subsector and in leadership positions in the work environment, enriching of female competence, experiences and potentials in TVET courses dominated by males is enhanced. Therefore, there is a need for governments to provide more targeted support to attract more girls and women into TVET fields, particularly those in which they are underrepresented. This may be through education and labour market policies, as well as enforcement of laws regarding gender equality. Lastly, the government may also select agencies to ensure that the policy framework is conducive and promising for women entering the TVET sector considering their social expectation so as to enable them balance work and their family responsibilities.

Finally, noteworthy is the fact that Kenya has already instituted many legal and policy provisions geared towards promotion of gender participation in TVET, hence, implementation and monitoring schemes should be reinforced. For instance in the area of networking, more possibilities should be explored to improve and strengthen social capital build-up with various sectors and organizations as a way of addressing various aspects of gender for an inclusive society.

8. RECOMMENDATIONS

Finally, in conclusion, this paper recommends the following ways of enhancing female participation in TVET fields:-

- Ensuring that educators, that is- teachers and trainers, are equipped to take more gender-responsive approaches at all levels of education and in workplace environment.
- Stimulating interest among female students in TVET-related subjects at quite an early stage in secondary school level for instance through having more female teachers as role models.
- The Ministry of Education Science and Technology (MoEST) should put policies in place to encourage female students to pursue TVET fields at an early stage, for instance, in secondary school level. Such as having policies like introducing a certain percentage of girls to being encouraged to do technical-based subjects in form one yearly. This will enable them to continue in TVET fields at tertiary or higher levels of learning.
- Finally, practicing women engineers should be attached to young scholars in the country for role modeling and mentorship using a specified ratio per individual role model.

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