



CHALLENGES IN THE SUPPLY OF SCIENCE AND TECHNOLOGY EDUCATION TRAINING PROGRAMS IN THE TVET INSTITUTIONS IN NYANZA REGION, KENYA

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Abstract:

The supply of TVET education refers to the amount of education that the stakeholders are willing to supply to its people. The relevance of the supply of TVET education must transform into labour market, which enables people, to renew old skills and develop new ones. The supply of TVET education has been increasing rapidly in relation to meagre resources. The enrollment has been doubling in every five years which is the fastest rate of increase in the world. This has been prompted by the economic growth in respective African countries which needs TVET education. The question is: what are the challenges facing this sector in terms of infrastructure, teachers, students and programmes? The study adopted a descriptive research survey paradigm and the theoretical perspectives are guided by the law of supply of education. The results of the study show that the supply of infrastructure, teachers, students and programmes is inadequate. For example, the adequacy of the training facilities has a mean of 3.175 and a standard deviation of 1.022 also the average score of the respondents' views on the adequacy of teachers in the departments have a mean of 2.93 and a standard deviation of 1.334 while there is an upward trend in the supply of students. The main challenges were: Inability to pay college fees; Poor entry behavior; Market demand; Negative attitude; Inadequate training facilities; Inadequate teaching staff. The study concluded that the supply of science and technology education in Nyanza region of Kenya remains a serious challenge. The study recommended that all stakeholders should increase their participation in marketing the supply of TVET programs for the benefit of the local communities.

Keywords: education; infrastructure; science; supply of education; technology; TVET

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1. Introduction

TVET education is of paramount importance for economic and social development. TVET Institutions of education have the main responsibility for equipping individuals with the advanced knowledge and skills required for positions of responsibility in government, business and the professions (Varghese, 2004). The TVET institutions produce new knowledge through research and serve as conduits for the transfer, adoption and dissemination of knowledge generated elsewhere in the world. They also support government businesses with advice and consulting services. In most countries, they play a very important identity the country and offer a forum for pluralistic debate (Altbach, Rumbly and Reisberge, 2009).

Ferej, Kitainge and Ooko (2012) state that in Kenya, Technical Vocational Education and Training are provided by several government departments in addition to the ministry of higher education. The government has established TIVET Authority, which is the umbrella body that will coordinate all TVET activities. Clearly, there is room for expansion at all levels, as increased access to general education has created a large pool of youth for training in various fields.

Although university education is the preferred choice of a large proportion of the youth, the sheer number of those completing secondary education with minimum entry requirements cannot find places in higher education. TVET institutions remain the alternative choice for most of the youth.

UNESCO (2011) points out that TVET relates to life skills for ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life skills programs.

This study laid emphasis on analysis of challenges facing learners' supply for science and technology education training programs and how to expand skills and broaden access to skills formation.

UNESCO (2010) states that TVET contributes to making education more accessible to teens, young adults and adults through an emphasis on the skills they perceive they need in order to get a job in the near future, rather than in the more distant future. It was, therefore, important to determine the challenges in the adequacy of infrastructure for science and technology education training programs in the TVET institution across Kenya, from the diversity of TVET providers to be able to understand the current situation before seeking for suitable immediate solutions. Despite these observations, determining the challenges in the adequacy of infrastructure for the work-based programs in the TVET institutions seemed not to have been a subject of serious systematic research study by contemporary researchers in Kenya.

This rapid expansion of TVET institutions has led to many challenges in terms of the supply of various programmes offered in the sector. This has prompted new challenges which require reforms in their management and governance styles. The rise of new stakeholders, internal factors, globalization and the rapid pace at which new developments take place is a challenge to these institutions. The response had been rather

slow, to the changing circumstances, and there is an urgent need for them to adjust in terms of the supply of university education (Jowi, 2003).

1.2 Statement of the Problem

Despite increased access to general education in Kenya, which has created a large pool of youth for training in various fields, enrolment is however skewed towards more academic programmes such as ICT, human resource management, accounting and other business courses. Enrolment in the more practical courses such as mechanical, automotive, building construction trades etc. is much lower, despite reforms in the government to support TVET, presenting opportunities for the training institutions to implement their programs.

Given the foregoing, the problem of the study will be to analyze the challenges facing learners' supply for science and Technology Education and Training in post-secondary TVET institutions in the Nyanza Region, Kenya. Nyanza Region is selected for the study for the following reasons: the availability of the subjects (a good number of postsecondary TVET institutions) and to limit the scope of the research topic.

1.3 Purpose of the Study

The study was an analysis of challenges facing learners' supply for science and technology Education and Training in post-secondary TVET institutions in Nyanza Region, Kenya.

1.4 Objectives of the Study

The objectives that guided the study were:

- 1) To determine the challenges in the supply of infrastructure in science and technology education training programs in the TVET institutions in Nyanza Region.
- 2) To determine the challenges in the supply of Teachers in science and technology education training programs in the TVET institutions in Nyanza Region.
- 3) To determine the challenges in the supply of students in science and technology education training programs in the TVET institutions in Nyanza Region.
- 4) To determine the challenges in the supply of programmes in science and technology education training programs in the TVET institutions in Nyanza Region.
- 5) Determine the strategies to address the challenges of the supply of TVET education in Nyanza region.

