EFFECTS OF COST-SHARING POLICY ON SCIENCE AND TECHNOLOGY EDUCATION AND TRAINING IN NATIONAL POLYTECHNICS IN KENYA.

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN PLANNING AND ECONOMICS OF EDUCATION

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ABSTRACT

Sessional paper No. 1 of 2005 states that without a working partnership on financing education, it will be hard to address the problems of inadequate access, inequity and low quality in education. The financing mechanisms also send signals to respective beneficiaries on their funds limitations. These limitations pose threats to the Technical Industrial, Vocational Entrepreneurship and Training (TIVET) objective which focus on provision and promotion of life long education and training for self reliance. Science and Technology Education Training in Kenya national polytechnics is based on this objective. Despite this, deterioration has been noted with the inception of cost sharing policies. The purpose of this study was to find out the effects of cost-sharing policy on Science and Technology Education and Training in Kenya national polytechnics. Objectives of the study were to; determine the average unit cost of educating a regular diploma student in Kenya national polytechnics; establish the effects of cost-sharing policy on access of regular diploma students in Kenya national Polytechnics; find out the effects of cost sharing policy on academic performance of regular diploma students in Kenya national polytechnics and to establish the cost sharing policy based challenges experienced by students, lecturers and the administrators in the Kenya polytechnics. The study was based on production function theory proposed by Wicksteed in 1884 and developed by Cobb and Douglas in 1928. This model identified the possible outcomes which could be achieved with a given combination of inputs. The study used Ex-post facto and descriptive survey research designs. Study population was 2824 which comprised of 2808 regular diploma students of Science and Technology Education Training, 12 lecturers and 4 administrators from the two national polytechnics. A sample size of 350 regular diploma students was arrived at using a formula by Yamane. Simple random sampling was used to sample the 350 students from the population. Purposive sampling technique was used to pick cases with required information. These were twelve heads of departments, two principals and two finance officers from the national polytechnics. Data was collected using questionnaires, document analysis guides and interview schedule. Face and content validity of the instruments was determined by experts in the Department of Educational Management and Foundations by including their suggestions. Reliability of the instruments was determined through test-retest. Pearson product moment correlation coefficient was used to determine the reliability at p value of 0.05.The coefficient for lecturers questionnaire was 0.75, principals' questionnaire 0.80 and finance officers 0.8. All instruments were therefore reliable. Quantitative data was analyzed using descriptive statistics in form of percentages, means and frequency counts. Qualitative data was transcribed and categorized in emergent themes. The findings of the study indicated the effects of cost sharing policy on Science and Technology Education and training in Kenya national polytechnics were that 69% of the students found their training cost unaffordable at Ksh. 545,256 and Kshs 664,653 for Kisumu and Eldoret respectively. There was a relatively low enrolment rate for example in the department of Electrical and Electronics in Kisumu polytechnic enrolment rate was at 8.5%. The drop-out rates ranged from 4.9% to 6% in Kisumu and Eldoret polytechnics. Performance index for Kisumu polytechnic was 59.8 and Eldoret polytechnic was at 63.1 out of 120. The major challenges were on capacity for access, inadequate training and learning materials, unskilled lecturers and inadequate quality assurance and standards guidance on curriculum implementation.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Science and Technology and Innovation are particularly important within the context of demands for global economic competitiveness, sustainable development and equity concerns (Republic of Kenya 2008). The development of the necessary scientific technological infrastructure as well as technical and entrepreneurial skills is an essential prerequisite to the transformation of Kenya into a knowledge base society. This development can be accomplished when a country has adequate and functional institutions to train the human resource required for development. Technical Industrial, Vocational and Entrepreneurship Training (TIVET) institutions are the middle level colleges which are mandated with the task of providing these technical and scientific skilled human resources (Republic of Kenya 2007). Kisumu and Eldoret Nation Polytechnics being the major stakeholders of TIVET which are expected to train and produce these required skilled human resources.

Psacharopoulos and Woodhall (1985) noted that some of the greatest challenges which faced the management of education were increasing demand of inadequate resources. They stated that the drastic reduction of financial allocation by governments or availability through sponsors to training and learning institutions had several adverse effects on the institutions. Reacting to the challenges of funding education institutions in Africa, the World Bank (1988) reviewed the challenges of funds and access in African learning institutions and released one of its most influential documents of education; Education in Sub-Sahara Africa: Policies for Adjustment, Revitalization and Expansion in 1988. This document was meant to cause changes in macro-economic adjustment first, then sectoral reforms later. The

Kenyan government acting on the report did not hesitate to launch the Presidential Working Party on Education and Training for the Next Decade and Beyond and released the outcome of the report in the same year, (Republic of Kenya, 1988a). This report institutionalized cost-sharing in education in order to reduce the proportion of government funds taken up by education (Republic of Kenya, 1988b).

In earlier studies, several scholars like Chesswas (1968), Educational Financing, Expenditure and Unit costs; Psacharopoulos (1979), Earning and Education the Fringe Benefits of Education; Atkinson (1988), Finance for Higher Education Through Grants; Schiefelnbein (1983), the Necessities for Societies and Governments to allocate resources for education for equity, efficiency and diversity; they all underscored the vital role of education in an individual improvement and national development with the financial implications taking centre stage.

Financing Education and Training in Kenya has been through partnership between the government, the private sectors, NGOs, families, communities and the development partners for example the World Bank, Netherlands and Italian governments. Despite the collaboration in funding TIVET institutions, a number of challenges emerged. Enrolment increased insignificantly by 7.5% between 2006 and 2007 with 5% of female students enrolling in engineering programmes. Relevance of TIVET curriculum deteriorated due to cost implications leading to mismatch of skills taught and the market demand. High cost of education and training compromised the adequacy and quality of training, learning materials and physical infrastructures in TIVET institutions (Republic of Kenya, 2005).

A comparative review of the 2004/005 and 2005/2006 Kenya government budgetary allocations showed that core poverty expenditures – recurrent (non wage) in Kshs

million 8,448.20 was allocated to Education in 2004/005 and 10,560.30 was allocated in 2005/006 which was a 25% increase, while allocation in development in Kshs was 3,821.70 in 2004/005 and 4,394.90 in 2005/006, an increase of 15% (Republic of Kenya, 2006). The budgetary allocations increased minimally in relation to the set target of Development of National Training Strategy for TIVET in 2005 ensuring that TIVET institutions were to be appropriately funded and equipped by 2008 as was stipulated in sessional paper No, 1 of 2005. This study therefore examined in depth the cost-sharing policy effects on Science and Technology Education and Training in Kisumu and Eldoret polytechnics, the institutions which are mandated with the task of training middle level technologists in the country. It attempted to provide suggestions and way forward on how to generate adequate funds and appropriate allocation methods for effective running of these polytechnics, increase access of both gender, improve on the Polytechnics academic performance and reduce the challenges to a minimum with a focus to Kenya's vision of industrialization by 2030.

1.2 Statement of the Problem

The challenges faced by Science, Technology and Innovation (STI) in Kenya include the need to develop stronger, national innovation systems. In addition, there is need to ensure sustained development of human resource within the realm of Science and Technology. Lack of critical financial resources and infrastructure to develop and integrate STI led to the mismatch between skills acquired from Kenyan training institutions and the industry requirements. Another challenge of meeting demand for Science and Technology Education in Kenya was an obvious gender gap among the graduates with male students forming the majority of 82% in Kisumu and 83% in Eldoret polytechnics. The challenges cited above have been to some extent caused by

the cost-sharing policy adopted by the Kenya government. A decline of almost all indices of precipitation was evidenced. A key TIVET policy of the development of National Training Strategy in 2005 and ensuring that these institutions were adequately funded and equipped by 2008 was not realized. The delay in adequately funding and equipping the Polytechnics caused challenges of enrolment, performance, capacity, innovation and consequently mismatch of skills in the labour market. Lack of firm policy on fees guidelines by the government left parents at the mercy of TIVET administrators. The continued rise in the cost of education curtailed enrolment in TIVET institutions. In 2006, there were 71,167 students in all TIVET institutions. Enrolment increased by 7.5% in 2007 to 76,516. The percentage increase however was negligible considering the country's vision of industrialization by 2030. More over, the majority of students in TIVET institutions do not take Science and Technology Education and Training courses due to cost challenges.

Complaints by parents against heavy educational costs prompted the government to remove technical subjects from primary school syllabus and later selectively removed a number of technical subjects from secondary schools' curriculum. The political pronouncements made by the government to please the voters had heavily compromised the education system in the country. This anomaly could only be corrected through a well established legal framework and the establishment of a TIVET authority to oversee the TIVET education system in the country. The challenges cited above could be effectively dealt with if the financial resource allocation and management were well established and prioritized with vision 2030. The main question that the study sought to ask is whether Kenya national polytechnics stakeholders would consider reforming educational cost-sharing policy to address the emerging issues to achieve vision 2030

1.3 Purpose of the Study

The purpose of this study was to find out the effects of cost-sharing policy on Science and Technology Education and Training in National Polytechnics in Kenya.

1.4 Objectives of the Study

The specific objectives of the study were to:

i) Determine average unit cost for educating a regular diploma student taking Science and Technology Education and Training in Kisumu and Eldoret Polytechnics.

ii) Establish the effects of cost-sharing policy on access for regular diploma students in Kisumu and Eldoret polytechnics taking Science and Technology Education and Training.

iii) Find out the effects of cost sharing policy on regular diploma students' academic performance in Science and Technology Education and Training courses.

iv) Establish the challenges experienced by students, lecturers and the administrators due to cost-sharing policy in Kisumu and Eldoret polytechnics

1.5 Research Questions

The following were the research questions that guided this study:-

i) What is the average unit cost of educating a regular diploma student taking Science and Technology Education and Training course in Kisumu and Eldoret polytechnics?

ii) What is the effect of cost-sharing policy on access for regular diploma students in Kisumu and Eldoret Polytechnics?

iii) How does cost-sharing policy affect academic performance of regular diploma students taking Science and Technology Education and Training courses in Kisumu and Eldoret polytechnics?

iv) What challenges are experienced by students, lecturers and administrators due to cost sharing policy in Kisumu and Eldoret polytechnics?

1.6 Significance of the Study

The findings of this study will add efficiency to scholarly research and literature on the effects of cost sharing policy on Science and Technology Education and Training in Kenya national Polytechnics. The study could be a learning paradigm in these institutions to enhance; compliment financial policy change and improvement as far as budgetary allocations were concerned. The study may assist individuals and their families to decide on investment levels which would be directed for a polytechnic diploma. Lecturers in the two polytechnics may also use the findings of the study to reform service delivery of programmes in Science and Technology Education and Training in their institutions in relation to market demand.

1.7 Assumptions of the Study

This study was carried out under the assumptions that:

i) Science and Technology Education and Training programmes offered in Kisumu and Eldoret polytechnics were relevant to the Kenya National development objectives.

ii) Cost-sharing policy on Science and Technology Education and Training in Kisumu and Eldoret polytechnics enabled the institutions to achieve maximum enrolment and retention of students.

iii) Sources of funds for Science and Technology Education and Training in Kisumu and Eldoret polytechnics were adequate for research, innovations and linkages with the relevant industries, acquisition of adequate and relevant training and learning materials and for putting up of up-to-date infra-structures.

1.8 Theoretical Framework

The focus of this study was to find out the cost sharing policy effects on Science and Technology Education and Training in the Kisumu and Eldoret Polytechnics. In so doing, the study established the appropriate funding options that would enable the national polytechnics attain affordable unit cost, maximum access in terms of retention, gender parity and quality progrmmes to fully in steer the country to industrialization by 2030. This study lent itself to the production function theory. Production function was first proposed by Wicksteed in 1884 mhtml:file://E The production Function.mht). The theory was developed by Charles Cobb and Paul Douglas in 1928 who came up with a function $Y = AF (L^9K^8)$. It was noted that the function lacked constancy over time because neither Cobb nor Douglas provided any theoretical reason why the coefficients the coefficients 'a' and 'b' should be constant over time or the same through sectors of economy. This concern was raised with regards to the nature of machinery and other capital goods which change or depreciate with time. The national polytechnics use machines, equipment and apparatus besides text-books for training. Economic organizations transform inputs into outputs or products. A production function is a mathematical relation between inputs and outputs which makes it concrete. It tells us how different amount of capital and labour may be combined to produce output. The critical ingredient in the function is f' thus the choice in this study.

Alexander and Simmon's (1975), Heyneman (1980), Heyneman and Loxley (1983) cited in Psacharopoulos and Woodhall (1985) used production function in finding out pupil's achievement and teachers motivation and came up with pessimist conclusions which have been challenged. World Bank (1980) research on determinants of academic achievement demonstrated that variations in inputs do affect additional outputs. Among the important factors were textbooks and teachers. Psacharopoulos & Woodhall (1985) explained the theory of production function for education as one that dealt with efficiency, investment decisions, and considered both external and internal efficiencies. Investment decision further placed a distinction between technical and economic efficiencies whereby external efficiency dealt with social costs and benefits, and internal efficiency dealt with relationships between educational inputs and outputs. It was on this strength that this study looked into internal efficiency of TIVET courses in Kisumu and Eldoret polytechnics.

The study focused on economic efficiency which was concerned with achieving a desired level of output at a minimum cost. The three rationales behind cost-sharing were; efficiency, equity and quality. Greater efficiency is achieved when there is a price or charge that reflects at least some of the real costs and trade offs involved in the provision of TIVET education and training. Equity rationale assumes the enjoyment of the tax payer's money by all students, yet it was well known that the children from high income families had greater purchase power. Quality needs were pegged on the availability of resources and the priority allocations of the same for curriculum delivery and institutional infrastructures. For Kenya to realize her vision of industrialization by 2030 there was need to study the cost-sharing policy effects on the three rationales in the two National Polytechnics for them to enhance employment

creation, innovation and to provide investors with abundant and qualified labour force at all levels (Republic of Kenya, 2003).

1.9 Scope of the Study

i) The study population was drawn from Regular Diploma Students, Science and Technology, Heads of Departments, Principals and Financial Officers in Kisumu and Eldoret Polytechnics.

ii) The study covered the students of years 2008, 2009 and 2010 in terms of enrolment and drop-out rates. The three cohorts were important because the researcher was able to obtain data containing different responses on access and performances from the same institutions for in depth information.

iii) Direct private costs were affordable.

1.10 Definition of Terms

Access: The number of Regular Diploma Students who enroled for Science and Technology Education and Training courses in Kisumu and Eldoret Polytechnics.

Cost-sharing: The separate contributions made in meeting the cost of Science and Technology Education and Training by government, families, individuals, donors, sponsors, employers, institutions, alumnae's institutional income generating projects and charitable organizations.

Course: A discrete component of learning or training pathway developed and /or used by a training provider that equips an individual with the knowledge, understanding, attitudes and

habits relevant to the requirements for the award of a unit standard or qualification usually more than one term in duration.

Efficiency: Is used to derive the relationship between inputs and outputs. This study adopted efficiency concept in dealing with development of skills and attitudes in Kisumu and Eldoret Polytechnic Colleges.

Finance: The decision and willingness by all the stake-holders to spend or invest their money in Science and Technology Education and Training at Kisumu and Eldoret Polytechnics.

Human Resource: An expert in a specific field who is ready to impart his or her ideas to others at a fee or for free.

Human Capital: Includes all those people who have or are benefiting from education as an investment to improve their skills and productive capabilities.

Infrastructure: The available, useable and up to date physical units which enables effective and efficient running of Kisumu and Eldoret Polytechnics.

In-put: In-puts are items which are factored into a system to be processed to come up with a product. In this study, the in-puts were revenue and expenditure funds; adequate training and learning materials, physical and service infrastructures, relevant programmes, innovation and research.

Investment: The act of providing education and training which are not for immediate consumption and a sacrifice for future returns.

Output:	In this study, Output is industrialization.
Programmes:	Science and Technology Diploma Courses offered at Kisumu and Eldoret Polytechnics.
Regular Diploma Students:	The students who obtained 'C' and above grades in KCSE and were admitted to pursue full time Diploma courses in Science and Technology Education and Training in Kenya National Polytechnics.
Stakeholders:	User groups who derive direct or indirect benefit from a qualification and its components.
Unit Cost:	This referred to the financial investment and expenditure on educating a student in Kisumu or Eldoret Polytechnic.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter deals with related literature review pertaining to effects of cost-sharing policies on Science and Technology Education Training in national Polytechnics in Kenya under the following themes; financing science and technology education and training in polytechnics, effect of cost sharing policy on access to science and technology education training courses in polytechnics, effects of cost sharing policy on academic performance in science and technology education and training, and challenges experienced by regular diploma students, lecturers and administrators due to cost sharing effects policy in polytechnics.

2.2 Financing Science and Technology Education and Training in Polytechnics

Psacharopoulos and Woodhall (1985) recognized that although the social and private rates of return to investments in education seemed high in many countries the private demand remained strong. Governments were no longer willing to allocate an increasing share of public expenditure on education. These sentiments were also echoed in Internal Labour Organization (1994) report which noted several reasons behind the growing interest in studying and reforming national system of financing Technical, Industrial Vocational Entrepreneurship and Training (TIVET). The approaches identified by International Labour Organization were: soft management which included such elements as flexible decentralized and performance based financing and co-financing of TIVET by governments, employers and workers due to the stagnation and even diminishing funding in many countries. These approaches were held with the assumptions that funding TIVET system were labour market

demand-driven and that they would provide the quality of Vocational Education and Training (VET) that would be flexible towards structural technological know how and other changes that would provide equal access to training in general skills. It was noted that TIVET system could not perform consistently without adequate funding. Such funding was generally based on the principle that training was a service, and that TIVET's direct and indirect beneficiaries would bear the cost. The beneficiaries were governments, employers and trainees themselves. The principle held by International Labour Organization of the beneficiaries of Science and Technology Education and Training was noble. The main problem emanating from cost-sharing policy was the reliability of source(s) of fund remitted to the institutions (ILO, 1994).

In most developing countries, public funds were spent in ways that impaired the effectiveness of training programmes and that most of the money was used to pay salaries for instructors and administrators; little or none was allocated for training materials, scholarships and research (UNESCO, 1992). In their findings on the utilization of training funds, UNESCO discovered that in industrialized countries, despite the considerable high demand for education, those countries had spent only an average of 13 to 14 percent on TIVET education. It was also noted that their relatively lower level of expenditure on education was as a result of cost efficient policies as well as greater employer and trainee involvement in financing training. In trying to achieve funding efficiency in Science and Technology Education and Training in Kisumu and Eldoret Polytechnics, this study adopted an economic efficiency approach to come up with desired results for economic growth stimulant which will enable efficient and effective funding of operational and investment activities in the institutions.