1.5 The Theoretical Framework

The study was guided by the theory of supply in education. Supply refers to the amount of university education that the state is willing to supply at a different price. Supply depends on the price of output, the number of inputs available and the production function (William, 2006). The law of supply states that other things remain the same

(*Ceteris-Paribus*), the higher the price of a good, the greater is the quantity supplied, (McConnell, 1999). Price (fees) is an obstacle from the standpoint of the consumer (students), who is on the paying end. The higher the price (fees), the less the consumer (students) will buy. But the suppliers (technical institutions) are on the receiving (profits) end of the product's price. To a supplier, price represents revenue and thus is an incentive to produce and sell a product. The higher the price (fees), the greater the incentive (profits) and the greater the quantity supplied (more programmes offered).

Specifically, McConnell (1999) argues that the supply is assumed to be a function of enrolment, the number of staff members, public spending for all levels of public institutions, and public spending to improve physical assets. He emphasizes that, unlike the downward-sloping demand curve, the supply curve will rise upward and to the right because larger tax revenue enables the state government to supply more public goods, including education for its citizens. So, it is assumed that tax paid by people to the state directly relates to the supply of university education. In support Altbach (2007) agree that the number of staff members, enrolments and public expenditures to improve physical assets indicates the extent to which government can supply technical education. Therefore, it is important to anticipate that these three variables are directly related to supplying education. Shultz (1986) supports this by saying that, the state's total appropriations for all levels of public university education institutions, present the size of public expenditure. In these relations, there is a positive relationship between appropriations and the supply of technical education

2. The Literature Review

TVET is the major connecting link between the school system and the employment market, which means that development in TVET is intimately linked to general trends in the economy UNESCO, (1990). Furthermore, the growing dissatisfaction with formal academic education, particularly its failure to provide much-needed skill training for employment, self-reliance and so on, implies that Kenya should evolve some positive economic policy measures to be directed at reviving, reactivating, restructuring and reorganizing the formal sector of the economy to satisfy our needs for technological advancement. It is an indisputable fact that a large number of young men and women do not meet the entry requirements for public Universities. Their only hope of continuing their education would be through middle-level colleges offering TVET programs. This route is currently being developed into one of the ways through which learners may proceed to higher levels of technical training. Some national polytechnics in Kenya offer courses up to the first-degree level. The implication is that planners and policy-makers should design a strategy for TVET programs providing the necessary skills and attitudes that would assist among other things, in making young people more productive and self-sufficient. Following the current international trends in technology, there is a need for all counties to make adjustments to ensure that technological and vocational education is compatible with the contemporary economy.

Ferej, Kitaienge and Ooko, (2012) state that in Kenya, TVET institutions designated as IST were formerly institutions constructed through community efforts and TTIs are the upgraded technical secondary schools. In practice, there is little difference in what IST and TTIs offer which is generally diploma and certificate courses. There is a healthy enrolment of students in these TVET institutions ensuring that they can raise adequate resources to run their affairs. Enrolment is, however, skewed towards more academic programs such as ICT, human resource, accounting, management and other business courses. Enrolment in the more practical courses such as mechanical, automotive, building construction trades etc. is much lower. Youth polytechnics have generally admitted post-primary school learners into courses that culminate in a trade certificate. At present time TVET is provided by several government departments in addition to the Ministry of Higher Education. These include the Ministries of Defense; youth and sports; and labour. The government has developed a blueprint to establish an independent TVET authority that has been approved by the legislature. The umbrella body will coordinate all TVET activities under one organization known as TIVET Authority or in Short TIVETA. Clearly, there is room for expansion at all levels as increased access to general education has created a large pool of youth for training in various fields.

Tale 1: Students Enrolment in Technical Institutions in Kenya, by sex, 2011-2015

Institution	2011*		2012*		2013*		2014*		2015*	
	Male	Female								
Technical universities										
Nairobi	2,360	2,098	1,698	1,024	4,814	2,607	4,432	2,769	3,911	2,517
Mombasa	3,558	1,794	2,190	1,150	3,048	1,506	3,250	1,708	2,835	1,633
Kenya Teachers	-	-	-	-	-	-	858	597	913	1,119
Polytechnics										
Kisumu Polytechnic	1,990	936	2,256	1,136	2,223	1,267	2,926	1,872	2,078	2,422
Eldoret Polytechnic	3,132	2,145	2,730	1,669	3,081	1,947	3,194	1,977	2,189	2,786
Sub-total	11,040	6,973	8,874	4,979	13,166	7,329	14,660	8,923	11,926	10,477
Other TIVET institutions										
Vocational colleges	26,898	21,862	28,153	18,631	31,956	23,989	29,632	21,232	32,221	23,087
Youth polytechnics	15,648	19,338	40,233	26,821	42,942	28,627	45,473	28,222	47,625	29,840
Sub-total	42,546	41,200	68,386	45,452	74,898	52,616	75,105	49,454	79,846	52,927
Total	101,759	101,759	127,691	127,691	148,009	148,009	148,142	148,142	155,176	155,176

*Provisional diploma and certificate courses only.

Source: Ministry of Education, Science & Technology

This study lays emphasis on the analysis of challenges facing learners' demand for science and technology education training programs and how to expand skills and broaden access to skill formation. UNESCO, (2001) states that TVET contributes to making education more accessible to teens, young adults and adults through an emphasis on the skills they perceive they need in order to get a job in the near future, rather than in the more distant future. It is therefore important to determine the challenges in the

supply of science and technology education training programs in the TVET institutions across Kenya, from the diversity of TVET providers to be able to understand the current situation before seeking suitable immediate solutions. Despite these observations, determining challenges in the supply of work-based programs in the TVET institutions seems not to have been a subject of serious systematic research study by contemporary researchers, particularly in Kenya. An attempt to conduct research in this area was made by Nyaberi (2009). He studied Nature and Trend in Enrolment in Technical Training in post-secondary TVET institutions in Kisii Central District. Nkpa (1997) points out that, a literature review should be guided by research objectives or research questions. Thus, the study appeared not to have given attention to challenges in the supply of practical-oriented TVET programs and therefore the findings of Nyaberi's, (2009) research might not be satisfactory to this study. Added to the foregoing, Achieng (2012) also did a study on factors affecting the acquisition of vocational skills among youth learners in Maranda Division Siaya County. Determining challenges in the supply of science and technology education training programs in post-secondary TVET institutions was not given a focus. This left a gap that this study came to fill. Endere's (2012) study was not different from the afore-cited studies, as it did not determine challenges in the supply of practical-oriented courses in the TVET institutions.

3. The Research Design and Methodology

The design of the study was a descriptive survey. Kothari (2004) explains that a research design is an arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. Gray (2009) states that a descriptive survey is a system for collecting information to describe, compare, and explain knowledge, attitudes and behavior. In everyday research terminology, Gatara (2010) states that survey has been used to refer to studies based on sampling. Nkpa (1997) points out that, the concern of a descriptive survey is to either describe and interpret existing relationships, attitudes, practices, processes and trends or compare variables. Surveys are used to ascertain the nature of a phenomenon from a relatively large number of cases. The study involved a large target population and used a number of data collection methods in order to answer the research questions. Cohen and Manion, (2006) state that, a combination of methods compensates for inadequacies that an individual method might have. Krathwohl (2003) recommends the foregoing approach since it gives room for providing answers to a number of research questions thereby being able to provide a more holistic picture of challenges facing learners' demand for the practical-oriented TVET curriculum. The researcher chose the descriptive survey design due to the fact that the studies are limited in geographical scope and hence tend to be logistically easier and simpler to conduct (Mugenda, 2008). Mugenda and Mugenda (2012) state that, in the survey, the investigator focuses on the links among a number of key variables across a sample of cases depending on the resources available and the size of the target population.

4. Results and Discussion

The main focus of the study was to determine the supply of science and technology education training programs in the TVET institutions in Nyanza Region, Kenya. The key for the rating scale is as follows: SA: Strongly Agree = 5; A: Agree = 4; MA: Moderately Agree (Neutral) = 3; D: Disagree = 2; SD: Strongly Disagree = 1. The training facilities whose adequacy the study sought to find as per the status of enrolment were: Workshops; Tools, Equipment and machines; Consumable training materials; Classrooms; ICT rooms; Library; Electric power supply; Water supply and link with the industry. In the interpretation of the level of adequacy of the training facilities, the mean score ratings were broken down into the following four ordinal categories: Very inadequate (0.0 – 2.4); Inadequate (2.5 – 3.4); Adequate (3.5 – 4.4); Very adequate (4.5 – 5.0) (Krishnaswami & Ranganatham, 2011).

5. Supply of Infrastructure for the Programs

The views of the principals in the regard to the adequacy of the facilities are shown in Table 2:

Table 2: Views of Principals' Supply of Infrastructure for Training Programs

Items	SA	A	MA	D	SD	Mean	Std
The workshop spaces available are adequate for practical sessions.	0 (0.00%)	0 (0.00%)	3 (0.00%)	3 (50%)	0 (0.00%)	2.5	0.548
The workshop facility for the accredited courses is adequate for students.	1 (16.7%)	2 (33.3%)	0 (0%)	3 (50%)	0 (0%)	3.17	1.329
Adequate classroom space for accredited TVET practical's.	0 (0.00%)	0 (0.00%)	4 (66.7%)	2 (33.3%)	0 (0.00%)	2.67	0.516
Spacious well equipped ICT room with adequate computers.	0 (0.00%)	0 (0.00%)	5 (83.3%)	1 (16.7%)	0 (0.00%)	2.83	0.408
Spacious well-equipped library with adequate reference materials	0 (0.00%)	1 (16.7%)	1 (16.7%)	4 (66.7%)	0 (0.00%)	2.5	0.837
The institution has a functional industrial liaison office.	5 (83.3%)	1 (16.7%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	2.81	1.266
Skills acquired march labor market skills demand.	0 (0.00%)	4 (66.7%)	2 (33.3%)	0 (0.00%)	0 (0.00%)	3.67	0.516

From Table 2 the study shows that the average score of the principals' views on the adequacy of the training facilities has a mean of 3.175 and a standard deviation of 1.022. This feedback illustrates that the training facilities are inadequate.