2.2.1 Sources of Funds for Science and Technology Education and Training in Polytechnics

Educational investment takes an increasing share of the national budget. This was supported by International Labour Organization (1994) in its report of Alternative Scheme for Financing Training which indicated that governments believed education would promote economic growth and provide the skilled man power needed for industrial developments. It elaborated on the various ways in which some of the developed countries obtained funds for Science and Technology Education and Training. It was noted that sectional funds in Belgium had been granted a taxing power and to impose a levy on employers which was collected by social security services and forwarded to the training fund. It was pointed out that employers in Denmark contribute specific amount per working hour to training funds which provided support for the development and testing of sector training programmes.

Ninety six training funds in France were established by collective agreements at national levels, 23 funds operated at the regional levels, 20 at the departmental levels and 5 funds had been established by individual enterprises. International Labour Organization (1994) further explained that training funds in France had a legal personality, operated under the control of the National Vocational Training Authorities (NVTA) and were allowed to receive public subsidies, donations and inheritance. Evolution of publicly financed training in United Kingdom between 1974 and 1988 was over seen by the Manpower Services Commission (MSC), which was a public monopoly. An employer financial contribution of 0.20% of payroll in Greece paid towards vocational training has been established. This collective labour agreement was ratified by the parliament in 1988. The vast majority of collective

agreement between social partners in Germany, the United Kingdom, Ireland, Italy, Luxembourg, Poland and Spain sometimes mention continuing training but do not attempt to regulate its financing government policies in these countries towards employer – financed training, which varies considerably.

Government grants in Germany were offered to firms lacking the necessary means to strengthen their training facilities (Bergner et-al 1991). International Labour Organization (1994) also noted that since the late 1980s, the government had taken steps to decentralize the role of (MSC) to privatize agencies supplying training and to introduce effective choice for trainees. The incorporation of further education for college and career development loans was some of the reforms which were introduced in U.K. It was also indicated that employers, organizations and trade unions in Netherlands were particularly active in establishing various developments, social and industrial funds which were strongly involved in financing training. International Labour Organization (1994) found out that Japan employers and employees had to pay an employment insurance tax of which a certain proportion was earmarked for financing public TIVET institutions. Korea expanded employer involvement in training to raise TIVET funds by the government enacting the basic law for vocational training in 1963 and in 1976, the vocational promotion became law. The fund supported TIVET through training provisions, subsidies and loans for enterprises.

Though International Labour Organization (1994) established the existence of various sources of TIVET funds in different developed countries, it did not cite sectoral funding.

Three main arguments used to justify public subsidy for education are externalities, equity and equality and economies of scale. Psacharopoulos and Woodhall (1985) argued out that governments should subsidize education to prevent underinvestment

and to avail equal and quality opportunities for all. They also noted that it would be efficient to provide education publicly. They however did not indicate the threshold for subsidies and the crucial vote heads to be prioritized.

International Labour Organization (1994) reported that vocational training in Brazil was mostly provided for by private corporations. These corporations were directly linked to the employer's organizations such as the National Confederation of Industries and the National Confederation of Commerce. Some of the training funds came from compulsory contributions from industries, which was 1% while 0.2% came from industrial corporations' payroll, which were used for special scholarship programmes for technicians, managers and teachers. The country adopted levy-based confirmacy agreement to the TIVET system.

International Labour Organization (1994) described financing as a *management function*, which should assist in directing training and education system towards specified requirements for example industrialization and goals of Education for all. It explained that those who administer training funds wield power in influencing training goals and in setting rules and conditions in controlling, testing and certification in their institutions. It therefore stated that a well designed financing scheme meant sound management of training Institutions. International Labour Organization further explained that financing of TIVET implied not only on how to source for funds but also to the manner in which financing was organized; that is, who received training funds, for what purposes and the conditions given to them by the donors. These concerns called for improved policies in funding TIVET Institutions. This study however endevoured to determine not only how TIVET is financed but also how cost sharing policy had impacted on the quality of programmes and rates of access in Kenya national polytechnics.

2.2.2 Financing of Science and Technology Education and Training in polytechnics in Kenya

Total donor support was expected to rise steadily from 3.9% in 2007 / 08 to about 4.6% of GDP by 2012/13 as the government improved the capacity of those funds (Republic of Kenya, 2008). The expected funds were to be used to scale-up programmes in the priority sectors including Millennium Development Goals (MGDs) related interventions and vision 2030 flagship projects. The intermittent pace at which donor funds are released to the government due to fear of mismanagement and misappropriation by the Kenya government stakeholders might disable the developmental goals and visions.

In the late 80s, Republic of Kenya (1988) compelled by the existing education situation in the country focused on improving education financing, quality and relevance. On its recommendation, Sessional Paper No.6 on Education and Training for the Next Decade and Beyond was produced. This document led to the policy of cost-sharing between government, parents and communities; thus for the first time enabling parents to sponsor their children to the polytechnics. Republic of Kenya (2003) explained that the main sources of funding for TIVET Institutions in Kenya had been the government, local community, parents, religious organizations, donors, private organizations, businesses and non-government organizations and that education was acknowledged as a key determinant of income distribution and productivity and therefore one of the country's highest development priorities. This was evidenced by the fact that 30% to 39% of the total government recurrent expenditure went to education from 1996 to 2001 at different levels except that the allocations were not prioritized with industrialization in mind.

With the demanding economy recording inflation rates of 18.91% in October 2011 it

was imperative for the educational institutional management to come up with sustainable financial programmes to cushion their administrative, training and learning activities. The table 2.1 below shows public expenditure on education sub-sectors in millions and percentages from 1996 – 2001.

Table 2.1

Public Expenditure on Education Sub Sector in Millions and Percentages, 1996-2001

SUB-SECTOR	1996/7		1997/8		1998/9		1999/00		2000/1	
	KSHS	%	KSHS	%	KSHS	%	KSHS	%	KSHS	%
UNIVERSITY	4474	14.84	5149.4	12.13	5094.7	11.49	54498	11.45	5097	10.53
POLYTECHNICS	153	0.51	187	0.44	201	0.43	205	0.43	251	0.52
SECONDARY	6766	22.50	100170	23.97	11871	26.78	12294	25.82	12629	26.9
PRIMARY	16719	55.60	24742	58.81	24817	55.98	27011	57.75	27759	57.7

Source :(Republic of Kenya 2003)

The percentage of public expenditure on education in polytechnic institutions was very low, ranging from 0.51% to 0.52%, while Primary schools received from 55.6%-57.7%, secondary schools from 22.50 – 26.9% and universities got between 10.53% – 14.8%. Consequently, the Kenya government development expenditure on education per sub-sector from 1997 to 2001 (in millions of shillings) showed a striking disparity as indicated in Table 2.2.

Table 2.2

Development Expenditure on Education Sub-Sector, Kenya, 1997-2001

Sub-Sector	1996/7		1997/8		1998/9		1999/00		2000/1	
	Kshs	%	Kshs	%	Kshs	%	Kshs	%	Kshs	%
University	489.8	37.43	839.8	52.14	1509	69.64	74.60	11.30	68.43	532
Polytechnics	120	0.09								
Secondary	22.60	1.72	10.60	0.66	14.0	0.64	2.40	0.36	9.30	6.72
Primary	282.8	21.51	310.40	19.27	160.8	7.43	284.8	43.15	235.86	18.37

Source : (Economic Survey 2000-2002)

For a period, the Kenya government stopped channeling development funds to the Polytechnics as seen in the table above. This trend challenged enrolment, training and learning materials as well as physical and service infrastructure in Mombasa Polytechnic in the subsequent years as was established by (Amuka, 2003). Most of the institutional grants financed the wage bill. This left the institutions with inadequate funds for developing institutional developmental programmes. Very little finances were spent on other important inputs such as learning materials and infrastructures, which were critical in improving educational effectiveness.

Over 98% of trainees enrolled in TIVET institutions were reported by Republic of Kenya (2003) to be self-sponsored while very few received any financial support from government bursaries or other charitable organizations. Republic of Kenya (2007) outlined that with the prevailing high levels of poverty among Kenyans, financing TIVET had been difficult for most parents who needed it most and that the budgetary allocations to TIVET had remained inadequate for many years. Although the existing expenditure on education had been on the increase, an average of about 35% of the

national budget as reported by Republic of Kenya, (2005/6), the allocation of resources to TIVET has consistently been low. In addition, out of 105,204.5 million shillings proposed in the Kenya Education Sector Support Programme (KESSP), only 3370 million shillings was earmarked to support TIVET programmes. This represented 3.2% of the total allocation which was in adequate. The Table 2.3 below shows the financing trend of technical education in the years 2001/2002 to 2005/2007.

Table 2.3

Trends in Financing Science and Technology Education in Kenya, 2001-2007

Amounts in Kshs. 000,000

ITEM	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7
RECURRENT	888.34	889.94	1,171.40	1,449.38	1,865.2	2,113.59
DEVELOPMENT	0.00	0.00	00	00	70.00	100.8
TOTAL	888.34	889.94	1,171.40	1,449.38	1,935.2	2,214.39

Source: (MOEST Estimates)

From the table above, it could be observed that recurrent financing provision had been increasing especially since 2003/4. Development financing which was crucial for capacity development and expansion was not forthcoming until 2005/6. The amounts availed to TIVET institutions were however still low, hence the need to strategies for enhancing resource base for efficient and effective implementation of improved TIVET Programmes. The irregular remittance of funds by ministries and departments to the TIVET institutions necessitated the creation of National Skills Development Fund (NSDF). This was suggested by Republic of Kenya (2007) for NSDF to receive contributions from the government, industry, levy, development partners and tuition

fees and a semi-autonomous body to manage and allocate funds to TIVET institutions. It was hoped that NSDF would be able to prioritize the key development sectors in TIVET institutions in order to cope with industrialization demand for vision 2030.

2.3 Effects of cost sharing policy on access in Science and Technology Education and Training courses in polytechnics

India had a free and compulsory education up to the age of 14 and more emphasis was paid on the enhancement of vocational and technical skills as was reported by (Prabhu 2006. He explained that by February 2009, India had 140 researchers per 1,000,000 population compared to 4,651 in the United States and was still considered to be lagging behind in science and technology! In a similar study, World Bank (2000) stated that forty percent (40%) of students who successfully completed nine years of formal school at the elementary and middle schools in Korea received Vocational and Technical Education.

In All Africa.com, it was indicated that there were 2,048 trainees in the polytechnic of Namibia in various fields of studies who were recipients of study loan. In Kenya the demand for scientists and technologists when measured on a per capita basis was bound to increase. There was need to progressively increase the rate of generation of high quality skilled human resource at all levels. Calling for the need to initiate new and innovative schemes to attract and train young talent with an aptitude for research compelled agencies and departments concerned with science and technology to contribute substantial funding from their allocations. According to gasmi@eucmax.sim.ucm "IITAP Science and Technology in Africa", there were two main reasons why Africa was lagging behind in science and technology. Lack of

meaningful commitment towards science, basic or applied due to scant realization that science could be applied to development. By contrast, the Japanese emperor took five oaths of such type. He indicated that the consequences of lack of commitment towards basic science had been: little expenditure on science, weak universities, sub-critical and isolated communities of scientists with scant provision for infrastructure and for scientific literature, and weakness in scientific and technological education. It indicated the inadequacy of institutional legal framework. It gave the example of Korea where the enactment of several important laws for development of science and technology led to the provision of fiscal and financial incentives to private industries for Technological Development in 1972 while the Engineering Services Promotion Law in 1973 promoted local engineering firms by assuring markets and performance standards.

The need for basic technology echoed in http://en.wikipedia.org/w/index.php is very important to the developing countries. Technological development cannot be achieved if the institutions which are supposed to produce the skilled human resource are not adequately funded. It was also realized that the paltry funds that reached the institutions were not industrialization goals oriented in their allocations. Furthermore the efficiency in managing these funds was wanting. Apart from inadequate funds, the ad-hoc measures taken by the majority of countries in upgrading or merging the polytechnics into universities had actually hurt technology by reducing the number of middle skilled manpower who were hands-on. This study objective determined access rates in the national polytechnics under the cost sharing policy.

The objectives of TIVET in Kenya include; providing increased training opportunities for school leavers that enable them to be self supporting developing practical skills and attitudes which lead to income generating activities in urban or rural areas through salaried or self-employment; providing technical knowledge and vocational skills necessary for the growth of agriculture, industry and commerce and producing people who can apply scientific knowledge to the solution of environmental problems (Republic of Kenya, 2003). This is why it was sad to note in Republic of Kenya (2004) that the total enrolment in TIVET institutions had increased and stood at 79,000 in 2003 with female enrolment constituting 44% of the total student population. The above enrolments portrayed gender disparity. Enrolment in Kenya national polytechnics had been on the increase from 9,042 in 2000 by 15.8% to 10,472 in 2001. Administrative records showed that by 2007, there were a total of 13,276 students pursuing Diploma courses in all Kenya national polytechnics and polytechnic universities. Noting the importance of Science and Technology courses, an increase of 21% was negligible. The Table 2.4 below shows the disparity of gender enrolment in Kisumu and Eldoret Polytechnics.

Table 2.4

Regular Diploma students enroled in Science and Technology Education and Training in Kisumu and Eldoret Polytechnics by gender, 2007 (n = 2808)

Year	Kisumu				Eldoret			
	M	%	F	%	M	%	F	%
1	484	87.40	70	12.60	440	75.30	144	24.70
2	411	83.11	83	16.89	354	73	132	27
3	317	91.40	30	8.60	289	84.30	54	15.70
Total	1212		183		1083		330	

Source :(Admin. Records)

Republic of Kenya (2007) expressed the determination of access and equity in an education system as issues of great importance. It indicated that out of the two hundred and fifty thousand (250,000) students who sat for KCSE in 2008, only about twenty five thousand got the chance to enroll in Public and Private Universities locally. Another 5,000 students went to foreign universities outside Kenya. Out of the remaining two hundred and twenty thousand (220,000) or 88% only sixty thousand (60,000) or 24% may be were absorbed in the middle level colleges. The balance of about one hundred and sixty thousand (160,000) or 64% of the candidates might not have been placed due to limited spaces. The urgent need to expand the current capacity of the middle level colleges to absorb more students in order to reduce wastage and prepare them for the labour market is paramount. The demand for scientists and technologists when measured on a per capita basis is bound to increase. There was need to progressively increase the rate of generation of high quality skilled human resource at all levels.

The Cost-sharing policy for Science and Technology Education and Training in Kisumu and Eldoret Polytechnics in Kenya was looked into critically by this study and it came up with suggestions on how to achieve adequate funding system in these institutions. Consequently, increase in access of students in Kisumu and Eldoret Polytechnics was looked into in details, suggestions and way forward were given to assist the Polytechnics to be vision 2030 compliant.

2.4 Effects of cost sharing policy on academic performance in Kenya national polytechnics

Kenya Institute of Education (KIE) is the National Curriculum Development and Educational Research centre. It was charged with the responsibility of developing Curricula and curriculum Support materials which were provided for by Technical Education Programme (TEP) policy document (Republic of Kenya, 2003). In its effort to develop demand driven courses relevant to industrial needs, KIE made efforts to liaise with and involve all stakeholders including industries in curriculum development matters. Curriculums in the middle level colleges were developed to cater for post-school technical courses leading to Certificates, Diploma and Higher Diploma awards. The examinations of Technical Institutions have been developed by various bodies such as KNEC, KASNEB, IMIS, PITMAN, City and Guilds and Industrial government institutions.

Republic of Kenya (2003) stated that Industrial Attachment was an integral part of the TEP curriculum and therefore required serious attention. It was therefore critically necessary for students to undergo attachment, be supervised, assessed and to be professionally guided. It was equally noted that for optimal performance in National Polytechnics, adequate and qualified human resources were required. A challenge

observed was that the majority of the lecturers were diploma and education degree holders who were expected to teach and train diploma programmes in the Polytechnics. The Lecturers were therefore unable to cover the syllabus effectively due to lack of adequate skills.

Another challenge indicated by Republic of Kenya (2003) was that KNEC Diploma entry requirement which was a grade (C) did not have any provision of cluster subjects. Those students who did not possess the required clusters went through bridging courses which had added costs. The basic curriculum in TIVET was the 8-4-4 Technical Education Programme (TEP) curriculum which was developed between 1986 and 1989. There were 19 Artisan syllabi, 48 Craft and 48 Diploma syllabi in the institutions. Besides TEP, many other types of curriculum had found their way into TIVET especially in the areas of information technology, electronics and business studies. The manipulative and analytical skills time duration varies from artisan to technologist. Eight to nine subjects are taught in the TEP curriculum but only five to six are taken in the final examination. The review of any particular syllabus depends on the availability of funds in the absence of which the syllabi may remain static for several years. This study looked into ways in which the study may assist Kisumu and Eldoret polytechnics on how best they could utilize the available funds to develop new programmes which reflected labour market realities.

2.5 Challenges experienced by regular diploma students, lecturers and administrators due to the effects of cost-sharing policy in Kenya national polytechnics.

The goal for the education sector in Kenya was the attainment of Education for all by 2015. This implied that every learner eligible for schooling enroled and completed a course in basic education (Republic of Kenya, 2003). The increased demand for

primary education following the policy of Free Primary Education (FPE) confirmed that cost was a major factor which constrained participation. Although the cost burden at primary and secondary levels had been some what reduced through FPE and Free Day Secondary Education (FDSE), house holds still shouldered the burden of educating their children through TIVET and other tertiary institutions.

The cost of providing learning and training materials and the expansion of physical facilities, purchasing of equipment, form a substantial proportion of the total cost of education in the National Polytechnics. A policy to address further reduction in costs to households is bound to significantly contribute to increased enrolment. Consequently, the increased enrolment especially in TIVET institutions will come with its own problems. TIVET institutions which were supposed to produce skilled and high level manpower intended to meet demands of the economy have resorted to theoretical instructions due to inadequate training and learning materials and equipment (Amuka, 2003). Increased enrolment thus lowered the curriculum quality and produced graduants who were a mismatch in the industrial fields. This was in agreement with (Kerre, 1997) who observed that many TIVET institutions had the very basic facilities and that some offered programmes which did not have even the basic facilities. Despite the seemingly growing enrolment rate in the Kenyan education sector, TIVET institution faced challenges of access, participation, quality, relevance and efficiency due to cost sharing policy which did not prioritize vision 2030.

The Technical, Industrial, Vocational Entrepreneurship Training (TIVET) programmes were being revised to cater for new technology, issues and trends that have emerged since early 1990s when the syllabi were developed under Technical Education Project (TEP) programmes. The new curriculum is modular and

competency based allowing for trainees' exit to the world of work and easy re-entry to the course (Republic of Kenya, 2009). Kenya National Examination Council (KNEC) issued a circular KNEC issued a circular KNEC/GEN/EA/PSEM/BE/2009 on 23/9/2009 to all TIVET stakeholders. This circular informed all the stakeholders of the gradual change of Technical Education Programme (TEP) to TIVET programmes. A further circular KNEC/TD/PSE/TECH/ of 17/1/2011 informed the principals of TIVET institutions that the phasing out examination under TEP would take three years from April 2010 when TIVET syllabus was adopted for examinations.

The review and the changes have caused confusion to the academic administrators because they do not have academic document guides from the Ministry, KIE or from KNEC. They depended only on the circulars for curriculum implementation. This confusion is a challenge to the administrators of Kenya national polytechnics in their quest to achieve maximum enrolment, develop affordable programmes and impart relevant and quality training. This study investigated and determined how these challenges could be solved.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This section describes the research design of the study, the study population, sample and sampling techniques, instruments of data collection, data collection procedures, validity and reliability of the instruments and methods of data analysis.

3.2 Research Design

This study used two research designs, Ex-post facto and descriptive survey research. Descriptive survey research determined and reported the way things were on the ground. Kerlinger (1983) stated that ex-post facto is a systematic, empirical inquiry in which the researcher did not have direct control of independent variables because their manifestations had already occurred. In this study, performance, access, the cost of education and challenges faced had occurred by the time data was collected. The advantage of ex-post facto design is that data cannot be manipulated by the researcher or the respondent (Gall and Borg, 1996). Descriptive research involves making careful descriptions of educational phenomena. It is concerned with determining "what is" (Gall and Borg 1996). It was used to study the questions on enrolment, performance challenges.

3.3 Area of Study

The study was carried out in Kisumu and Eldoret Polytechnics in Kenya. Kenya is located in the Eastern Africa region. It is divided into almost two equal parts by the equator and lies between 4½° N and 4½° S latitudes and longitudes 34°W and 42°E. The country has an area of 584,000 km^2. It is divided into forty seven counties. Kisumu Polytechnics situated in Kisumu County. In 2008, Kisumu Polytechnic had 9 academic departments, 163 lecturers and 1395 regular diploma students. Eldoret

Polytechnics situated in Uasin Gishu County. The Polytechnic in 2008 had 7 academic departments, 109 lecturers and 1413 regular diploma students. The two national polytechnics were chosen because they were expected to produce technically high skilled middle level man power required for national economic growth and development (Appendix F). These polytechnics train students in diversified Engineering courses (ref. tables 4.14 and 4.15).

3.4 Study Population

The target population of this study was 2824. It comprised of 2808 regular diploma Students enroled in Eldoret and Kisumu polytechnics under the following courses; Building and civil engineering, Computer and Information Technology, Applied Sciences, Mechanical Engineering, Automotive Engineering, Electrical and Electronics Engineering. The others were 12 Heads of Departments, 2 Principals and two Finance Officers from the national polytechnics.

3.5 Sample and Sampling Procedure

A formula by Yamane (1976) $n = \frac{N}{1+N(e)^2}$ was used to determine the sample size of this study. The formula yielded a sample of 350 regular diploma students which were picked using simple random sampling. Simple random sampling was selected because it has a process that provided every sample of a given size an equal probability of being selected. The samples yielded research data that generalized to a larger population within margins of error that could be determined by statistical formulas (Gall and Borg, 1996). Stratified random sampling technique was used to determine 58 students in years 1, 2 and 3 from each polytechnic. Stratified sampling involved selecting a sample so that certain subgroups in the population were adequately

represented in the sample (Gall and Borg, 1996). Stratified sampling is also used when a number of subgroups or strata that may differ in the characteristics being studied (Ary et al 1990). Purposive sampling is used when the sample size in qualitative study is small. The purpose in selecting the cases was to develop a deeper understanding of the Phenomena being studied (Gall and Borg, 1996). It is also referred to as Judgment sampling; sample elements judged to be typical or representative are chosen from the population. The assumption underlying this type of sampling is that erroneous judgments in the selection of elements from the population will counter balance one another (Ary; et al 1990). The elements in this study were; 6 heads of department, 1 principal and 1 finance officer from each Polytechnic.

Students of years 1, 2 and 3 from each Polytechnic were sampled so that they could give heterogeneous experiences. Six heads of departments were purposively sampled to give in depth information concerning the effects of cost sharing policy in regards to curriculum implementation in relation to unit cost, access, performance and challenges faced in national polytechnics. The finance officers gave the financial sources, allocations and how they were utilized in the polytechnics. The two Principals gave the effects of cost sharing policy on the administrative aspects of running the polytechnics using questionnaire and giving in-depth information through interviews.

3.6 Instruments for Data Collection

Instruments for data collection comprised of four different questionnaires, and structured interview schedule and document analysis guides. The first section in the questionnaires was used to obtain background and personal information of

respondents. The remaining sections generated information on unit cost, access, performance and challenges in the national Polytechnics. These methods of data collection enabled the researcher to obtain specific information from the relevant respondents to avoid guess work. The structured interview schedules were given to the Principals to obtain in-depth information on the effects of cost-sharing policy on Science and Technology Education and Training in the polytechnics.

Questionnaires were used to obtain important information about the sample population. Each item in the questionnaire was developed to address a specific objective or research question of the study. Interviews are face-to-face encounters. The researcher therefore established a friendly relationship with the respondents prior to conducting the interviews. Document analysis was used to retrieve information such as KNEC examination results, enrolments, standard fees charged, sources of revenue, revenue expenditures and Curriculum Based Establishment (C.B.E) from the national polytechnics.

3.6.1 Principal's Questionnaire

The principal's questionnaire consisted of structured and open ended question items. It was used to collect data on effects of cost sharing policy on science and technology education and training in national polytechnics.

3.6.2 Finance Officer's Questionnaire

The finance officer's questionnaire consisted of structured and open ended question items. It was used to collect data on effects of cost sharing policy on science and technology education and training in Kenya national polytechnics.

3.6.3 Lecturer's Questionnaire

The lecturer's questionnaire consisted of structured and open ended question items. It was used to collect data on effects of cost sharing policy on science and technology

education and training in Kenya national polytechnics.

3.6.4 Interview Schedule for Principal's

Interview schedule was used to collect data to complement the data that was collected using the questionnaire.

3.6.5 Regular diploma students' questionnaires

The students' questionnaire consisted of structured and open ended items. It was used to collect data on effects of cost sharing policy on science and technology education and training in Kenya national polytechnics.

3.7 Validity of Instruments

Validity is defined by Gall and Borg (1996) as the appropriateness, meaningfulness and usefulness of the specific inferences made from test scores. Mugenda and Mugenda (2003) define it as the accuracy and meaningfulness of inferences which are based on research results. It is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study. Face validity in this study was carried out by consulting experts in the department of Education Management and Foundation in Maseno University. They scrutinized the instruments to ensure that the data resulting from the administration of the instruments' accuracy represented the variables of the study. Before the instruments were used to collect data for the study, a pilot study was conducted in Mombasa Polytechnic University which though a university still trains Regular Diploma Students taking Science and Technology courses and sit for the same KNEC examination administered to the regular diploma students in the two national polytechnics. The pilot study enabled the researcher to add, delete and change some items in the instruments.

3.8 Reliability of Instruments

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. It is the degree to which results obtained from the analysis of the data actually represent the phenomenon index study (Mugenda & Mugenda 2003). The questionnaires were administered twice to the same group of subjects after two weeks. To determine test-retest reliability, correlation coefficient called coefficient of stability Gall and Borg (1996) was calculated. The scores from both testing periods were correlated.

Pearson product-moment correlation **r** was used to measure the correlation in the four different questionnaires and the following results were obtained; student's questionnaires, 0.75, lecturers, 0.80 and principals, 0.85, finance officers, o.8 at a **p** value of 0.05, the instruments were reliable. Pearson product moment correlation r for interviews with the principals was 0.9 at a p value of 0.05 and the instrument was found reliable.

3.9 Data Collection Procedures

A letter of introduction was obtained from School of Graduate Studies (SGS) Maseno University which was used to obtain a research permit from National Council for Science and Technology (NCST) based in Nairobi for research in Kisumu and Eldoret polytechnics. The researcher visited the institutions to explain to the Principals the intended study and scope. A request for audience with the officers who assisted in the organization of the sample population was sought for planning purposes from the Principals. The instruments were administered to the respondents in groups and to individuals by the researcher and an assistant research officer. Questionnaires administered to the students were collected on the same day of the exercise.

Questionnaires for the H.O.Ds and the administrators were collected on different agreed dates ranging from a period of one week to two weeks. Interview responses were recorded using a tape recorder. The interviews were carried out on two separate days for the two polytechnic Principals. Each interview session took a maximum of one hour. The authorities were assured of the observation of professional ethics while dealing with the institutional records. Research plan guided the researcher.

3.10 Methods of Data Analysis

Qualitative data was derived from interview notes, written expressions and opinions by the respondents on the questionnaires. Content summary form was made from where the most salient points were picked out with theme codes assigned. Comments and a brief summary were included for each document and patterns. Numerical codes assigned to them enabled analysis and interpretations of the information. The analysis was done together with the report. Data was described using descriptive statistics. The statistics used in this study were the mean, the variance and percentages (Mugenda & Mugenda 2003). The purpose was to enable a meaningful description of the distribution of scores. Data were converted to numerical codes representing attributes of the variables. Indicators of unit costs, access, performance and challenges brought about by the effects of cost-sharing policy on Science and Technology Education and Training in Kenya national polytechnics were described using descriptive statistics computed for each group in the study. These statistics included group means and standard deviation (Gall and Borg, 1990). Formulae by Chesswass J, D. (1968) were used to calculate drop-out, graduation survivor and enrolment rates .A scale retrieved from a website. www.ode.state.oh.us/GD/Documentmanagement was used to calculate academic performance index.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results and discussion of the findings of the study under objective driven themes. The objectives of the study were to:

i) Determine average unit cost for educating a regular diploma student taking Science and Technology Education and Training in Kisumu and Eldoret Polytechnics.

ii) Establish the effects of cost-sharing policy on access for regular diploma students in Kisumu and Eldoret polytechnics taking Science and Technology Education and Training.

iii) Find out the effects of cost sharing policy on regular diploma students' academic performance in Science and Technology Education and Training courses.

iv) Establish the challenges experienced by students, Lecturers and the administrators due to cost-sharing policy in Kisumu and Eldoret polytechnics.

The return rates for questionnaire were 2(100%) for Principals, 2(100%) for finance officers, 12(100%) for heads of academic department and 350(100%) for regular diploma students taking science and technology education and training courses.

4.2 Average unit cost of educating regular diploma students taking Science and Technology Education and Training in Kenya national polytechnics

The research first question responded to was: What is the unit cost of educating a regular diploma student taking science and Technology Education and Training in

Kisumu and Eldoret polytechnics in Kenya? To address this research question data was collected on enrolment, social and private costs in the national polytechnics for the same year 2010 (Tables 4.1, 4.2, 4.3 and 4.4).

Table 4.1

Enrolment of regular diploma students in Kisumu polytechnic in 2010

	Courses	Year I			Year II			Year III			Total
		M	F	T	M	F	T	M	F	T	
1	Applied Biology	27	12	39	39	10	49	56	17	73	161
2	Analytical Chemistry	5	1	6	14	5	19	21	5	26	51
3	Food and Beverage	10	23	33	6	24	30	10	34	44	107
4	Quantity Survey	3	0	3	8	1	9	3	1	4	16
5	Civil Engineering	40	6	46	41	4	45	30	1	31	122
6	Building and Construction	10	0	10	23	0	23	20	1	21	54
7	Electronics Engineering	17	0	17	17	1	18	22	0	22	57
8	Electrical Power Engineering	89	8	97	81	5	86	55	1	56	239
9	Computer Studies	0	0	0	7	1	8	10	4	14	22
10	Information Technology	53	14	67	0	0	0	0	0	0	67
11	Information Communication	35	14	49	0	0	0	0	0	0	49
12	Mechanical Production	17	0	17	17	2	19	16	0	16	52
13	Mechanical Engineering Plant	15	0	15	18	0	18	32	1	33	66
14	Motor Vehicle Tech.	1	0	1	0	0	0	0	0	0	1
15	Automotive Engineering	10	0	10	16	0	16	28	0	28	54
	Total	**332**	**78**	**410**	**287**	**53**	**340**	**303**	**65**	**368**	**1118**

Source:(Admin.Records)

From Table 4.1, it was revealed that enrolment in most courses was below 100 except in applied biology where the enrolment was 161, food and beverage 107, civil engineering was 122 and electrical power engineering where enrolment was 239. This level of enrolment generally implied that the enrolment was lower than expected.

Table 4.2

Enrolment of regular diploma students in Eldoret polytechnic in 2010

	Course	Year I		Year II		Year III		Total
		M	F	M	F	M	F	
1	Applied Biology	20	10	16	15	16	9	86
2	Analytical Chemistry	30	9	13	6	17	9	84
3	Food and Beverage	2	10	0	0	0	0	12
4	Civil Engineering	32	0	40	4	38	7	121
5	Building and Construction	3	0	11	1	6	6	27
6	Medical Engineering	19	10	0	0	0	0	29
7	Electronics Engineering	26	2	14	0	14	0	56
8	Electrical & Power Engineering	14	1	56	5	38	4	118
9	Telecommunication Engineering	22	2	31	5	21	4	85
10	Instrumentation control	11	0	12	0	10	1	34
11	Computer Studies	16	4	24	7	21	5	77
12	Information Technology	39	16	1	0	0	0	56
13	Applied statistics	2	0	12	9	18	5	46
14	Mechanical Engineering (Power)	23	1	11	1	17	2	55
15	Mechanical Engineering (Plant)	16	0	29	3	22	3	73
16	Mechanical Engineering Production	20	0	18	1	12	1	52
17	Mechanical & Automotive Engineering	12	1	20	0	14	0	47
	Total	**307**	**66**	**318**	**57**	**264**	**56**	**1058**

Source: (Admin. Records)

From Table 4.2, it was revealed that Eldoret polytechnic had more courses offered but enrolment was generally lower than in Kisumu polytechnic. Enrolment in most courses was below 100 except civil engineering where enrolment was 121 and electrical and power engineering where enrolment was 118. Just like in the case of Kisumu Polytechnic these were male dominated courses with very low enrolment for female students.

Average unit cost of educating a regular Diploma student was calculated by dividing the total social and private costs by enrolment in each polytechnic.

In order to establish the average unit cost of educating a regular diploma student social and private cost were established as shown in Tables 4.3 and 4.4.

Table 4.3

Social and private costs for regular diploma students in Science and Technology Education and Training in Eldoret polytechnic from 2008 to 2010

Vote head	Year 2008 Kshs	%	Year 2009 Kshs	%	Year 2010 Kshs	%
Personal Emolument	26,213,000	19.9	38,988,000	19.1	41,980,000	18
Training & Learning Materials	22795,000	17.3	27,429,000	13.4	32,930,000	14.0
Salaries	76,303,080	58	85,566,720	41.9	86,952,000	37.1
Operations	3,164,000	2.4	43,640,000	21.3	53,740,000	22.9
Maintenance	464,000	0.4	4,636,000	2.3	14,120,000	6.0
Research	2,768,000	2.1	4,180,000	2.0	4,679,000	2
Total	**131,707,080**		**204,439,720**		**234,401,000**	

Source: (Admin: Records)

From Table 4.3, it was revealed that social and private costs increased from Kshs. 131 707,080 in 2008 to Kshs.234, 401,000 in 2010.

Table 4.4

Social and private costs for regular diploma students in Science and Technology Education and Training in Kisumu Polytechnic from 2008 to 2010

Vote heads	2008 kshs	%	2009 Kshs	%	2010 Kshs	%
Personal emolument	11,866,556	7.8	15,857,088	9	24,565,549	12.0
Salaries	89,162,916	58.3	96,085,560	54.1	98,579,950	49
Training & learning Materials	18,302,796	12	19,778,413	11.1	20,584,189	10.0
Operations Maintenance	29,521,951	19.35	26,425,333	15	35,056,767	17.2
Research and innovation	3,770,883	2.5	17,429,525	9.8	22,726,130	11.0
Scholarships & bursaries	- 150,000	0 0.1	1,500,000 621,190	0.8 0.3	1,686,000 0	0.8 0
Totals	**152,775,102**		**177,697,109**		**203,198,585**	

Source: (Admin. Records)

From Table 4.4, it was revealed that social and private costs increased from Kshs. 152,775,102 to Kshs, 203,198,585 in 2010.

Development costs were omitted since they spread over the years and could not therefore be accurately established.

4.2.1 Unit cost for educating Science and Technology Education and Training regular diploma student in Eldoret polytechnic for the year 2010

Eldoret Polytechnic Total Revenue Expenditure (TRE) = 234,401

Total Enrolment (N) = 1,058

Unit Cost per year Kshs = $\frac{\text{TRE}}{\text{N}}$ = 221,551 per year

A three year course would cost approximately 221,551x 3 = 664,653

When expenditures on vote heads are high and the enrolments are low, unit cost becomes high. Optimum access therefore lowers the indirect costs for students.

It is slightly cheaper to purchase goods in bulk (wholesale) than per piece (retail) for more students than for fewer students respectively.

4.2.2 Unit cost for educating Science and Technology Education and Training regular Diploma student in Kisumu polytechnic for the year 2010

Kisumu Polytechnic Total Revenue Expenditure (TRE) = 203,198,585

Total Enrolment in 2010 (N) = 1,118

Unit Cost per year Kshs = $\frac{\text{TRE}}{\text{N}}$ = 181,752 per year

A three year course would cost approximately 181,752x 3 = 545,256.

Psacharopoulos and Woodhall (1985) indicated that all educational expenditures, both recurrent and capital can be regarded as a means of forming human capital that will yield benefits throughout the working life of an educated person. Research in the education sector suggests that the value of the resources required to impart work and life skills into a student in the modern economy may be difficult to qualify. However, comparing data on spending per student can provide a starting point. Apart from the available standardized fees structure availed to the researcher on our boarding and tuition fees, students gave varied cost which they paid while taking different courses.

Table 4.5 gives the average individual costs for students in Kenya national polytechnics taking Science and Technology Education and Training and Fig. 4.1 shows the comparison. The total levies for each item for the respondents in each Polytechnic was tallied then averaged to get the mean.

The private costs incurred by the students, polytechnic, college fees and accommodation were already factored into the indirect costs; therefore, the actual direct costs would be less by either one or both vote heads depending on whether the students were boarders or day scholars. Table 4.5 gives statistics for boarders and day scholars.