6. Supply of Teachers

The students, HODs and Principals were presented with Likert scaled itemed questionnaires whose constructs were related to the supply of teachers. They were asked to indicate the extent of their agreement with the given statements. Their views were summarized in Table 3.

Table 3: Views of Respondents on the Adequacy of Teachers for All the Subjects Offered (Principals' n = 06; HOD's n = 26; students' n = 354)

Items	SA	A	MA	D	SD	Mean	Std
Students' response on – The department has adequate teachers in all the subjects and for all the courses offered.	60 (19.2%)	59 (00.0%)	87 (00.0%)	80 (00.0%)	68 (00.0%)	2.9	1.354
HODs response on – The department has adequate qualified teaching staff for all the subjects offered.	4 (00.0%)	8 (00.0%)	7 (00.0%)	5 (00.0%)	2 (00.0%)	3.27	1.185
Principals' response on – There are adequate qualified teaching staff for all the subjects offered in the departments.	0 (00.0%)	2 (00.0%)	0 (00.0%)	4 (00.0%)	0 (00.0%)	2.67	1.033
Average score of respondents						2.93	1.334

The data analysis shows that 87 of the students (24.6%) moderately agree that the departments have adequate teachers in all the subjects and for all the courses offered, while 80 (22.6%) students disagree with the given statement, 68 (19.2%) students strongly disagreed and 60 (16.9%) students strongly agree. Only 59 (16.7%) students agree with the given statement. The students' responses on the adequacy of teachers in the departments have a mean of 2.9 and a standard deviation of 1.354. This result illustrates that the departments have inadequate teachers for the courses offered.

The study indicates that 08 (30.8%) HODs agree that the departments have adequate qualified teaching staff for all the subjects offered while, 07 (26.9%) HODs moderately agree with the given statement, 05 (19.2%) HODs disagree and 04 (15.4%) HODs strongly agree. Only 02 (7.7%) HODs strongly disagree about the same. The HODs' views on the adequacy of qualified teaching staff in the departments have a mean of 3.27 and a standard deviation of 1.185. This result provides evidence that the departments have inadequately qualified teaching staff, however.

The research shows that 04 (66.7%) Principals disagree that, there are adequate qualified teaching staff for all the subjects offered in the departments. Only 02 (33.3%) principals agree with the given statement. The principals' views on the adequacy of qualified teaching staff in the departments have a mean of 2.67 and a standard deviation of 1.033. This answer depicts that, the teaching staff in the departments are inadequate. Table 2 study data shows that the average score of the respondents' views on the

adequacy of teachers in the departments has a mean of 2.93 and a standard deviation of 1.334. The effect indicates that the teachers in the departments are inadequate.

7. The Supply of Students

To establish the trend of enrolment in the TVET institutions, the Registrars gave the enrolment data for the last seven years (2010 - 2016). This is shown in Table 4.

Table 4: Registrars' Response on Supply of Diploma Technical Programs

The trend in the supply of students						
Year	Building civil Engineering	Mechanical Engineering	Automotive Engineering	Electrical Engineering	Institutional Management	Total
2016	2071	402	365	1546	1115	5499
2015	1528	441	200	1278	996	4443
2014	1287	427	210	1284	1076	4284
2013	1164	535	165	1105	1010	3979
2012	929	374	172	926	782	3183
2011	784	343	156	807	447	2537
2010	527	237	158	737	443	2102
Total	8290	2759	1426	7683	5869	26027

Table 4 shows that there has been a general upward increase in enrolment in all the programs presented over the seven years. The highest enrolment of 5,449 students was achieved in the year 2016 and the lowest enrolment of 2,102 students was attained in the year 2010. Total enrolment rose by 162% from 2102 in 2010 to 5499 in 2016.

8. The Challenges Facing Supply of Students in TVET Institutions

The students were asked to give information about challenges the institutions are facing in enhancing enrolment. The results are shown in Table 5:

Table 5: Students' Views on the Factors Affecting Enrolment

	Frequency	Percent (%)
Inability to pay college fees	69	19.5
Poor entry behavior	68	19.2
Market demand	4	1.1
Negative attitude	26	7.3
Inadequate training facilities	150	42.4
Inadequate teaching staff	37	10.5
Total	354	100.0

Table 5 shows that 150 of the students (42.4%) consider inadequate training facilities as an important factor affecting enrolment for their departments, at the same time 69 (19.5%) students see the inability to pay college fees as an important factor; 68 (19.2%) believe poor entry behavior as an important factor; 37 (10.5%) students count inadequate teaching staff as an important factor and 26 (7.3%) students observe Negative attitude as

an important factor. Market demand is not regarded as an applicable factor as only 04 (1.1%) students gave this response.