Table 4.5

Private Cost incurred by regular diploma students in 2010 (n = 350)

	POLYTECHNICS	KISUMU					ELDORET				
		Years					Years				
	Vote heads	1	2	3	Total	%	1	2	3	Total	%
1	Tuition	32,660	20,700	24,050	77,410	27	32,660	20,700	24,050	77,410	25
2	Boarding / hostel	30,000	20,000	30,000	80,000	28	36,000	26,000	36,000	98,000	25.8
3	Learning materials	8,000	8,000	8,000	24,000	8	9,000	9,000	9,000	27,000	8.7
4	Fare	6,000	6,000	6,000	18,000	6	5,000	5,000	5,000	15,000	4.8
5	Food	12,000	12,000	12,000	36,000	13	16,000	16,000	16,000	48,000	15.5
6	Clothing	6,000	6,000	6,000	18,000	6	6,000	6,000	6,000	18,000	5.8
7	Pocket money	7,000	7,000	7,000	21,000	7	10,000	10,000	10,000	30,000	9.7
8	Health care	4,000	4,000	4,000	12,000	4	5,000	5,000	5,000	15,000	4.8

A comparison between private costs in the two polytechnics was as shown in Figure 4.1.

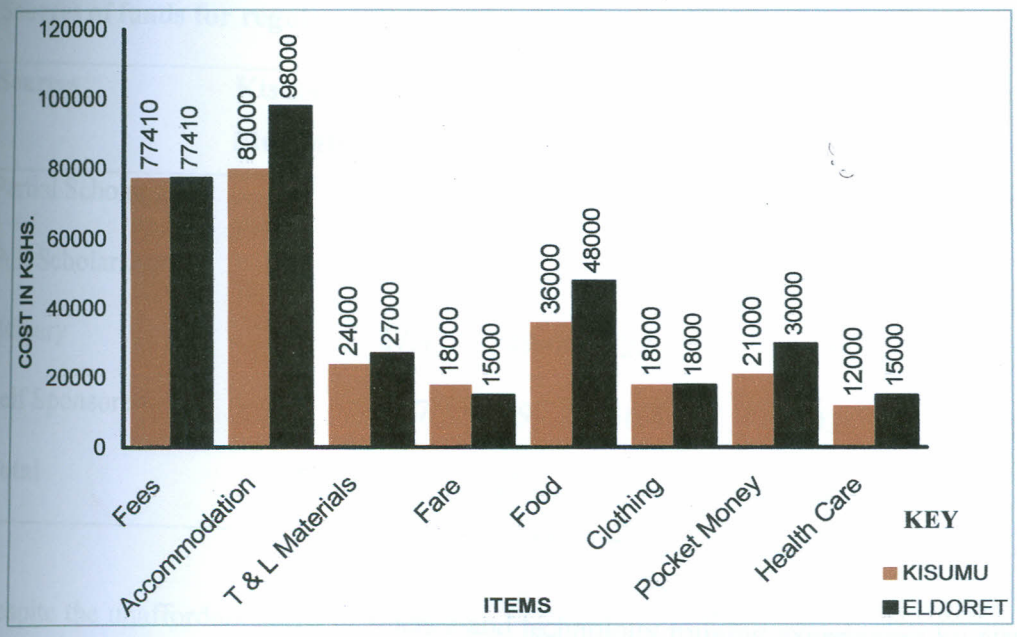

Figure 4.1: Private costs incurred by regular diploma students taking Science and Technology Education and Training courses in 2010

Expenditure per student is to a large extent related to instructional costs and includes all expenditures on lecturers' salaries and fringe benefits. In this study, the researcher analyzed the social and private costs of a regular diploma student in Kisumu and Eldoret polytechnics in Kenya. The indirect cost of training a student in each of the two Kenya national polytechnics was calculated using 2010 enrolments and 2010 revenue expenditures.

Table 4.6

Sources of funds for regular diploma students in 2010 (n = 350)

Sources	Kisumu Students	%	Eldoret Students	%	Kisumu & Eldoret Total Students	%
Partial Scholarship	23	13.2	14	8	37	10.6
Full Scholarship	10	5.7	13	7.5	23	6.6
Bursary	48	27.4	49	28	97	27.7
Self Sponsored	94	53.7	99	56.6	193	55.2
Total	**175**		**175**		**350**	

Despite the unaffordable cost of science and technology training experienced by 69% of the respondents, 170 students gave science and technology a percentage value of importance, as 70%, 108 students gave 50%, 50 students gave 90% and 22 students gave 30%. Table 4.7 gives the statistics of values which were given by the student for the importance of science and technology courses from both polytechnics.

Table 4.7

Percentage Values of Importance given for TIVET courses by regular diploma students (n = 350)

Value %	Polytechnics		Total No of Students
	Kisumu No of Students	Eldoret No of Students	
90	20	30	50
70	82	88	170
50	60	48	108
30	13	9	22

The students were willing to share their training cost as follows, 23 student were willing to cost share 80%, 48 students were comfortable with 60% and 125 students did not mind cost-sharing 50% while 154 students who were the majority were willing to cost share 40% of their training. The students were not against cost-sharing but required more government subsidies to lessen their cost burdens. Table 4.8 gives the statistics of the willingness of the students to cost share TIVET courses.

Table 4.8

Average cost percentages which regular diploma students were willing to cost share (n =350)

Cost sharing %	Polytechnics		Total No of students
	Kisumu No. of students	Eldoret No of students	
80	10	13	23
60	18	30	48
50	58	67	125
40	89	65	154

The students were further questioned on their attitudes on specific items as far as cost sharing policy for science and technology education and training in their Polytechnics were concerned. A scale one and two were combined for disagreement and scales four and five were combined for agreement. Scale three consisted of uncertainty and was therefore left out. Tables 4.9 and 4.10 show the statistics.

Table 4.9

Students' Attitude towards cost-sharing policy in Kenya national polytechnics (n = 350)

	Strongly Disagree			Disagree			Uncertain			Agree			Strongly Agree			Not Applicable			
Items	KSM	ELD	T	KSM	ELD	T	KSM	ELD	T	KSM	ELD	T	KSM	ELD	T	KSM	ELD	T	GRAND T
1	24	23	47	34	35	69	31	23	54	43	55	98	28	25	53	22	7	29	350
2	14	11	25	25	13	38	16	15	31	42	48	90	61	84	145	1	0	1	350
3	26	25	51	33	36	69	31	32	63	33	30	63	43	41	84	13	7	20	350
4	54	40	94	48	50	98	23	29	52	28	32	60	18	15	33	9	4	13	350
5	55	27	82	51	47	98	25	26	51	31	51	82	19	16	35	2	0	2	350

KEY

Items

1 – Students to pay fees because they benefit

2 – Government to subsidize TIVET for industrialization

3 – Cost-sharing is a barrier for access to TIVET

4 – There are adequate Training and Learning facilities in Kenya national polytechnics

5 – There are adequate infrastructures in the national polytechnics

KSM – Kisumu polytechnic

ELD – Eldoret polytechnic

T – Total

Table 4.10

Percentage summary on attitude test scales for regular diploma students (n = 350)

	Items	Score	
		Agree %	Disagree %
1	Students to pay fees because they benefit	56.6	43.4
2	GoK. to subsidize TIVET for Industrialization	78.9	21.1
3	Cost-Sharing is a barrier for access to TIVET	55.1	44.9
4	There are adequate Training & learning facilities in national polytechnics	32.6	67.4
5	There are adequate physical Infrastructures in the national polytechnics	35.3	64.7

It was found out that;

i) Fifty six point six percent of the students respondents were willing to pay for their training cost because the courses were beneficial to them but 43.4% were not willing to cost –share their training cost.

ii) Seventy eight point nine percent of the student's respondents required the government to heavily subsidize TIVET courses to allow for more students to access the institutions. This was earlier echoed by the students where 69.05% of them found the cost of their training un-affordable with only 21.1% who said that government subsidy were not necessary.

iii) Fifty five point one percent of the students indicated that cost sharing policy for TIVET hindered bright but needy students from completion of their courses due to poverty while 44.9% disagreed.

iv) Thirty two point six percent of the students responded that the Polytechnics had adequate training and learning materials but 67.4% disagreed. The heads of departments concurred with the majority of the students on the inadequacy of training and learning materials in most of the departments.

v) Thirty five point three percent of students found the available infrastructures adequate while 64.7% found them inadequate. Nearly all H.O.Ds who responded to the question on infrastructures indicated that there were inadequate infrastructures except in computing and information technology departments where they were adequate.

In the students' opinion, there should be half payment made by individuals because they stood a chance of gaining from science and technology courses after graduation. In the earlier analysis, it was found out that 52% of the students' respondents expected to be employed and 36% of the students expected to be self employed after graduation. Only 12% were not sure of what they would do after graduation. Because of the importance pegged to TIVET courses, 78.9% of the students required the government to subsidize the cost of their TIVET courses. The government subsidy would be used in the acquisition of more training and learning materials and the additional of the required service and physical infrastructures in the institution. Apart from the national polytechnics getting revenue from the students in the form of tuition and boarding fees, they also receive or obtain funds from various sources. Tables 4.11 and 4.12 show statistics of Eldoret and Kisumu polytechnic's sources of revenue respectively.

Table 4.11

Sources of revenue in Eldoret Polytechnic from 2008 to 2010

Vote head	Year 2008 KHS	%	Year 2009 KHS	%	Year 2010 KHS	%
i) Tuition	33,495,000	14.5	45,147,000	11.5	53,000,000	14.4
ii) Boarding	13,865,000	6.0	55,930,000	14.2	12,168,000	3.3
iii) Government Grants	38,000,000	6.5	90,000,000	22.9	90,000,000	24.5
iv) Production Unit	91,658,000	39.7	97,000,000	24.6	96,173,000	26
v) Special grants	52,500,000	22.1	105,128,000	26.7	115,399,000	31
vi) Other Sources	1,425,993	0.6	599,149	0.2	1,235,000	0.3
Total	**230,863,993**		**393,804,149**		**367,975,000**	

Source: (Admin. Records)

In three consecutive years that is; 2008, 2009 and 2010 Eldoret polytechnics received revenue surplus over expenditures of Kshs 175,459,993, 274,931,149 and 220,526,000 and failed to allocate funds for innovation, scholarships and bursaries. The Polytechnic administrators explained that the excess funds were channeled to infrastructure developments to create capacity for access. It was noted during the interview that although efforts made by the government to finance the polytechnic through grants and out-sourcing from donors for special grants were commendable, more subsidy was still required in order to meet the research and innovation costs.

Financial trend above showed that Eldoret polytechnic got percentage funds allocation from production units amounting to 39.7%, in 2008, 24.6% in 2009 and 26% in 2010.

Special grants contributed 22.7% in 2008, 26.7% in 2009 and 31% in 2010. Individual students paid 20.5% in 2008, 25.7% in 2009 and 17.7% in 2010.

In 2008, Kisumu polytechnic experienced a deficit of Kshs.9, 783,710 in revenue over expenditure, while surplus of Ksh.95, 553,267 revenue in 2009 and Ksh.87, 820,563 in 2010 were realized. The surplus funds were allocated to developmental projects like construction of hostels and expansion of training rooms to increase access. The college principal said that the funds which were factored into development projects were still inadequate. Table 4.12 give statistics of sources of revenue in Kisumu Polytechnic and the comparisons respectively.

Table 4.12

Sources of revenue in Kisumu Polytechnic from 2008 to 2010

Vote head	Year 2008 KHS	%	Year 2009 KHS	%	Year 2010 KHS	%
i) Tuition	14,384,250	26.8	14,175,323	8.0	10,801,329	5.6
ii) Boarding	12,439,200	23.2	13,908,700	7.9	13,884,395	7.2
iii) GoK. Grants	10,933,576	20.4	110,000,000	62.1	130,000,000	67.6
iv) Production Unit	15,926,450	29.7	39,080,791	22.1	37,783,474	19.6
Total	**53,678,476**		**177,164,814**		**192,439,198**	

Source: (Admin. Records)

The growing burden of fees payment shouldered by parents needed to be shared by the public and private providers of education. The cost sharing policy in the Polytechnics in Kenya had no provision for the needy but bright students in the institutions. It was learnt that scholarships and bursaries landed into the hands of those students who really did not require them. For example, some of the students who were on bursaries or scholarships

used more money on clothes and pocket money than what was required for college fees. The administrators regretted the high poverty rates and HIV AIDS pandemic which had affected retention of bright but needy students to TIVET courses. These students incurred huge fees debts which forced them to drop out. The pandemic had negatively impacted on access despite the fact that Republic of Kenya (2007) had earlier suggested the formulation of a policy on HIV/AIDS which the institutions and departments were to in co-operate into their operations.

Over 98% of trainees enrolled in TIVET institutions were self sponsored, with very few receiving any financial support from government bursaries or other charitable organizations Republic of Kenya, (2007). The researcher found out that 55.2% of the students in Kenya national polytechnics were self sponsored. Considering the poverty levels in Kenya mentioned earlier, financing TIVET had been difficult for most parents who needed it most because on course completion, their children would either be self employed or employed. The low budgetary allocation for the TIVET sector by the Kenya government contradicts the priority value TIVET had given vision 2030 (Republic of Kenya 2007).

For a country with vision 2030 as industrialization, the allocations were in bad taste. The challenges of resource acquisition and allocation were important in the two National Polytechnics. They needed to re-visit their budgetary plans and re-schedule the allocations to suite vision 2030. Kenya requires more artisans and technologists from middle level colleges. The polytechnics' stakeholders have to come up with practical ways of acquiring funds for adequate and quality training and learning materials and to re-train the Lecturers to be skilled and competent trainers. The stakeholders would also be required to source for scholarship funds and bursaries to give to the needy but bright students to access TIVET courses.

4.3 Effect of cost sharing policy on access of regular diploma students taking Science and Technology Education and Training in Kenya national polytechnics

The second research question was: What is the effect of cost-sharing policy on access for regular diploma students in Kisumu and Eldoret Polytechnics?

The fundamental axiom of manpower requirements is that highly qualified manpower constitutes a bottleneck to economic growth. They are indispensable input into the productive process and take a long time to produce. Their shortfall must impede growth. In science and technology fields, these results are still very relevant. There is minimum education for each occupation below which the task in question cannot be carried out at all but above which additional qualifications have no economic value!

In this study, the researcher was interested in the number of regular diploma students who were able to access Kenya national polytechnics. These categories were important to the researcher because they were the middle level skilled employees of the future who could assist Kenya achieve her vision for 2030. The second research questions responded to was: What is the influence of cost-sharing policy on the access of Regular Diploma Students in Kisumu and Eldoret polytechnics? The responses were recorded and analyzed in respect to the experiences of the students, lecturers and the national polytechnics' administrators.

Other materials were retrieved from the institutional documents. Since the implementation of Free Secondary Education (FSE) in 2008, there had been an upsurge in enrolment in public schools. In 2010, there were about 6000 (six thousand) secondary schools in the country. Daily Nation (2011 March. 14th) reported that form four candidates who sat for KCSE in 2010 were 351,955. Out of these students, 30,000 were expected to join public universities. Approximately 50,000 were expected to join private universities. The remaining 80,000 students were expected to join TIVET institutions and

other middle level training colleges. 191,955 students would have to join private colleges or be absorbed as unskilled labourers. Those students who would have wished to join Kenya national polytechnics might not secure the chances in these institutions because the institutions are only two in the country. The wastage trend of form four graduates is likely to grow in future if physical expansion or building of new national polytechnics does not receive the immediate necessary urgent attention of creating adequate capacity to absorb the students it deserves. Kisumu polytechnic enroled 410 first year regular diploma students in 2010, out of this enrolment, 81% were male students and 19% were female. Second year students were 340 of which, 84% were male and 16% were female. The Polytechnic had an enrolment of 368 third year students out of which 82.3% were male and 17.7% were female. Female gender disparity was evident in all departmental enrolments except in food and beverages department where they were more.

Table 4.13 shows the enrolment of regular diploma students in Kisumu polytechnic by course, by year and gender in 2010.

Table 4.13

Enrolment of regular diploma students in Kisumu polytechnic in 2010

	Courses	Year I			Year II			Year III			Total
		M	F	T	M	F	T	M	F	T	
1	Applied Biology	27	12	39	39	10	49	56	17	73	161
2	Analytical Chemistry	5	1	6	14	5	19	21	5	26	51
3	Food and Beverage	10	23	33	6	24	30	10	34	44	107
4	Quantity Survey	3	0	3	8	1	9	3	1	4	16
5	Civil Engineering	40	6	46	41	4	45	30	1	31	122
6	Building and Construction	10	0	10	23	0	23	20	1	21	54
7	Electronics Engineering	17	0	17	17	1	18	22	0	22	57
8	Electrical Power Engineering	89	8	97	81	5	86	55	1	56	239
9	Computer Studies	0	0	0	7	1	8	10	4	14	22
10	Information Technology	53	14	67	0	0	0	0	0	0	67
11	Information Communication	35	14	49	0	0	0	0	0	0	49
12	Mechanical Production	17	0	17	17	2	19	16	0	16	52
13	Mechanical Engineering Plant	15	0	15	18	0	18	32	1	33	66
14	Motor Vehicle Tech.	1	0	1	0	0	0	0	0	0	1
15	Automotive Engineering	10	0	10	16	0	16	28	0	28	54
	Total	332	78	410	287	53	340	303	65	368	1118

Source: (Admin. Records)

One issue which was found out in Kisumu polytechnic by the researcher was that a hostel was not occupied. There were quite a number of assumptions that crossed the researcher's mind; that for this hostel to be unoccupied, enrolment must have been going on, the boarding cost for the hostel was too high for the students to afford or that the

administrators might have constructed unnecessary structures to the expense of research, innovation, training and learning materials? No convincing reason sought was given thus the assumptions.

Table 4.14 and Figure 4.7 show the comparison between male and female students in KisumupPolytechnic2010.

Table 4.14

Gender Enrolment comparison in Kisumu polytechnic by academic year in 2010

Year of Study	Students				Total number of students
	M	%	F	%	
1	332	81	78	19	410
2	287	84.4	53	15.6	340
3	303	82.3	65	17.7	368
Total	**922**	**82.5**	**196**	**17.5**	**1,118**

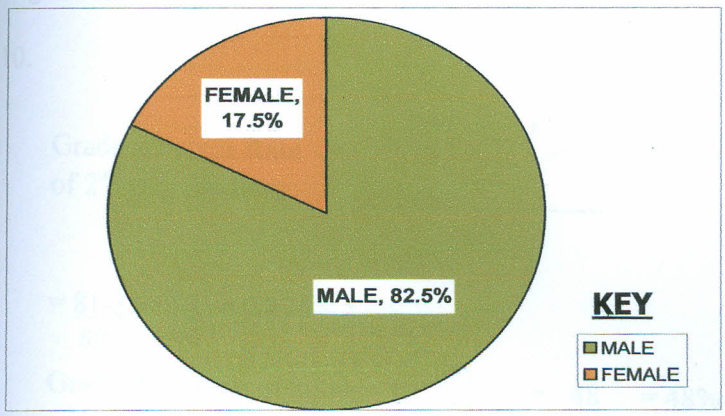

Fig. 4.2: Percentage gender enrolment Kisumu polytechnic in 2010

The disparity in gender enrolment of 82.5% male and 17.8% female students requires to be addressed.