The HODs were requested to give their opinion on challenges their departments are facing in enhancing enrolment for their programs. The results are shown in Figure 3:

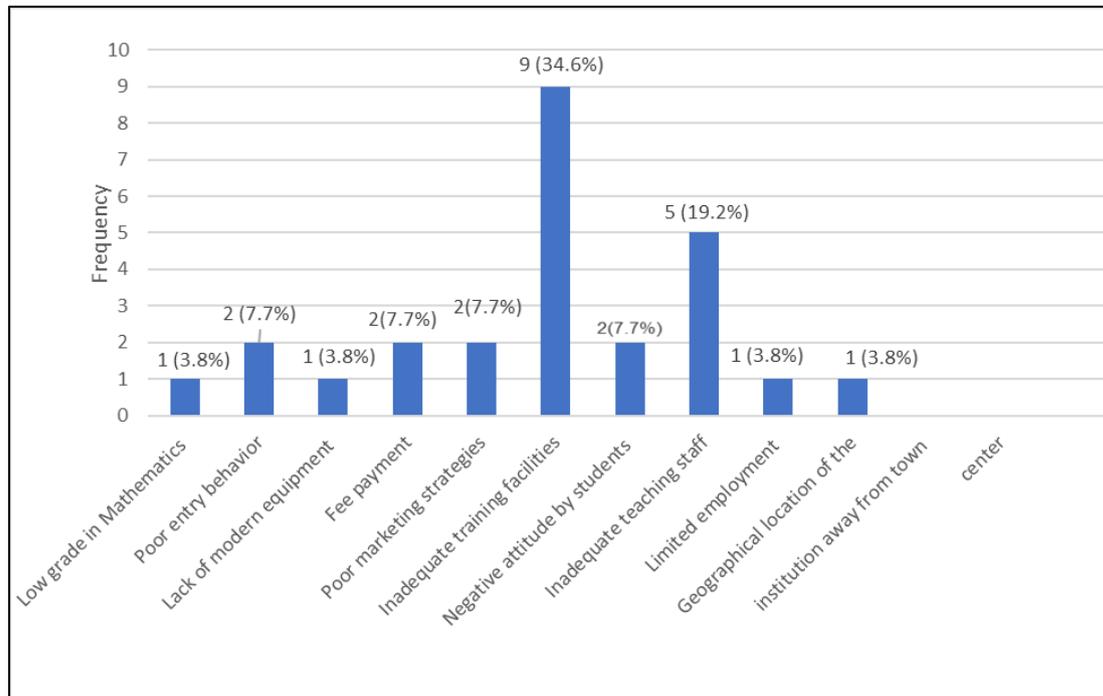


Figure 1: HODs Response to Challenges on Enrolment in the Programs

Figure 1 shows that 09 of the HODs (34.6%) saw inadequate training facilities as an important challenge the departments are facing in enhancing enrolment for their programs, as 05 (19.2%) HODs regard inadequate teaching staff as the challenge; while 02 (7.7%) HODs viewed poor entry behavior as the challenge; another 02 (7.7%) HODs felt fee payment as the challenge; another 02 (7.7%) HODs were of the opinion that poor marketing strategies are the challenge and yet another 02 (7.7%) HODs viewed Negative attitude by the students towards work-based TVET programs as the challenge. Low grades in mathematics and sciences obtained at KCSE; Lack of modern equipment; Limited employment opportunities; and geographical location of the institution away from the town centre is not regarded as applicable challenges as only 01 (3.8%) HODs gave these responses respectively.

The Registrars were asked about the challenges the departments are facing in enhancing enrolment in general in TVET technical training programs in their institutions. The results are shown in Figure 2:

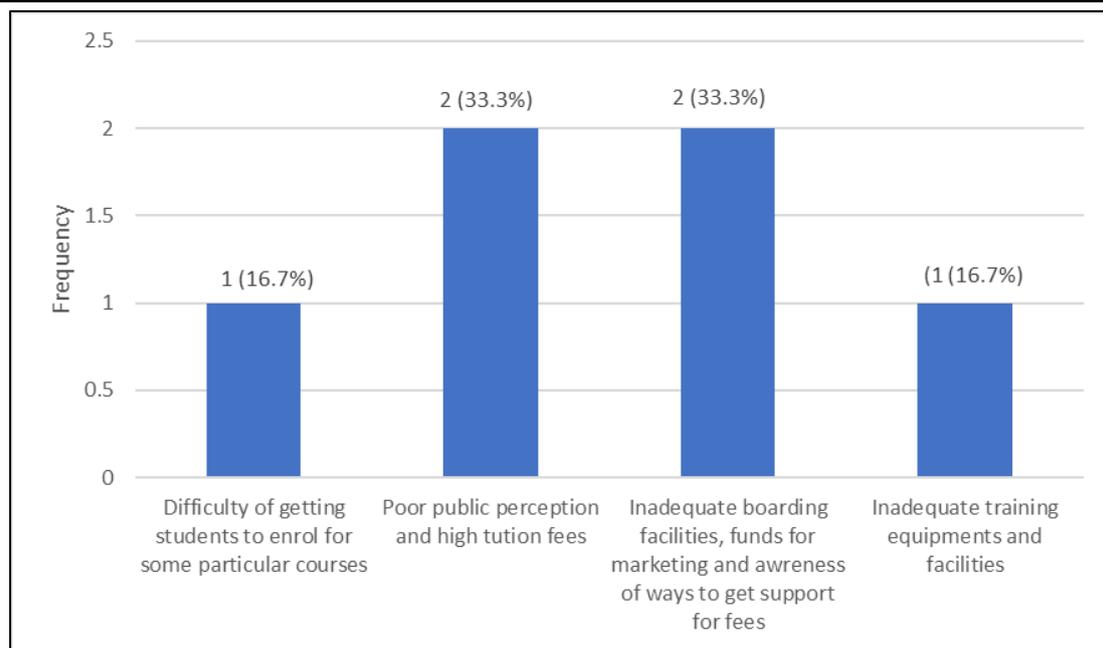


Figure 2: Registrar's Opinion on Challenges on Enrolment in the Programmes

Figure 2 shows that 02 (33.3%) Registrars are of the opinion that, poor public perception and high tuition fees are the challenges the departments are currently facing in enhancing enrolment in general in TVET technical training programs in the institutions while another 02 (33.3%) Registrars consider inadequate boarding, inadequate funds for marketing and inadequate awareness of ways to get support for fees as the challenges. The difficulty of getting students to enrol for some particular courses; and inadequate training equipment and facilities on their own are not counted as applicable challenges facing enrolment as only 01 (16.7%) Registrar gave these responses respectively.

The Principals' views on challenges facing enrolment in the TVET technical training programs in their institutions are as shown in Figure 4. The figure shows that 02 of the Principals (33.3%) consider financial demands as the challenge being faced in enhancing enrolment in the TVET technical training programs. The other challenges cited in the figure are not regarded as applicable as only 01 (16.7%) principals gave those responses respectively.

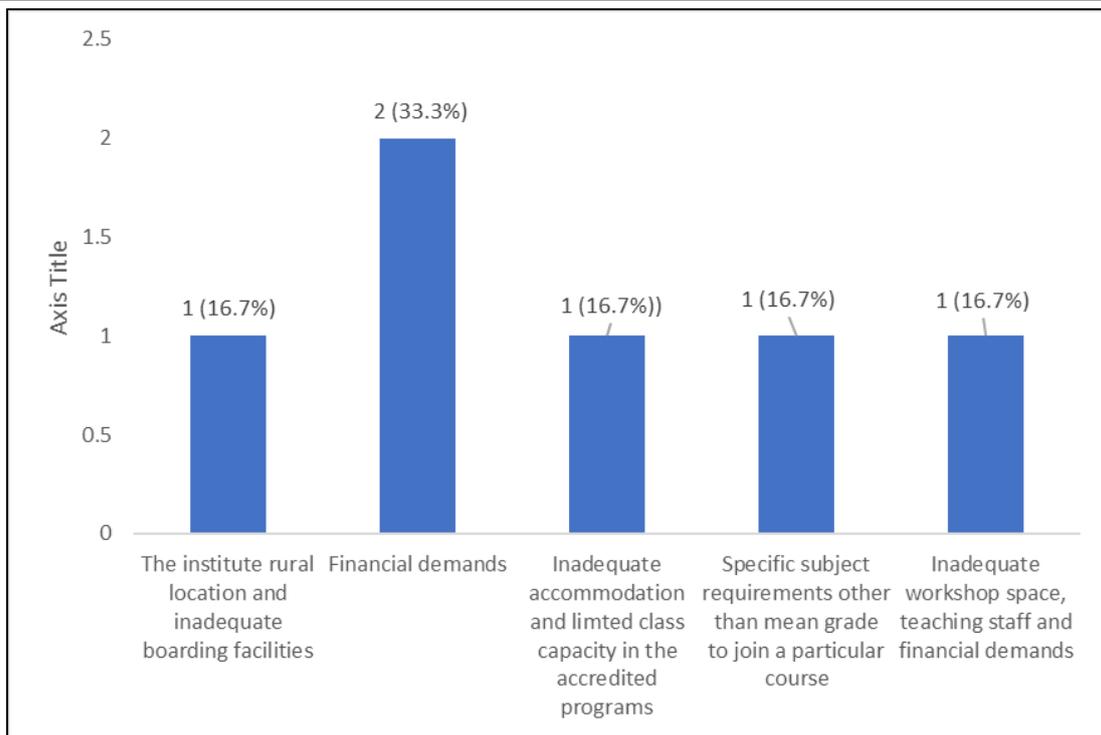


Figure 4: Principals' Views on the Challenges Facing the Supply of Students in the Programs