An in-depth analysis was done on the enrolment trend of students taking electrical and electronic course in Kisumu Polytechnic from 2008 to 2010 to measure some of the aspects of internal efficiency in national TIVET institutions in Kenya. These were; drop out rates, Graduation rates, enrolment ratio and survivor rates. Table 4.15 gives the data

Table 4.15

Trends of regular diploma students' enrolment in electrical and electronics engineering courses in Kisumu polytechnic from 2008- 2010

Year	1st year	2nd year	3rd year	Graduates
2008	89	91	60	Not available then
2009	102	81	99	48
2010	114	83	78	Were not out yet

The following efficiency index was looked into as concerns the enrolment of students taking Electrical And Electronics Engineering courses in Kisumu Polytechnics in 2008-2010.

(i) Grade survivor Rate of 2nd year students $= \dfrac{N_{t+1}^{k+1} - R_{t+2}^{k+1}}{N_t^k}$

$= \frac{81-3}{89} = \frac{78}{89} = 0.876 = 87\%$

(ii) Graduation Rate in 2009 $= \dfrac{G_{t+3}^{k+3}}{N_{t+3}^{k+3}} = \frac{48}{99} = 48\%$

(iii) Enrolment Rate (ER) in 2009 $= \frac{N}{P}$

Total electrical and electronics enrolments in year 2009 (P) = 3316

Number of diploma students enroled in electrical and electronic in 2009 (N) = 282

Enrolment Rate = $\frac{N}{P} = \frac{282}{3316} = 8.5\%$

This ratio is important in measuring a country's requirements of a particular skill or meeting specific objectives like vision 2030.

(iv) Drop out Rate for 1st and 2nd year regular diploma students taking electrical and electronic course in 2010 in Kisumu polytechnic

$$= \frac{N_t^k \left[- \left(N_{t+1}^{k+t} - R_{t+1}^{k+t}\right) + R_t^k \right]}{N^k}$$

$$102 - \frac{(83-15) + 29}{102} = {}^{t}4.9\%$$

Although 87% of regular diploma students taking electrical and electronics course in Kisumu polytechnics in 2009 were retained in the Polytechnic, only 48% graduated. This was attested to in their academic performance where there were mass failures and referrals. A drop out of 4.9% was a negative indicator to access. Eldoret polytechnic enrolment also showed gender disparity where 83.20% male and 16.80% female students were enrolled as shown on Tables 4.16, 4.17 and Figure 4.3.

Table 4.16 and 4.17 give the enrolment and gender percentages and Figure 4.3 shows the comparison.

Table 4.16

Enrolment of regular diploma students in Eldoret polytechnic in 2010

	Course	Year I		Year II		Year III		Total
		M	F	M	F	M	F	
1	Applied Biology	20	10	16	15	16	9	86
2	Analytical Chemistry	30	9	13	6	17	9	84
3	Food and Beverage	2	10	0	0	0	0	12
4	Civil Engineering	32	0	40	4	38	7	121
5	Building and Construction	3	0	11	1	6	6	27
6	Medical Engineering	19	10	0	0	0	0	29
7	Electronics Engineering	26	2	14	0	14	0	56
8	Electrical & Power Engineering	14	1	56	5	38	4	118
9	Telecommunication Engineering	22	2	31	5	21	4	85
10	Instrumentation control	11	0	12	0	10	1	34
11	Computer Studies	16	4	24	7	21	5	77
12	Information Technology	39	16	1	0	0	0	56
13	Applied statistics	2	0	12	9	18	5	46
14	Mechanical Engineering (Power)	23	1	11	1	17	2	55
15	Mechanical Engineering (Plant)	16	0	29	3	22	3	73
16	Mechanical Engineering Production	20	0	18	1	12	1	52
17	Mechanical & Automotive Engineering	12	1	20	0	14	0	47
	Total	**307**	**66**	**318**	**57**	**264**	**56**	**1058**

Source: (Admin. Records)

Table 4.17

Gender enrolment comparison in Eldoret polytechnic in 2010

Year	M	%	F	%	Total No. of Students
1	307	82.3	66	17.7	373
2	318	84.8	57	15.2	375
3	264	82.5	56	17.5	320
Total	**889**	**83.2**	**179**	**16.8**	**1,068**

Source: (Admin. Records)

The two polytechnics showed an increase in enrolment in the years 2009 (2nd year) and 2010 (1st year) compared to 2008 (3rd year) students.

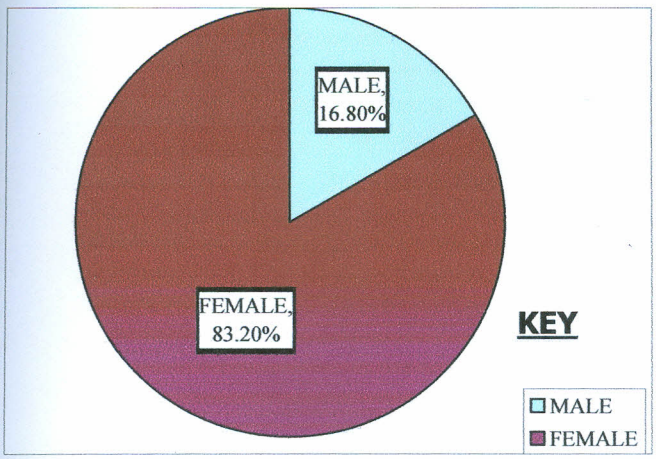

Figure 4.3: Percentage gender enrolment in Eldoret polytechnic in 2010

The gender disparity of 83.2% male and 16.8% female students requires bridging.

Table 4.16 gives the Enrolment rates per course in the two national Polytechnics. The researcher found out that the availability of training learning materials, the skilled Lecturers and space determined the enrolments.

Enrolment rates in Eldoret polytechnic by course showed that civil engineering had the highest enrolment rate of 11.4% followed by electrical and power engineering at11.2% and applied Biology with 8.1% out of total enrolment of 1058 students in 2010. Kisumu

polytechnic had Electrical and power engineering with an enrolment rate of 21.4% followed by applied Biology at 14.4% and civil Engineering at 10.9%.

Eldoret polytechnic registered enrolments in 17 courses in 2010 while Kisumu polytechnic registered enrolments in 15 courses during the same year. The most popular courses in the national Polytechnics were electrical power engineering, civil engineering and applied Biology. Table 4.18 gives the enrolment rates per course in each polytechnic.

Table 4.18

Enrolment Rates of regular diploma students in Kisumu and Eldoret polytechnics by course in 2010

	Course	Enrolment Rate			
		Kisumu		Eldoret	
		T	%	T	%
1	Applied Biology	161	14.4	86	8.1
2	Analytical Chemistry	51	4.6	84	7.9
3	Food and Beverage	107	9.6	12	1.1
4	Civil Engineering	122	10.9	121	11.4
5	Building and Construction	54	4.8	27	2.6
6	Medical Engineering	-	-	29	2.7
7	Electronics Engineering	57	5.1	56	5.3
8	Electrical Power Engineering	239	21.4	118	11.2
9	Telecommunication Engineering	-	-	85	8.0
10	Instrumentation control	-	-	34	3.2
11	Computer Studies	22	22	77	7.3
12	Information Technology	67	5.9	56	5.3
13	Applied statistics	-	-	46	4.3
14	Mechanical Engineering (Power)	-	-	55	5.2
15	Mechanical Engineering (Plant)	66	5.9	73	6.9
16	Mechanical Engineering Production	52	4.7	52	4.9
17	Mechanical & Automotive Engineering	54	4.8	47	4.4
18	Quantity Survey	16	1.4	-	-
19	Information Communication	49	4.4	-	-
20	Motor Vehicle Technology	1	0.1	-	-
	Total	**1118**		**1058**	

It was sad to note the Mechanical Engineering courses, Building and Construction and Motor Vehicle Technology had very few students enroled. It would not be pre-mature for the researcher to indicate that the lack of these skilled human resources in the job market could be some of the reasons for the number of buildings collapsing during their construction, or the frequent road carnage due to faulty vehicles.

The first objective of TIVET in Kenya, Republic of Kenya, (2005) was to provide increased training opportunities for secondary school leavers that would make them to be self-supporting and relevant in the changing economy. The strategy to address this objective was to provide loans and bursaries to enhance access to TIVET, take special account of marginalized groups such as female and physically handicapped students. These Kenya Education Sector Support Programme (KESSP) strategies remained just that, strategies! 69.05% students' respondents from the national Polytechnic found the science and technology courses unaffordable and 55.2% were self sponsored.

On transition from secondary schools to TIVET institutions, assuming that out of the estimated one million students graduating from secondary schools by 2016, the universities would admit 100,000 and TIVET would have to absorb the remaining 900,000 Republic of Kenya (2007). Based on the above assumption, no one expected the Kenya government to upgrade the Mombasa and Kenya national polytechnics to university status reducing the number of national polytechnics to two. There is a great need for the Kenya government to; upgrade the existing middle level colleges to national Polytechnic status and to encourage the private sectors to establish technical colleges to supplement government efforts. The recommended standard ratio of Engineers: Technologists: Craftsmen is 1:5:15 respectively in industrial and manufacturing world. The inverted pyramid scenario in the Kenya situation is unhealthy for industrial growth

where theme were more degree holders than Technologists and Craftsmen. Lack of capacity for access in National Polytechnics was attributed to limited physical facilities which included workshops, laboratories, classrooms and limited number of National Polytechnic institutions in the country which determined access. Apart from space, there were variations on levies charged for similar programmes in Kisumu and Eldoret polytechnics and this could have been a challenge.

4.4 Effects of cost-sharing policy on academic performance of regular diploma students taking Science and Technology Education and Training courses in Kenya national polytechnics.

The third research question was: What is the influence of cost-sharing policy on the performance of regular diploma students taking science and technology education courses in Kisumu and Eldoret polytechnics. The key variables that impact on quality of education include curriculum, instructional materials and equipment, physical facilities, lecturers' assessment and examinations, institutional management and institutional environment. Improvement on the quality of education focuses on setting of standards for these variables and ensuring that the set standards were adhered to.

Republic of Kenya (2005) noted that pursuit to internal efficiency in Kenya education system required policy attention. Amuka (2003) indicated that the primary subjects' requirements for science and technology courses were Physics, Mathematics, Chemistry and Biology. Yet, physics, according to Okebukola (1995) and Mathematics, according to Foundation for Research and Development (1993) were least preferred subjects by students at secondary levels. This was because of lack of computational skills by the students, inappropriate teaching methodologies used by teachers (Nganga, 1999) and (Waithaka, 1996). Other reasons were inadequate equipment and apparatus (Orogho,

1996). The researcher found out that there was curriculum inflexibility due to cost implications. Some courses were too expensive for the students to undertake. It was also found out that the variables mentioned above were either inadequate or were not relevant to TIVET' instructional requirements.

4.3.1 Evaluation

Evaluation is one of the major components of curriculum implementation in a learning institution. A look at Kisumu national Polytechnic KNEC results was a sorry situation. Referrals and failures were common. Tables 4.19 and 4.20 give the data and Figures 4.4 and 4.5 shows the comparison.

Table 4.19

Kisumu polytechnic KNEC 2008 Results Analysis

	Course	Gender							
		M	**F**	**Dist**	**Credit**	**Pass**	**Refer**	**Fail**	**Absent**
1.	Mechanical Eng (production)	12	0	0	0	4	7	1	0
2.	Mechanical Eng (plant)	14	0	0	1	3	3	7	1
3.	Automotive Engineering	23	0	0	0	2	11	9	1
4.	Electronic Engineering	15	1	0	0	3	7	5	1
5.	Electrical Eng. (power)	27	5	0	0	0	9	23	0
6.	Computer studies	10	1	0	1	1	8	0	1
7.	Information technology (Module I)	40	16	0	23	25	5	2	1
8.	Information Technology (module II)	21	14	0	1	10	9	14	1
9.	Information Technology (Module III)	6	3	0	1	4	4	0	0
10.	Building Construction	17	1	0	0	2	5	10	1
11.	Civil Engineering	24	2	0	1	4	8	12	0
12.	Food & Beverage Management	8	24	0	8	23	1	0	0
13.	Applied Biology	25	11	0	1	7	16	12	0
14	Analytical Chemistry	24	4	0	0	3	9	16	0
	Total	**266**	**82**	**0**	**37**	**91**	**102**	**111**	7

Source: (Admin. Records)

The female enrolment in all the courses except in food and beverages was dismal. Out of the 348 students who sat for KNEC examinations in 2008, only 23.6% were females. Mechanical and Automotive Engineering did not present female students for examinations.

Figure 4.4 gives the performance comparison.

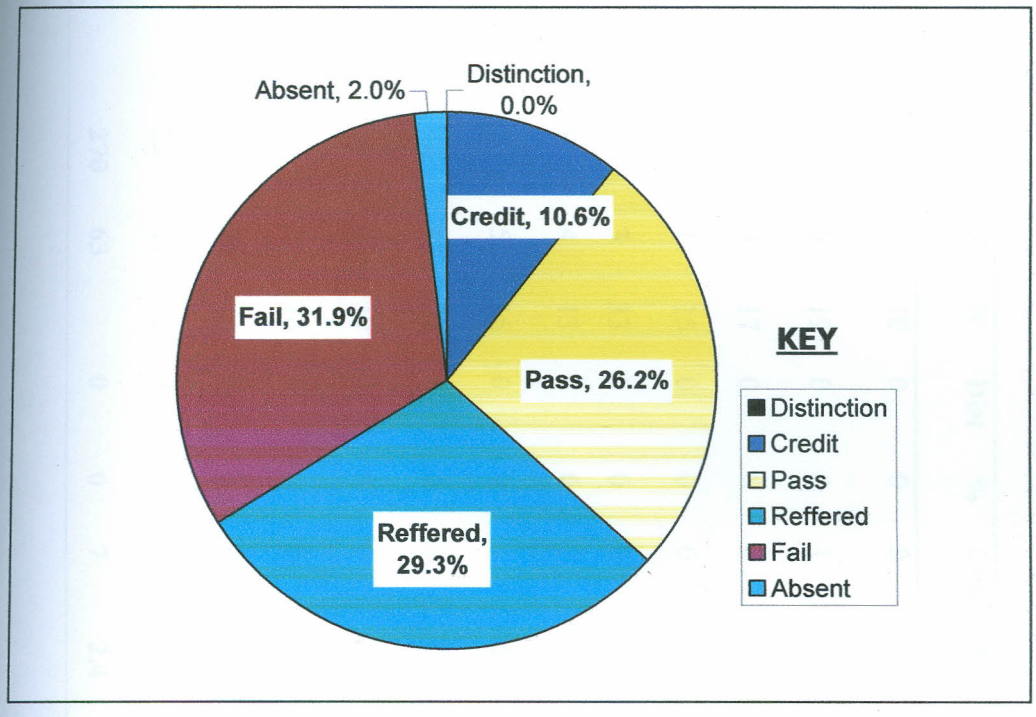

Figure 4.4: Kisumu polytechnic2008 KNEC Examination Results Analysis

There were no students who got distinctions in 2008 KNEC examination. Students who got credits were 10.6%, pass were 26.2% referrals were 29.3%, failures were 31.9% and 2% were absent. Examination results scenario in 2009 were no different from 2008 as shown in Table 4.20 below. Very many students in Kisumu Polytechnic either failed in their exams or were referrals as shown in the Table 4.20.

Table 4.20
Kisumu polytechnic KNEC 2009 Results Analysis

Course	Gender		Scores												
	M	F	N	Dist	%	Cred	%	Pas	%	Refr	%	Fail	%	Abst	%
Mechanical Eng (production)	10	0	10	0	0	0	0	2	20	6	60	2	20	0	0
Mechanical Eng (plant)	19	0	19	0	0	1	5.2	0	0	12	63.1	6	32	0	0
Automotive Engineering	17	0	17	0	0	0	0	6	35.2	7	41.1	4	24	0	0
Electronic Engineering	14	1	15	0	0	0	0	3	20	8	53.3	4	27	0	0
Electrical Eng. (power)	30	3	33	0	0	0	0	6	18	13	39	14	42	0	0
Computer studies	9	4	13	0	0	2	15.4	3	23	5	38.5	3	23	0	0
Information Technology (M1)	11	5	16	0	0	1	6.3	12	75	2	12.5	0	0	1	1.8
Information Technology (M1)	44	12	56	0	0	0	0	8	14.3	15	27	33	59	0	0
Building Construction	19	0	19	0	0	0	0	1	5	4	21	14	74	0	0
Civil Engineering	25	3	28	0	0	0	0	1	3.6	10	36	16	57	1	3.6
Applied Biology	50	24	74	0	0	2	3	28	38	38	51	6	8	0	0
Analytical Chemistry	22	11	33	0	0	0	0	4	12.1	25	75.7	2	6	2	6
TOTAL	**270**	**63**		**0**	**0**	7	**2.4**	95	**20.3**	**168**	**38.1**	**104**	**29.3**	5	22.1

Source: (Admin: Records)

In 2009, there was a slight increase on the number of students who sat for the KNEC examinations. Female enrolment still remained low at 26.65%. Mechanical, Automotive Engineering and building construction did not present female students. Figure 4.6 gives the comparison.

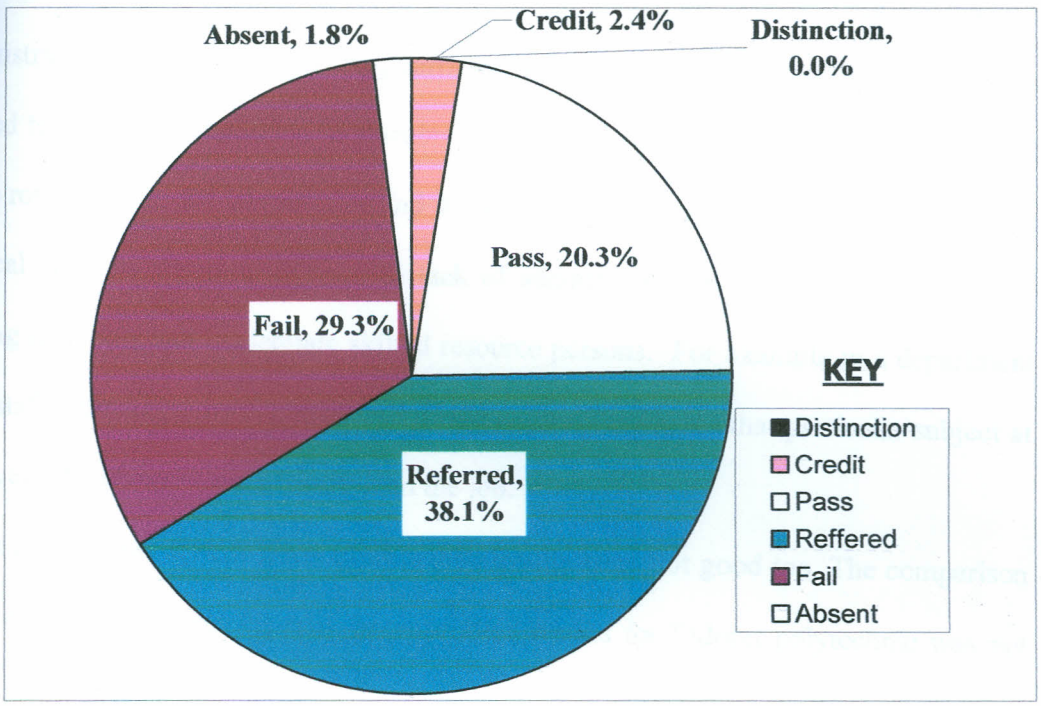

Figure 4.5: Kisumu polytechnic2009 KNEC Results Analysis.

Kisumu polytechnic KNEC examination Results Analysis compared.

Year	No. of Candidates	Distinction	Credit	Pass	Referred	Fail	Absent
2008	348	0	37	91	102	111	7
2009	333	0	7	95	168	104	5

Out of 333 students who sat for their KNEC exams in Kisumu polytechnic, there were no distinctions, 2.4% of the students got credit, 20.3% passed, 38.1% were referred and 29.3% failed and 1.8% were absent.

The percentage wastage of 63.22% and 69.20% in 2008 and 2009 respectively were too high for a National college. The researcher would boldly say that Kisumu Polytechnic administrators required re-examining curriculum delivery in their institution. The results attested to the below standards of learning and training materials and machines observed by the researcher in the laboratories and workshops (Appendix G). Students were taught practical subjects theoretically due to lack of adequate space, inadequate training and learning materials and inadequate skilled resource persons. For example in a department of 14 staff members only 5 Lecturers had the required skills for that particular subject at that level, 11 Lecturers were learning on the job.

Eldoret polytechnic KNEC 2009 examination results were not good too. The comparison was done using 2009 results only because 2008 results for Eldoret polytechnic was not availed to the researcher.

Table 4.21 and Figure 4.6 give the statistics and the comparison respectively.

Table 4.21
Eldoret Polytechnic regular diploma students' KNEC 2009 Results Analysis.

Course	Gender			Dist.		Credit		Pass		Referred		Fail		Absent	
	M	F	N	F	%	F	%	F	%	F	%	F	%	F	%
Diploma in Civil Engineering	23	0	23	0	0	2	9	4	18	13	57	3	13	1	4.3
Diploma in Building and Construction	6	0	6	0	0	0	0	0	0	4	67	2	33.3	0	0
Diploma in Mechanical & Automotive Engineering	17	0	17	0	0	0	0	6	35.3	9	53	2	12	0	0
Diploma in Mech. Eng.(Production option)	28	0	28	0	0	3	11	4	14.3	12	43	8	29	1	4
Diploma in Mechanical Eng. (plant option)	28	0	28	0	0	1	4	10	36	11	39.3	6	21.4	0	0
Diploma in Computer Studies	12	5	17	0	0	1	6	4	24	9	53	2	12	1	6
Diploma in Information Technology module 1	22	13	35	0	0	1	3	26	74	3	9	2	6	3	9
Diploma in information Technology module II	13	15	28	0	0	0	0	6	21.4	7	25	14	50	1	3.6
Diploma in Applied Biology	54	64	118	0	0	4	3.4	41		64	54.2	7	6	2	2
Diploma in Analytical	51	19	70	0	0	3	4.3	12	17.1	34	49	19	27	2	3
Diploma in Electronic Engineering	31	0	31	0	0	1	3.2	7	22.6	9	29	13	42	1	3.2
Diploma in electrical engineering (power option)	53	2	55	0	0	3	6	7	12.7	15	27.3	24	44	6	11
Total	338	118		0	0	19	4.10	127	22.90	190	42.10	102	24.60	18	3.80

Table 4.23

Eldoret polytechnic2009 KNEC Performance index (P1)

	Performance level	n	%	Weight	Score
1	Distinction	0	0	1.2	0
2	Credit	19	4.10	1.1	4.5
3	Pass	127	25.9	1	25.9
4	Referred	190	42.1	0.6	25.3
5	Fail	102	24.5	0.3	7.4
6	Absent	18	3.8	0	0
	Total	**452**			**P1 = 63.1**

Kisumu and Eldoret polytechnics performed poorly in KNEC examination results in 2009. Since most of the students found the courses un-affordable, one would therefore expect that not all of the students who got referrals were retained. A number of students must have dropped out. The percentage wastage due to referrals and failures from the two polytechnics was very high. The major cause of drop out from the two polytechnics was found out to be academic failure. An examination of the probable cause of the dismal performance was required. If these polytechnics were to be the production units for the middle level college engineers who were to assist Kenya to industrialize by 2030, then the policy makers required to thoroughly examine curriculum delivery in Kenya national polytechnics.

4.3.2 Human Resource

Curriculum Based Establishment (CBE) and other quality assurance and standards activities in the polytechnics which were associated with results were invested into and the following information given in Table 4.24 was obtained.

Table 4.24

Kenya national polytechnics Curriculum Based Establishment (CBE) in 2010.

		Lecturers							
	Department	**Kisumu Polytechnic**				**Eldoret Polytechnic**			
		M	**F**	**Total**	**Required**	**M**	**F**	**Total**	**Required**
1	Computer study	10	3	13	16	11	2	13	21
2	Building & Civil Engineering	12	-	12	16	6	0	6	16
3	Mechanical & Automotive Engineering	22	1	23	26	17	0	17	21
4	Applied Sciences	10	8	18	20	8	7	15	24
5	Electrical &Electronic Engineering	13	2	15	17	9	1	10	15
	Total	**67**	**14**	**81**	**95**	**51**	**10**	**61**	**97**

Source: (Admin. Records)

Kisumu polytechnic in 2010 had 82.7% male Lecturers in five departments of science and technology courses and 17.3% female trainers. Kisumu polytechnic principal indicated that there were shortages of 14 trainers. Eldoret Polytechnic in 2010 had 84% male and 16% female trainers. The principal indicated that he had a shortage of 36 trainers. A lot of emphasis had been put on the need to increase access into TIVET institutions by the Kenya government to meet the vision industrialization by 2030 yet not so much was being done to improve the shortage of skilled lecturers in the polytechnics. The administrators faced difficulties in handling lecturers who were not adequately skilled to handle the students. The institutions lacked the necessary funds to re-train the un-skilled lecturers.

National polytechnics Principals said that lack of relevant academic skills and qualifications affected content delivery to students by lecturers in that the practical nature of the courses in the polytechnics required lecturers who were competent in the subject matter and with required practical skills to transfer to the students. The researcher found out that only 0-24% of the lecturers in the National Polytechnics had achieved the required professional technical skills. It was lamented by the principals that sometimes, the students were more knowledgeable in subject content and skills than some lecturers especially in the use of Information Technology (IT).

4.3.3 Curricular and co-curricular activities in Kenya national polytechnics

Apart from the competency of the trainers, other activities in the Polytechnics which could improve management and content delivery skills were quality assurance monitoring, workshops, motivational talks and seminars. The researcher sought to know how often these activities were carried out in the two polytechnics. Using a scale of 1-5, the researcher found out the frequencies of curriculum and co-curricular activities that took place in Kenya national polytechnics as indicated on Table 4.25.

Table 4.25

Kenya national polytechnics curriculum and co-curricular activities in 2010.

	Action	Poly	Very often	Often	Rarely	None	N/A
			1	2	3	4	5
1	Departmental meetings	Kisumu	1				
		Eldoret	1				
2	Seminars	Kisumu					
		Eldoret					
3	Workshop & capacity building	Kisumu			3		
		Eldoret		2			
4	Internal Quality Assurance and Standards	Kisumu		2			
		Eldoret		2			
5	External quality assurance and standards	Kisumu		2			
		Eldoret			3		
6	Educational excursions	Kisumu		2			
		Eldoret			3		
7	Industrial linkage exposures	Kisumu	1				
		Eldoret		2			
8	Staff Appraisals	Kisumu				3	
		Eldoret				3	
9	Made an invention	Kisumu			2		
		Eldoret				4	

It emerged from the data above that while departmental meetings and internal inspections were done regularly in the two polytechnics, Kisumu polytechnic rarely held workshops and capacity buildings for its staff and that staff appraisals were limited. It was also unfortunate for Eldoret polytechnic that they did not get exposed to frequent seminars, made an invention and that they rarely had external quality assurance and standards visitations. Eldoret polytechnic also did not go for educational excursions often and rarely had staff appraisals in 2010. With a staff

which already had some problems of content and skills competency, the administrators required more organized seminars, capacity buildings and appraisals for the Lecturers to deliver the curriculum effectively to the students. If all activities were well planned for in advance and implemented, the polytechnics would be self evaluating and would improve in their out-put; that is performance. The activities required adequate funding which was not available.

4.3.4 Income Generating Projects (IGP)

The management organized for IGPs in the Polytechnics for self sustenance to supplement the funds deficit. A scale of 1 to 5 was used to find out the importance of Income Generating Projects in the two National Polytechnics (Table 4.26).

Table 4.26

Principals' Responses on Income Generating Projects (n =2).

Statements		N/A	Disagree	Not sure	Agree	Strongly Agree
		1	2	3	4	5
(IGP) should be mandatory in	Kisumu				4	
the polytechnics	Eldoret				4	
More focus on IGP shifts						
focus from academics to	Kisumu				4	
business	Eldoret		2			
Most of the departmental						
operation funds came from	Kisumu		2			
IGP	Eldoret		2			
Income generated from IGP						
were more often	Kisumu	-	-			
misappropriated or	Eldoret		2			
mismanaged						
IGP funds were meant to						
subsidize economically less	Kisumu		2			
fortunate students	Eldoret				4	

Kisumu polytechnic administrator said that too much of income generating projects shifted attention from academics to commercial activities and therefore should be done in moderation. The two principals indicated that the importance of income generation projects were to generate funds to subsidize the polytechnic's revenue for operations. For example, they used the fund to purchase additional training materials, hire or contract Lecturers and workers whenever there were shortages and also used the funds for repair and maintenance.

The question asked here was that if the income generating projects were that beneficial to the polytechnics, then their values could be improved to be vision 2030 compliant. The recycling skills of milk, eggs, fruits and vegetables production done by both institutions could be translated into fruits canning, preservation of vegetables and production of long life milk. The finding was in agreement with Republic of Kenya (2008) which indicated that manufacturing of products would create employment, improve standards of living and yield more income into the economy. The income would be used to improve the infrastructures in the polytechnics. The students would also gain more of the industrial skills required for self sustainability once they graduated. This could only be possible if the government injected more grants to bridge the financial gaps where IGP were used in short-term to a certain long term financial solutions and to improve on research using IGPS. Improved research would add value to academic performances in the polytechnics.

4.5 Challenges of cost sharing policy experienced by regular diploma students, lecturers and administrators in Kenya national polytechnics

The fourth research question responded to was; what are the challenges brought about by cost-sharing policy in Kenya national polytechnics? This question was responded to by establishing the challenges under seven sub-topics and they included physical

and service infrastructures, quality and relevance, access and equity, research and development, awareness, gender and resource mobilization.

4.5.1 Physical and Service Infrastructures for Training in Kenya national polytechnics.

There was need to recognize training as an investment and not a cost. Rapid changes in technology today rendered work skills obsolete quite fast. Republic of Kenya (2003) noted that employees needed to be multi-skilled and versatile in order to adjust to frequent changes in technological developments. Provision of facilities for training is paramount. Polytechnic curriculum is practical in nature and therefore the inadequacy of the required facilities would defeat the curriculum delivery. The infrastructures included space capacity, relevant learning and training materials. Libraries were inadequate or were lacking in terms of space and materials in both the polytechnics. In some departments, workshops, laboratories and lecture rooms either not available, relevant or were inadequate. From the approximate construction costs given by the H.O.Ds, it was obvious that physical facilities were very expensive to construct and equip. Therefore, special funds were required for new buildings expansions. Some of the laboratories used were in wanting states physically and lacked the basic machines apparatus and equipments (Appendix G). Lecturers resorted to teaching technical courses theoretically because of inadequate and the use of some obsolete apparatus and equipment available.

Table 4.27 shows some of the available departmental infrastructures in Kisumu and Eldoret polytechnics with their approximate costs.

Table 4.27
Number and cost of departmental special rooms given by H.O.Ds (n=12)

Department		Lib	Lab	Workshop	Staff room	Adequacy	Good condition	Average	Below average	Cost
1. Applied Science	KSM	0	2	0	0	Inadequate	___	___	√___	2M
	ELD	1	4	0	1	Inadequate	___	√___	___	9M
2. Computing & Information Technology	KSM	0	3	1	3	Adequate	√___	___	___	20 M
	ELD	0	2	0	1	Adequate	___	√___	___	15 M
3. Electrical & Electronics Engineering	ELD	1	2	1	1	Inadequate	___	√___	___	6.2M
	KSM	0	N/A	1	1	Inadequate	___	___	√	2M
4. Building & Civil Engineering	KSM	0	N/A	2	1	Inadequate	___	√___	___	5 M
	ELD	3	N/A	3	2	Inadequate	√___	___	___	2M
5. Mechanical Engineering	KSM	0	N/A	4	1	Inadequate	___	√___	___	3M
	ELD	0	N/A	3	1	Inadequate	___	√___	___	6M

The cost of departmental physical infrastructures ranged from 2m to 15m Kenya shillings. It was found out that there were inadequate lecture rooms, workshops, laboratories, libraries and staffrooms in both Kisumu and Eldoret polytechnics. There was lack of adequate funds to put them up or to expand the existing buildings. It was only in computing and information technology departments in Eldoret and Kisumu which were found to have had adequate physical facilities (Appendix G). Physical capacities are very important for access. The size of the lecture rooms, laboratories and workshops would determine the number of students who would be admitted into those departments. More important are the departmental relevant machines and equipment availability and their usability. They were found to be wanting in relevance and were inadequate in numbers in most of the departments.

A number of the buildings were rated average in suitability. Applied sciences, computing information and technology, building and civil engineering buildings were rated to be in good physical conditions and had some relevant machines and equipment. This could have been because these departments did not require very expensive machines and equipment. The researcher found out that chemistry department buildings in Kisumu Polytechnic required thorough renovations and expansion for it to be relevant for vision 2030 expectations. This is because Kisumu Polytechnic was originally a secondary school. The finding confirmed by KATTI (2008) which indicated that theme was in urgent need to refurbish the polytechnics. The elevation of the institutions' infrastructures to a polytechnic college level was at snail pace. The great need for expansion of the existing buildings or building of the new ones to allow for increased access in both institutions was important. This was in consideration to the very many applicants who were still in the waiting list and yet merited to join the institutions and had not been given the chance by end of January 2011.

The improvements of the infrastructures would only be possible if the concerned stakeholders prioritized access and relevance in their budget by allocating specific funds. There is great need for the prioritization of development funds for capacity expansion, purchase of training and learning materials to increase access and to improve relevance in Kenya national polytechnics.

4.5.2 Quality and Relevance of Training

The Principals of the polytechnics indicated during in-depth interviews that quality and relevance of training was a challenge in Science technology education and training. The quality and relevance of a training system is essential for effective and efficient products Republic of Kenya (2007). Studies undertaken in Lesotho, Malawi, Namibia, South Africa, Swaziland, Tanzania, Kenya, Zimbabwe and Botswana by World Bank (1990), UNESCO (2000) were reported to pivot around relevance, effectiveness, efficiency and budgetary constraints as was reported by Republic of Kenya (2003) and recommended the following points to improve relevance of TIVET skills to industry;

i) Establishment of a position of attachment officers within the TIVET institutions,

ii) Review the theory to practical ratio in the TIVET curriculum,

iii) Develop mechanisms of financing industrial attachment,

iv) Need to develop and implement a competence based modular curriculum system in collaboration with industries,

v) A database for industry professional personnel interested in part time instruction at TIVET institutions to be developed.

These recommendations had been partly implemented though many were just still recommendations! The researcher found out that the dismal academic performance in Kenya National Polytechnics was partly attributed to unskilled costly human resource. That graduates from Kenya national polytechnics were not efficiently equipped to handle the challenges posed at their work places. Most industries had to invest heavily in the re-training of polytechnic diploma graduates in order for them to cope with the industrial demands. This was disclosed to the researcher by polytechnic heads of departments (H.O.Ds) of their graduates after receiving complaints from their employers. In support of the above statement, the H.O.Ds attested the low performance of training providers in the polytechnics to some of the following factors, usage of outdated inflexible curricular that was not responsive enough to the changing needs of the labour market, lecturers posted by the Teachers Service Commission (TSC) who were trained to teach in secondary schools and lacked the required technical skills needed for TIVET. As a result, practical work was jeopardized and service delivery limited. Inadequate relevant learning and training facilities was mentioned in almost all the departments by the Lecturers and lack of regular mechanism for quality assurance leading to; inefficient delivery systems, low quality of skills imparted to trainees and lack of proper accountability for performance on a continuous basis was noted in the students' performance released by KNEC in 2008 and 2009.

The administrators were concerned about the challenges of quality in their institutions and were taking up measures to remedy some of the issues. There was the re-training of the existing Lecturers in local and international relevant universities for masters' degrees and PhD programmes were going on in both polytechnics to upgrade the trainers' skills.