8. Supply of Programs

All the Registrars indicated that their institutions are offering all the training programs included: Building and Civil Engineering; Mechanical Engineering; Automotive Engineering; Electrical and Electronics Engineering; and Institutional Management. The results are as shown in Figure 5:

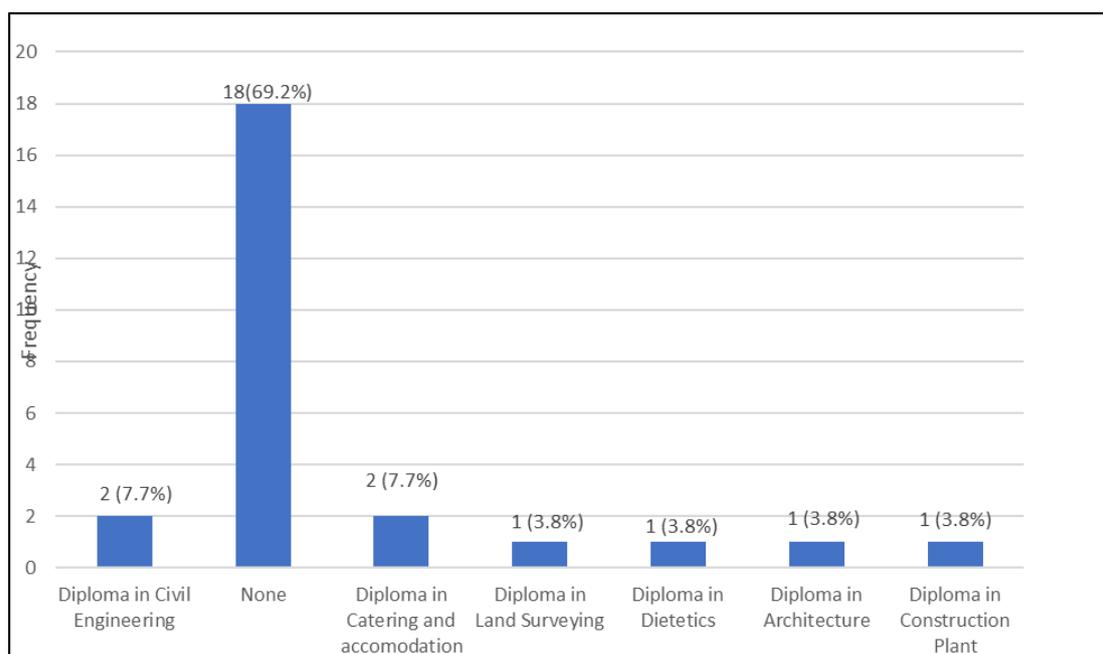


Figure 5: Diploma Technical Training Programs that are Being Offered

Figure 5 shows that 18 (69.2%) HODs revealed that their institutions were not offering any other programs other than the ones shown in Figure 2. While 02 (7.7%) HODs indicated that their institutions are offering Diploma in Civil Engineering and another 02 (7.7%) HODs unveiled that their institutions are offering Diploma in Catering and Accommodation. Very few TVET institutions are offering Diploma in Land survey; Diploma in Dietetics; Diploma in Architecture; and Diploma in Construction plant; as only 01 (3.8%) HODs gave the response in each case.

8. Strategies Adopted to Address the Challenges

The Registrars' responses on how their departments were addressing challenges being faced in enhancing enrolment in general in technical training programs are as shown in Figure 6:

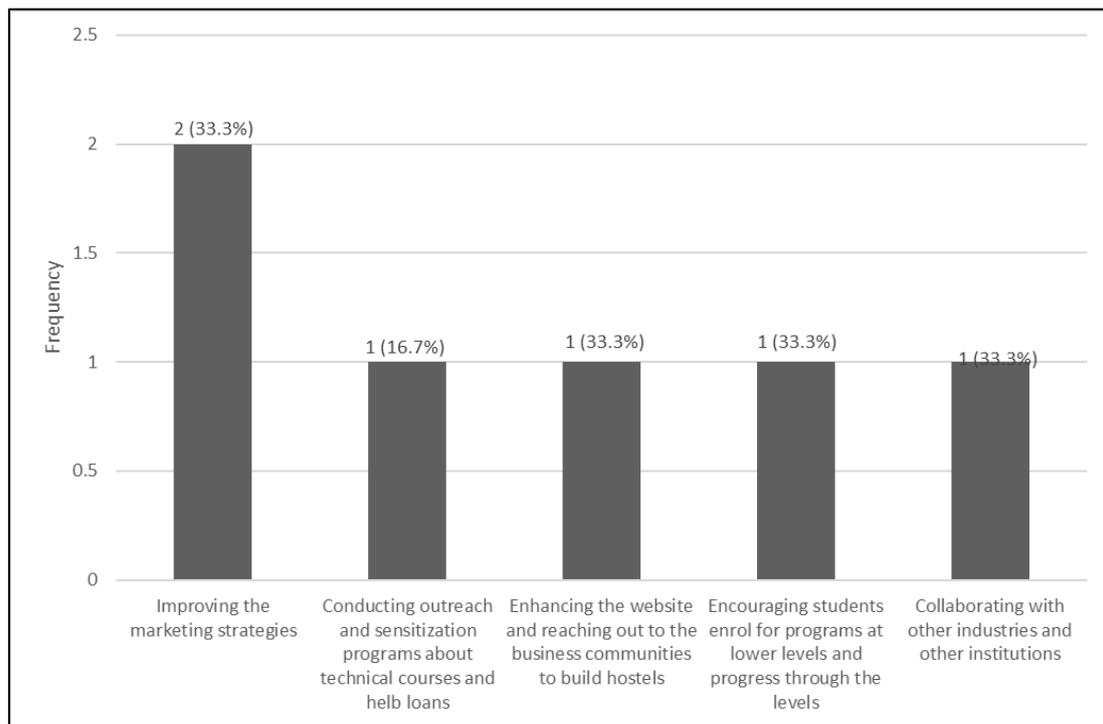


Figure 6: Registrars' Views on How the Departments are Addressing the Preceding Challenges

Figure 6 shows that 02 of the Registrars (33.3%) consider improving the marketing strategies as an important way of addressing the challenges being faced in enhancing enrolment in the TVET technical training programs. The other ways mentioned in the figure in connection with addressing the challenges were not regarded as reliable as only 01 (16.7%) Registrar gave those responses respectively.

In addressing these challenges, the Principals provided the responses shown in Figure 7:

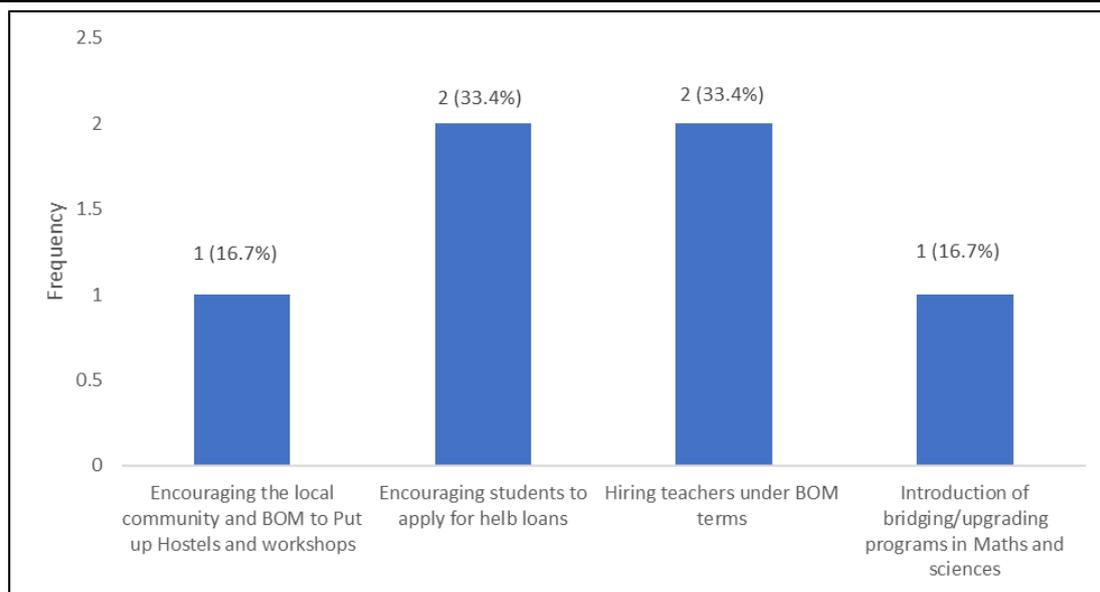


Figure 7: Principals' Views on How the Institutions are Addressing the Challenges

Figure 6 shows that 02 (33.4%) institutions encourage students to apply for HELB Loan, while another 02 (33.4%) institutions are hiring teachers under BOM terms. Only 01 (16.7%) institutions encourage the local community and BOM to put up Hostels and workshops, and another 01 (16.7%) institutions offer bridging/upgrading programs in Maths and Sciences.

9. Conclusion

There exists a challenge in the supply of TVET programmes in Nyanza region in terms of physical infrastructure, Teachers, students and the programmes being offered. The strategies adopted by the management include marketing of the programmes, attracting financial aid and seeking to employ teachers within the terms of the management of these institutions.

10. Recommendations

The study recommended that measures be adopted to increase infrastructure, the number of teachers, and the number of programs offered. The TVET institutions in Nyanza Region are owned by the government and funded by the government. It seems the government is unable to finance TVET at a level that can support quality training because the study revealed that the demands for funds by TVET outstrips the available government resources. Lack of resources could also lead to cuts in the volume of training provided by TVET. Therefore, the government should increase funding to this sector.

Conflict of Interest Statements

There was no conflict of interest in this study

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