This finding was in line with one of the recommendations in Republic of Kenya (2008) for TIVET lecturers to trainers with the required skills by 2012. The Heads of Departments from Kisumu and Eldoret polytechnics had positive attitude towards their departmental programmes. They said that the programmes which they had developed were relevant to industrialization, affordable to the students, internationally recognized and that they were not meant for income generation purposes mainly! In contrast, 69.05% of the student respondents found training costs unaffordable. If a bout 15% of the Polytechnic recurrent expenditures came from students and they found the cost unaffordable, then, there was need to source for extra funds to allocate to departmental innovation and programmes in the polytechnics. Eldoret Polytechnic was working on research projects with vision 2030 in mind. They had worked on a robot construction at a cost of Kshs. 170,000 and had also researched on intercropping of tea with night - shade to solve food insecurity in the region at a cost of Ksh.500, 000. Kisumu Polytechnic on the other hand was researching on the development and characterization of sisal twinners at a cost of Ksh. 2,100,000 and a learner perception of TIVET at a cost of 500,000. Development of sisal twinner for sale and intercropping tea plantations with night shade to solve food insecurity in Eldoret County were productive programmes. They were both meant for jobs creation and eradication of poverty in the local regions. The next important step for the polytechnics to successfully accomplish their goals was to patent, publish and then implement their findings at the grass-root level targeting vision 2030. From the aforesaid projects, the polytechnics lecturers and their students were willing to work on programmes which were 2030 complaint. The main difficulties faced by the H.O.Ds were funds inadequacy to initiate, carry out more projects and implement the results.

4.5.3 Access and Equity in Training

Principals pointed out during the interviews that access and equity were challenges that contended. The first objective of TIVET in Kenya, (Republic of Kenya, 2005) was to provide increased training opportunities for secondary school leavers that would make them to be self-supporting and relevant in the changing economy. The strategy to address this objective was to provide loans and bursaries to enhance access to TIVET, take special account of marginalized groups such as female and physically handicapped students. These Kenya Education Sector Support Programme (KESSP) strategies remained just that, strategies! 69.05% students' respondents from the national Polytechnic found the science and technology courses unaffordable and 55.2% were self sponsored.

On transition from secondary schools to TIVET institutions, assuming that out of the estimated one million students graduating from secondary schools by 2016, the universities would admit 100,000 and TIVET would have to absorb the remaining 900,000 (Republic of Kenya, 2007). Based on the above assumption, no one expected the Kenya government to upgrade the Mombasa and Kenya National Polytechnics to university status reducing the number of National Polytechnics to two.

There is a great need for the Kenya government to upgrade the existing middle level colleges to National Polytechnic status and to encourage the private sectors to establish technical colleges to supplement government efforts.

Lack of national polytechnics in the country deprived students from other counties the opportunities of access into Science and Technology courses. There was need to build or create more national polytechnics. Quite a number of regular diploma students were day scholars because they could not afford boarding fees paid at once. This implied that the

students were locals because it would have been very expensive for them to rent rooms in Eldoret or Kisumu towns. The localization of the national polytechnics came about because of the high cost of TIVET programmes and boarding facilities which have denied access for the needy but bright students from far distances into these two national polytechnics.

The above findings were in agreement with Republic of Kenya (2007) which stated that rural areas had no reliable sources of income and hence could not afford boarding expenses yet at the same time it was not convenient for day scholars to commute due to lack of reliable transport system and the comparatively long distances from the institutions. In a nut shell, more government subsidies were required to cater for boarding expenses and also to build more national Polytechnics to increase access and improve on equity distributions. This conclusion was arrived at when it was found out in this study that the students in Kisumu and Eldoret polytechnics who responded to the question on how their courses were funded indicated that 55.2% of the students were self sponsored, 27.7% were on bursaries, 6.6% were on full scholarship and four, 10.6% were on partial scholarships.

According to the lecturers, the education system of 8-4-4 presented two major access bottlenecks to TIVET courses because it did not allow for subjects specialization at KCSE level. The 8-4-4 system played a very negative role on the admission of students into post secondary institutions because of the mismatch of subject clusters at secondary school levels due to lack of proper career guidance. The mismatch could have been prevented had the Kenya government stuck to her earlier 8-4-4 curriculum which included technical subjects in primary and secondary schools. The polytechnics would receive relevant students into their

institutions. Kenya government due to financial constraints coupled with complaints from the parents removed technical subjects from primary and secondary curricular under the 8-4-4 of education system. It was reported in nation media (March, 2007) that a Mr. Paul Kanyi was at cross roads. He could not understand the fact that plumbers had so busy schedules that one needed to book an appointment to have some work done. In other words, they were very few. The paper also indicated that parents were also so worried and wondered why the higher education ministry was concentrating in upgrading national polytechnics to universities instead of building new universities. The phasing out of middle level colleges jeopardized chances for students who would have joined them. ILo (1994) also concurred about the upgrading and the amalgamation of polytechnics into universities as a way of killing middle level colleges which produced technologists and craftsmen. Just like a primary school should not be combined with a secondary school using the same teachers, Polytechnic institutions should not be combined with universities using the same trainers. The Kenya national Polytechnics should be left on their own to prioritize on research and innovation at their level, increase access and develop more relevant programmes in their institutions as they target 2030. The conversion of national polytechnics into universities is an easy way out for the government but very expensive for TIVET education in terms of access and performance. The conversion of national polytechnics to universities was contrary to the Kenya education and training goals echoed in Republic of Kenya (2007), that is, vision 2030 which targeted school enrolment rates to 95% and to increase in transition rates to technical institutions and universities from 3% to 8% by 2012.

4.5.4 Research and Development

During in-depth interviews with principals it was revealed that research and development was a big challenge in science and technology education and training. Research and Development (R & D) is a means of creating wealth and enhancing human development and is a critical component of higher education and training. It also plays a vital role in industrial transformation, economic growth and poverty reduction (Republic of Kenya 2005). There is great need to regularly review staff development policies to promote further training for better service delivery, professional growth and motivation. However, quality research requires sufficient funding availability of highly trained staff, adequate and appropriate facilities and equipment. Quality research and development could only be achieved if the following weaknesses were addressed in the Kenya national polytechnics; limited institutional capacity for research in terms of human resources and facilities and limited research funds and limited linkages with industries and other consumers of research. Research and development are the co-ordination nerves to vision 2030. Table 4.2 showed that of the Ksh.234, 401,000 revenue expenditure received by Eldoret Polytechnic in 2010, only 4,679,000 (2%) was allocated for research. In Kisumu polytechnic, out of Kshs. 203,198,585 revenue expenditure received in 2010, only 0.8% was allocated for research. The polytechnics could only aspire to be 2030 compliant if they prioritized on research and development when budgeting and allocating more funds for improvement.

4.5.5 Awareness

During interviews with the national polytechnic principals, they lamented the perceptions held by the public of the engineering courses as being negative. Career options in engineering were not well known by most adults and youth. They were also not well

presented in high school career guidance and counseling booklets. The administrators cited lack of adequate funds to conduct polytechnic access sensitization seminars and workshops for the relevant stakeholders who were the communities, secondary schools career guidance and counselors, Head teachers and the local administrators' for example the area chiefs and D.Os. The challenges were on cost. Three hundred and twenty thousand shillings (Ksh. 320,000) was required to advertise on two pages of a print national media in 2010 and this was too expensive for the Kenya national polytechnics. The engineering careers were perceived difficult and that they were meant for the "A" material students only. The polytechnics administrators said the negative perception about TIVET programmes held by the public who viewed the programmes as for failures and not as alternative education and training which offered Science and Technology skills hindered access and needed to be demystified.

The negative attitude feared by the administrators was evidenced from the students' responses when they were asked about their opportunity cost of joining the polytechnics. Their responses were categorized into five major activities of what the students would have done if they did not join the Polytechnics.

i) Fifty percent of the respondents would have gone into business. Examples of the businesses they would have ventured into included being shopkeepers, salon owners, Juakali artisans, mining sand, selling changaa, selling charcoal, M-Pesa outlets, selling mitumba, construction workers and professional footballers,

ii) Ten percent of the male students would have joined the defence force.

iii) About 20% of the respondents would have ventured into crop & animal farming, poultry projects, fishing, and social-worker / community development activities,

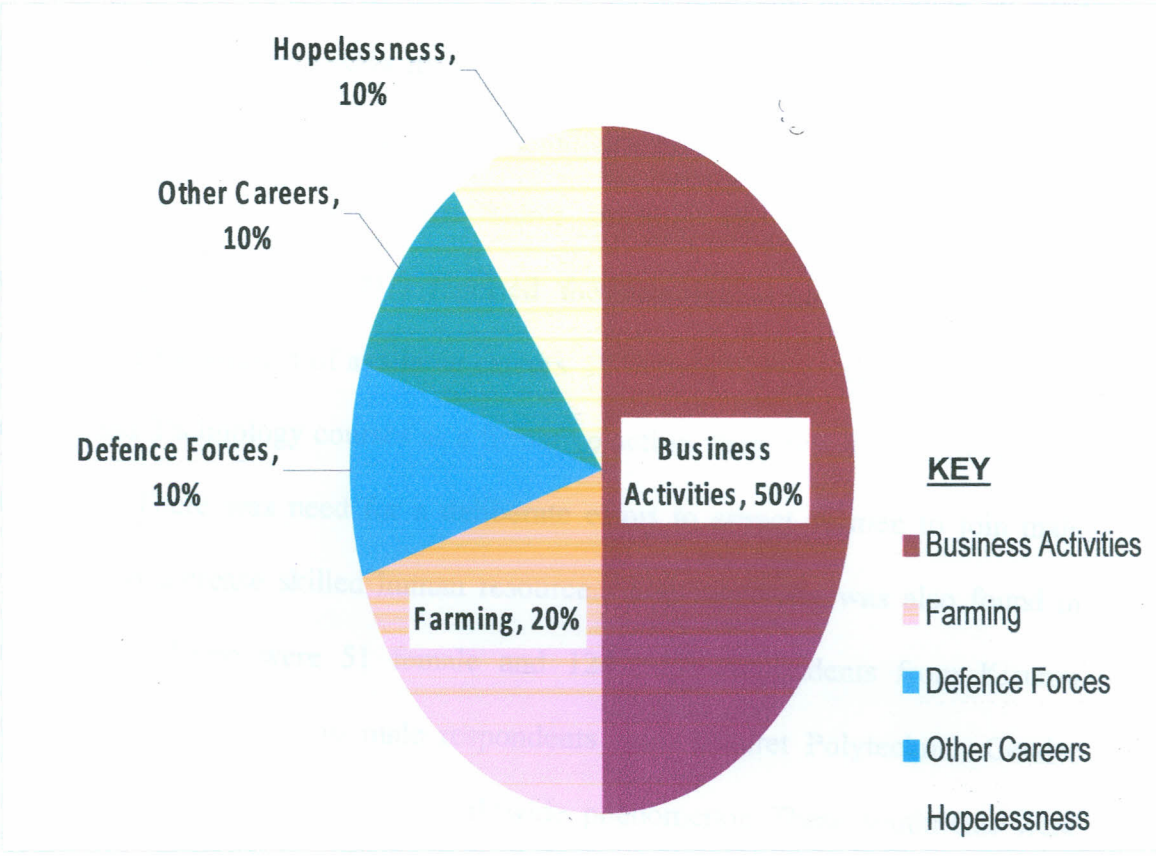

Figure 4.7 Opportunity Costs for Students.

Fifty percent of the students who responded to opportunity cost questions had entrepreneurial mind. If they were retained in the Polytechnics and were given relevant entrepreneurial skills, they would graduate and add technological values into the job market as employers or employees.

4.4.6 Gender in Science Technology Education and Training

During in-depth interviews, Principals indicated that gender in science and technology

education and training was a challenge. Gender disparity was clearly evidenced in the Kenya national polytechnics where lack of women lecturers' role models was a challenge. In 2010, it was found out that there were 83% male Lecturers and 17% female lecturers training regular diploma students taking Science and Technology Education and Training courses. Such inequality gave wrong signals to the female students who intended to join these institutions. Republic of Kenya (2007) reported the negative attitudes as resulting in limitations of choices for women of available careers. If women were given sponsorships to enrol for Science and Technology courses as a firmative action, there would be some change in gender disparity. There was need for a deliberate effort to attract women to join male dominated courses to increase skilled human resource. The inequality was also found in students' enrolments. There were 51 female and 124 male respondents from Kisumu Polytechnic and 35 female and 140 male respondents from Eldoret Polytechnic. Gender inequality in science and technology is a worldwide phenomenon These sentiments were earlier echoed by UNESCO (1992), which noted that the under-representation of women in the traditional male fields of mathematics, engineering and technology were wildly held to be the result of gender stereotyping leading to lack of encouragement to girls wishing to enter those professions.

Table 4.28

Gender enrolment of regular diploma students respondents in 2010 (n = 350)

Kisumu					**Eldoret**					**Grand**			
F	%	M	%	Total	F	%	M	%	Total	M	%	F	%
51	29	124	71	175	35	20	140	80	175	264	75	86	25

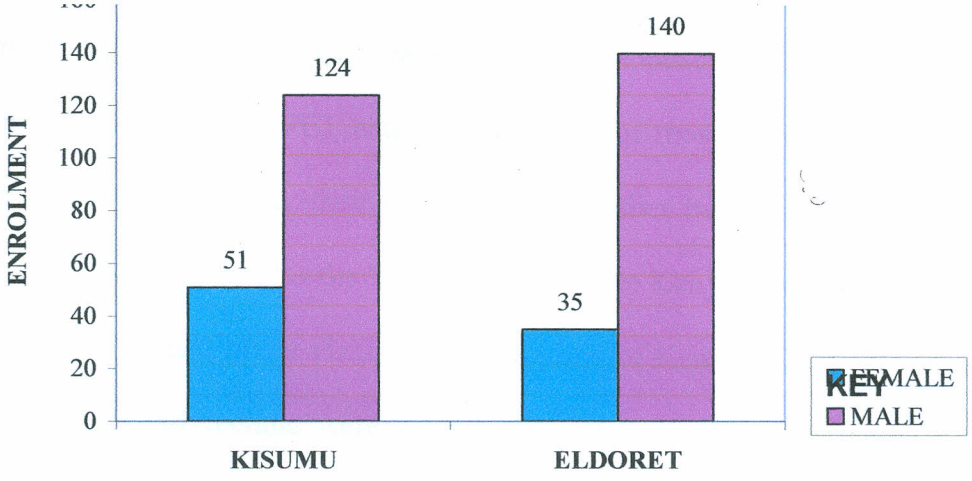

Figure 4.8 Enrolment of students respondents by gender in 2010

Admission policies into polytechnics should articulate criteria for attracting more students from disadvantaged regions, gender and poor communities who are under represented into science and technology courses either because of cost implications, awareness or attitude. In an educational setting, gender dynamics could be analyzed from two perspectives, namely, the efforts at achieving gender parity in participation and policy measures put in place to address gender concerns. As the country struggles with an up hill gender parity walk, there should be a more pro-active approach to gender desk at the ministry of education headquarters to address the policy measures which governs access of women into the TIVET institutions.

4.4.7 Resource Mobilization

It emerged during interviews with the principals that resource mobilization was a challenge they contended with. Over 98% of trainees enrolled in TIVET institutions were self sponsored, with very few receiving any financial support from government bursaries or other

charitable organizations Republic of Kenya, 2007). The researcher found out that 55.2% of the students in Kenya national polytechnics were self sponsored. Considering the poverty levels in Kenya, financing TIVET had been difficult for most parents who needed it most because, on course completion, their children would either be self employed or employed. The low budgetary allocation for the TIVET sector by the Kenya government contradicts the priority value TIVET had given vision 2030 (Republic of Kenya, 2007). Revenue received in 2010 in Eldoret Polytechnic were as follows (31%) from special grants, (26%) from income generating projects (IGP) and (24%) from the government. The remaining revenue collected came from tuition and boarding fees (See Table 4.11). On expenditure, out of the total revenue received, (28.9%) went to operations and maintenance, (18%) to personal emoluments, (14%) to teaching and learning materials leaving (2%) for research and (0%) for scholarships and bursaries while 37.1% went to salaries (Refer to Table 4.3).

For a country with vision 2030 as industrialization, the allocations were in bad taste. The challenges of resource acquisition and allocation were grave in the two national polytechnics. The government needed to re-visit her budgetary plans and re-schedule the allocations to suite vision 2030. Kenya requires more artisans and technologists from middle level colleges. The polytechnics' stakeholders have to come up with practical ways of acquiring funds for purchasing adequate and quality training and learning materials and to re-train the lecturers to be competent trainers. The stakeholders would also be required to source for scholarship funds and bursaries to give to the needy and bright students to in TIVET courses complete and graduate.

CHAPTER FIVE

SUMMARY, CONLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary, conclusions and the recommendations of the study.

5.2 Summary

The findings of this study were summarized as follows.

5.2.1 Average unit cost for educating a regular diploma student taking Science and Technology Education and Training courses in Kisumu and Eldoret polytechnics

Average unit cost for educating science and technology education and training regular diploma students ranged from Kshs. 545,256 and Kshs. 664,653. Specifically, the unit cost per year for Science and Technology Education and Training for regular diploma students in Eldoret polytechnic was Kshs. 221,551 while for regular diploma students in Kisumu polytechnic was Kshs. 181,752.

The unit cost for training a regular diploma student in the national polytechnics was very high noting that the sources of funds, besides private costs included partial scholarships which accounted for 13.2% for revenue in Kisumu polytechnic while 8% for Eldoret polytechnic. Full scholarship accounted for 5.3% in Kisumu polytechnic and for 7.3% in Eldoret polytechnic. Bursary accounted for 27.4% for Kisumu polytechnic while in Eldoret was 28%. Self sponsorship accounted for 53.7% in Kisumu polytechnic and 56.6% in Eldoret polytechnic.

5.2.2 Effects of cost-sharing policy on access for regular diploma students in Kisumu and Eldoret Polytechnics taking Science and Technology Education and Training courses.

The study established that cost sharing policy had affected students' enrolment such that there were more male students than female students. That is Kisumu Polytechnic had 82.5% being male students while only 17.5% being female students. In Eldoret Polytechnic the male students were 83.2% while female students were 16.8%.

The study also established that cost sharing policy affected the programmes which in turn affected access for instance inadequate teaching/learning resources in the polytechnics tended to discourage students from enrolment with the consequences that they joined cheaper commercial colleges and other colleges like armed forces where very little is paid as fees.

Cost sharing policy also affected access by encouraging truancy for students who had problems in payment of fees.

The study further established that most students that is, 69% could not afford to pay the fees and therefore dropped out of the programme.

5.2.3 Effects of cost-sharing policy on regular diploma students' performance in Science and Technology Education and Training courses in Kisumu and Eldoret polytechnics

The study established that cost sharing policy had affected students' performance in Science and Technology Education and Training somewhat negatively with performance index of 59.8 for Kisumu and 63.1 for Eldoret polytechnics respectively. This was because the polytechnics had found it too expensive to purchase materials for research projects. Most lecturers in most courses experienced difficulties in academic curriculum delivery as they

were compelled to teach practical skills theoretically and did not involve students much in research work; consequently, they experienced mass failures and referrals.

The Lecturers did not have the required technical skills to impart to the students having trained as Secondary School teachers and posted to the polytechnics by TSC without being retrained to acquire teaching skills due to cost constraints.

Cost sharing policy also affected development of industrial linkages with the consequences that they were not done frequently during the three year course due to cost constraints. Further more students could not cope with industrial needs and therefore most industries would not accept them for attachment or internship. Lack of adequate and relevant training and learning materials, insufficient industrial linkages for students and incompetent lecturers in technical skills were further worsened by the absent of quality assurance and standard officers who were mandated with the task to oversee the internal efficiencies in the national polytechnics due to inadequate funds.

The above excuses were all blamed on the inadequacy and non prioritized allocation of funds by the government. As the challenges received minimal remedies, Regular Diploma Students in Kisumu and Eldoret Polytechnics continued to perform poorly in the KNEC examinations with mass failures and referrals. There were no disinclinations, few credit passes, and slightly over 20% pass from both polytechnics in 2008 to 2009.

5.2.4 Challenges faced in Kenya national Polytechnics due to cost sharing policy effects on Science and Technology Education and Training

The study established that the following challenges were faced by students, Lecturers and administrators due to cost sharing policy;

i) Inadequate physical and service infrastructure as social costs were not enough.

ii) Quality and relevance of curriculum delivery was below standards because practical courses were taught theoretically and very little research was done with minimal linkages as funds were inadequate.

iii) Access and equity and transition rates were limited because more students could not afford the fees to join and complete programmes as was expected due to financial constraints.

iv) Research and development was hardly undertaken as funds available were found to be generally negligible.

v) Capacity building among lecturers was hardly undertaken due to lack of funds and therefore could not help promote academic performance and leadership in polytechnics.

5.3 Conclusions

Resource mobilization is a key component of cost sharing policy in Kenya education system. Insufficient funds does not allow for the smooth implementation of education training programmes. The government has to work with other partners to provide quality investments especially in TIVET education sector to adequately fund the academic programmes. The study confirmed that the unit cost for educating a regular diploma student in Kenya National Polytechnics ranged between Ksh 545,256 and 664,653 for the three year course. Sixty nine percent (69%) of the students found the cost of training unaffordable. Despite the high cost of science and technology courses, the students gave commendable values to the importance of their courses. A value of 90% was given by 50 students, 70% value by 170 students, 50% value by 108 students and 30% value by 22 students. The students were not against cost-sharing for their courses except they required more subsides from the government to reduce

their cost of training. 34 students were willing to cost share 80% of the total cost, 66 students 60%, 107 students 50% and 143 students 40%.

Gender disparity was evident in enrolment into science and technology courses due to cost sharing policy. The study established that female enrolments were dismal or lacking in some of the engineering courses. In Kisumu polytechnic, there were 82.5% male students and 17.5% female students' enroled in 2010. In Eldoret polytechnic, there were 83.2% male and 16.8% female students enroled in 2010. The study did an in depth analysis on access of electrical and electronics engineering diploma students in Kisumu polytechnic. It established that in 2009, they had a dropout of 4.9% and graduation rate of 48%. For a growing economy which required abundant skilled middlemen who were hands on, these were negative indicators for economic growth. The study further established that enrolment rate in all courses done in Kisumu and Eldoret polytechnics in 2010 were between 0.1 to 14.4% of the total enrolments. There is need for revolving funds for bursaries and scholarships to alleviate the fees payment burden from parents and families in order to increase access in the national polytechnics.

Optimum access reduces unit costs. It allows for bulk and economic purchases of training equipment which would improve national polytechnics' academic performance. The study confirmed that the training facilities used especially in Kisumu polytechnic were not relevant to technological developments as modern machines and apparatus could not be afforded. The facilities could not be appropriately used to impart the necessary skills to the students which would be applied in industries without re-training. The study further established that lecturers resorted to lecturing technical skills instead of demonstrations because inadequate

and irrelevant training tools were in use. Quite a number of the Lecturers were trained to teach in secondary schools and did not have the required technical skills to train the diploma students. The few lecturers who had the required technical skills were themselves diploma holders. The study confirmed that High costs of science and technology programmes, inadequate and irrelevant training equipment and machines and unskilled human resource were some of the factors which led to dismal academic performance in Kenya national polytechnics. Kisumu Polytechnic had a performance index of 59.8 and Eldoret polytechnic63.1 out of a maximum 120 which is equivalent to 100%.

5.4 Recommendations

Based on the findings and conclusions of the study the following recommendations were made:

i) Identify students who come from poor families, and give them full sponsorships or adequate bursaries to enable them complete their courses.

ii) Affirmative action to sponsor or give scholarships to deserving female students wishing to join National Polytechnics was encouraged to bridge the gender gap.

iii) Improved allocation of funds by the government for basic and relevant National Polytechnics physical and service infrastructures for example laboratories, workshops, libraries, hostels, training and learning materials, equipment and research was urgently required to increase access.

iv) Curriculum policy makers to re-visit the original 8-4-4 curriculum and re-introduce technical subjects in primary and secondary schools. This would create positive awareness of science and technology courses to all the stakeholders.

v) Quality Assurance and Standards Officers to visit the national polytechnics to guide the Lecturers in curriculum implementation and efficient management of the institutions by the administrators.

vi) Practical subjects should not be taught theoretically. The numbers of students enroled into the national polytechnics should be limited if learning spaces were inadequate to give the few enroled students quality skills in order to improve the dismal academic performances.

vii) Income generating projects should be upgraded to produce national and internationally acceptable goods and services. This would create employment, improve research and generate the much needed funds.

5.5 Suggestions for Further Research

i) There is need to compare training costs in all programmes in the national polytechnics.

ii) There is need to study the relevance of Kenya's TIVET programmes to labour market requirements.

REFERENCES

American Psychological Association (1994). *Publication Manual.* Washington, DC: American Psychological Association.

Amuka, L.M. (2003).Gender factor in access and success in science and technology education and training in Mombasa Polytechnic Kenya. Unpublished masters thesis, Maseno University. Kenya.

Amutabi, M.N. (2003). Political *Interference in the Running of Education in Post-Independence Kenya: A Critical Retrospection.* International Journal of Education Development, 23(02), 127-144.

Ayodo, T.M. (2006). Enhanced Financing of Secondary Schools to reduce Inequality in Kenya. *Maseno Journal of Education, Science and Arts* Vol. 5 No. 2 of September 2006, (12-22).

Ary, D, Jacobs, L.C. & Razavieh, S, (1990). *Introduction to research in education.* New York: Holt, Rhinehart and Winston, inc.

Atchoerena, D. & Delluc, A. (2001). *Revisiting Technical and Vocational Education in Sub-Saharan Africa: an update on trends innovations and challenges. Paris.*

Atwell, G. (1997). *New Roles for Vocational Education and Training Teachers and Lecturers in Europe: A New Framework for their Education.* Journal of European Industrial Training, 21(6/7), 256-265.

Barthes, A.M. Nair, S. & Malpede, D. (2000). *Scientific, Technical and Vocational Education of Girls in Africa: A summary of 21 National reports.* Washington D.C: World Bank.

Bean, J.P. (1990). *Using Retention Research in Enrolment Management.* In Hossler, D.,

Bean, J.P., & Associates (Eds.), *The Strategic Management of College Enrolments* (170 – 185). San Francisco, CA: Jossey – Bass Publishers.

Bloom, D, Canning, D. & Chan, K. (2005). *Higher Education and Development in Africa.* Harvard: Hovard University Press.

Bregman, J. & Brymer, K. (2003). *Quality of Secondary Education in Africa.* ADEA IIEP Paris: UNESCO.

Card, D & Kruger A. (1990). *"Does School Quality Matter?: Returns to Education and the characteristics of Public Schools in the United States."* National Bureau of Economic Research, Working Paper No. 3358.

Carnoy, M. (1999). *"Cost – Benefit Analysis in Education. A case study of Kenya."* London: John Hopkins Press.

Chesswas, J.D. (1968). *Methodologies of Educational Planning for Developing Countries, Paris: UNESCO IIEP*

Clune, W.H. (1994). *"The Shift from Equity to Adequacy in School Finance".* Educational Policy 8(4): 376-395.

Cooper, B. (1994). *"Making Money Matter in Education:* A Micro-Financial Model for Determining School-Level Allocations, Efficiency, and Productivity". Journal of Education Finance 20(1): 66-87.

Creswell, J.W. (2003). *Research Design: Quantitative, Qualitative and Mixed Method Approaches.* London: Sage Publication Thousands Oaks.

De Jaeghere, J. (2004). *Quality Education and Gender Equality.* Geneva: UNICEF.

Desarrollo, I. (2007). *The Quality of Education in Latin America and Caribbean Latin America.* Washington D.C: Research Work Institute World Bank.

FRD (1993). *South African Science and Technology Indicators*. Pretoria: FRD.

Gall, M.D., Borg, W. R., & Gall, J. P. (1996). *Educational research, an introduction.* New York: Longman.

Gichira, R. (2002). *Ensuring Relevance and Quality in TIVET and Entrepreneurship Education.* Nairobi, Government Printer.

Hallack, P. Poisson, M. (2007). *Corrupt Schools, Corrupt University: What can be done?* Paris: IIEP UNESCO.

Hanushek, E.A. (1994b). *Making Schools Work: Improving Performance and Controlling Costs*. Washington, DC: The Brookings Institution.

Hicks, N. (1980). *Economic Growth and Human Resources*. World Bank Staff working paper No. 408. Washington DC: World Bank.

Israel, G.D. (1992). *Sampling and Evidence of Extension Program Impact*. Programme Evaluation and Organizational Development, IFAS, University of Florida. PEOD-5

International Labour Organization. (1994). *Alternative schemes of financing training.* Geneva: Gasskov, V. (ed).

Kenya Association of Technical Training Institution (1998). Report on the Launch and Inauguration conference. Theme. *Challenges facing Technical Training Institutions in industrialization of Kenya 2020.* Mombasa: Government Printer.

Kenya Association of Technical Training Institution (2002). *Report on 3rd National Conference on technical vocational, education and training in Kenya.* Mombasa: Government Printer.

Kenya National Bureau of Statistics (2007b). *Basic Report on Well-Being in Kenya – Based*

on the Kenya Integrated Household Budget Survey, 2005-2006. Nairobi: Government Printer.

Kerlinger, F. (1983). *Foundation of Behavioral Research:* Education and Psychological Inquiry. Chicago: Holt, Reinhart and Winston, Inc.

Kerre, B.W. (1997). *The Technical and Vocational Education for the rural development.* Nairobi: Oxford University.

Knight, J.B. & Sabot, R.H. (1990). *Educational Production and inequality: The East Africa natural experience*. World Bank: Oxford University Press.

Levin , H.M. (1995). Cost *Effectiveness Analysis: International Encyclopedia of Economics of Education.* Oxford: Paragon.

Levin, H.M. (2002). Cost Effectiveness Analysis: Methods and Applications. (2nd Ed.) California: Sage, Thousands Oaks.

Lewin, K.M. (1996). *Planning Secondary Science Education.* Progress and Prospects in the Africa region Paris: UNESCO.

Lewin, K.M. (2004). *Anticipation and Planning Association for Development of Education in Africa.* Washington D.C: World Bank.

Lou. H.M. (1985). *Science and Technology Indicators for Development.* London: DP Publications.

Ministry of Education (2008). *The Development of Education: National Report of* Kenya. A report presented at the International Conference on Education on 25th – 28th November 2008, in Geneva, Switzerland.

Ministry of Education (2004). *Development of Education in Kenya*. Nairobi: Government Printer.

Ministry of Education (2003). *National Action Plan on Education for All 2003 – 2015.* Nairobi: Government Printer.

Mugenda, A.G. & Mugenda, O. M. (2003). *Research methods. Quantitative and qualitative approaches*. Nairobi: Acts press.

Mwinzi, D. & Kimengi, I. (2006). Learning Science and Mathematics among female students in Secondary Schools in Economically Disadvantaged Areas in Kenya: Challenges and Prospects. Nairobi: IIPE.

Nachmias, C.F. & Nach Mias D. (1992). *Research Methods in Social Science.* London: Edward Arnold.

Ng'ang'a, A. (1999). *Pupils' difficulties in computing fractions: a study of selected secondary schools in Nairobi. M.Ed.* Unpublished thesis. Kenyatta University.

Ngare P. (2007). Free Secondary Education Major Campaign Issue. Nairobi: Nation Media.

Okebukola, P. (1995). *Organizations and conditions of Secondary Science Education in Nigeria submitted to planning science education at the secondary school level.* Johannesburg: IIEP and CEPD.

Orogho, J.A. (1996). Factors *determining achievement in science subjects at secondary school level in Kenya.* A Ph.D.Unpublished thesis submitted to Kenyatta University.

Oxfam International (2006). Kicking *the Habit: How the World Bank and the IMF are still addicted to attaching economic policy conditions to aid.* Oxfam Briefing Paper, November.

Picus, L.O. (1994b). *"The Local Impact of School Finance Reform in Four Texas School Districts."* Educational Evaluation and Policy Analysis 16(4):39-404.

Prabhu, J. (2006).*"Institutions and International Labour Organizationsophies, traditional and modern"* in Encyclopedia of India (Vol.2 (ed) Stanley Wolpert. 23–27. Thomson Gale.

Psacharopoulos, G. & Woodhall, M. (1985). *Education for development. An analysis of Investment Choices.* New York: Oxford University Press.

Republic of Kenya (2008). First Medium Term Plan, 2008-2012. *Vision 2030.* Nairobi: Government Printer.

Republic of Kenya (June, 2007). *National training strategy second draft.* Nairobi: Government Printer.

Republic of Kenya (2007-2012). *Strategic plan 2007-2012.* Nairobi: Government Printer.

Republic of Kenya. (July, 2005). *Kenya education sector support programme 2005- 2010.* Nairobi: Government Printer.

Republic of Kenya (2004). *Public Expenditure Review*: Towards Efficiency in Public Expenditure Management. Nairobi: Central Bureau of Statistics (CBS).

Republic of Kenya (2003b). *Report of the ministerial committee on problems facing national polytechnics and technical training institutions.* Nairobi: Government Printer.

Republic of Kenya (2003 a) Estimates *of recurrent expenditure 200/2004.* Nairobi: Government Printer.

Republic of Kenya (2003). *Rapid appraisal on the status of Technical and Vocational Education and Training (TIVET) in Kenya*, Nairobi: Government Printer.

Republic of Kenya (2002 d). *Economic survey*. Nairobi: Government Printer.

Republic of Kenya (2002 c). *Estimates of recurrent expenditure 2002 / 2003)*. Nairobi : Government Printer.

Republic of Kenya (2002b). *Data on technical training institutes and national polytechnics for 2000*. Nairobi : Government Printer.

Republic of Kenya (2002a). *Eighth national development Plan 2002-2008*. Nairobi: Government Printer.

Republic of Kenya (1999 c). *National poverty eradication plan*, 1999-2015. Nairobi: Government Printer.

Republic of Kenya (1999a). *Report on the commission of inquiry into the education system of Kenya. Totally Integrated Quality Education and Training* (TIQET). Nairobi: Government Printer.

Republic of Kenya (1998). *Master Plan on Education and Training 1997-2010*. Nairobi: Government Printer.

Republic of Kenya (1988a). *Report of the presidential working party on education and manpower training for the next decade and beyond*. Nairobi: Government Printer.

Republic of Kenya (1981). *Report of the presidential working party on second university in Kenya*. Nairobi: Government Printer.

Ross, K.N. & Genervois, J. (2006). *Cross National Studies of the Quality of Education: Planning their design and managing their impact*. Paris: IIEP UNESCO.

Samarrai, S.A, & Zaman, H. (2002). *The Changing Distribution of public education Expenditures in Malawi*. Washington D.C: World Bank.

Schreens, P.J. (2000). *Improving School Effectiveness*. Paris: IIEP UNESCO.

Semboja, H. (2007). The Youth Employment in East Africa: An Integrated Labour Market Perspective. *African Integration Review*, 1 (2), 2 – 15.

Sharma, S. D. (2006). *"Biotechnology revolution."* In Encyclopedia of India (Vol. l), (ed) Stanley Wolpert. 145-157. Thomson Gale.

Sharma, S.D. (2006). *"Globalization"* in Encyclopedia of India (Vol.2), (ed) Stanley Wolpert 146-149. Thomson Gale.

Sianesi, B. & Reenen (2002). *The Returns to Education*: "A review of the Empirical Macro-Economic Literature" IFS Working paper No. 02/05.

Teijlingen, E.R. & Hundley, A.M. (2005). *The Importance of Pilot Studies in Social Research Update*. Surrey: Guilford.

Tum, P.C. (1996). *Education Trends in Kenya a Vocational Perspective*. Nairobi: Jomo Kenyatta Foundation.

UNESCO (1992). Higher Education in Africa. Trends and Challenges for the 21st Century. Dakar: UNESCO.

UNESCO (1990). World Declaration on Education for All and Framework for Action to meet Basic heavy needs. Paris: UNESCO.

Waithaka, N.I. (1996). Students and Teachers' of practical work in physics. A study of Laikipia and Nyandarua Districts of Kenya. M.Ed. Unpublished thesis submitted to Kenyatta University.

Wikipedia (2009, March – April). *Science and technology in India, Korea and China.* retrieved on march 14, 2009, from Wikipedia free encyclopedia.

Woodhall, M. (2004). *Analysis in Educational Planning Cost Benefit*. Paris: UNESCO

World Bank (2007). School and Work: *Does Eastern Caribbean Educational System Adequately prepare Youths for Global Economy.* Washington D.C: World Bank.

World Bank (2005). *Education Sector Strategy Update: Achieving Education for All Broadening our perspective, maximizing our effectiveness.* Washington D.C: World Bank.

World Bank (2006). Kenya *Education Sector Support Programme (KESSP) Project* Appraisal Document. Washington, D.C: The World Bank.

World Bank (2002). *Higher education in development countries*: *Peril and Promise.* Washington DC: World Bank.

World Bank (2000). *Vocational education and training reforms, matching skills to market and budgets.* New York: Oxford University Press.

World Bank (2000). Education *for All.* From Jomtien to Dakar and Beyond. Paper prepared by the World Bank for the World Education Forum in Dakar, Senegal April 26-28, 2000. Washington: The World Bank.

World Bank. (1999). Tertiary Distance Education and Technology. Washington D.C: World Bank.

World Bank). *Argentina: Relocating Resources for the improvement of Education*: Washington D.C: World Bank.

World Bank (1988). *Education in Sub-Saharan Africa: Policies for Revitalization and Expansion.* Washington D.C: World Bank.

World Bank (1986). *Financing Education in Developing Countries: an Exploration of Policy Options*. Washington D.C: World Bank.