

IMPROVEMENT OF TECHNICAL EDUCATION IN PUBLIC TECHNICAL SECONDARY SCHOOLS (ECOLE TECHNIQUE OFFICIEL - ETOS) IN RWANDA

Maina Maringa
Integrated Regional Polytechnic Centre (IPRC)
Kigali City – Kicukiro Campus, Rwanda
Mwangi Maringa
Rwanda Workforce Development Authority, Rwanda

Email: pmmaringa@yahoo.co.uk

ABSTRACT

This paper presents a brief review of the state of technical education in Rwanda based on a study conducted in 2007, with pertinent recommendations. The background of technical education in the country is appreciated first, and then followed up with a situational analysis. Thereafter, a 5-year implementation project plan proposal, to address the identified shortcomings, needs, and expectations of government is advanced. The need to raise access to post tronc commun (post O-Level) technical training is addressed within this proposal with a specific interest to increase the capacity and range of programmes running in the existing ETOs, and the introduction of new ETOs where deemed necessary. The establishment and sustenance of a good quality technical education system is also given consideration in this proposal for effective and efficient rehabilitation of existing physical facilities and the purchase of new and appropriate training equipment. Simultaneously, considerations for increasing the number of technical teachers in the system to a determined optimum level while setting minimum acceptable qualifications for technical teachers are advanced. Implementation of this proposal is expected to contribute greatly to the continuous development of a labour pool with skills that are relevant to and adequate for the needs of the economy.

Key words: TVET, cost-effectiveness, fitness for purpose.

BACKGROUND OF STUDY

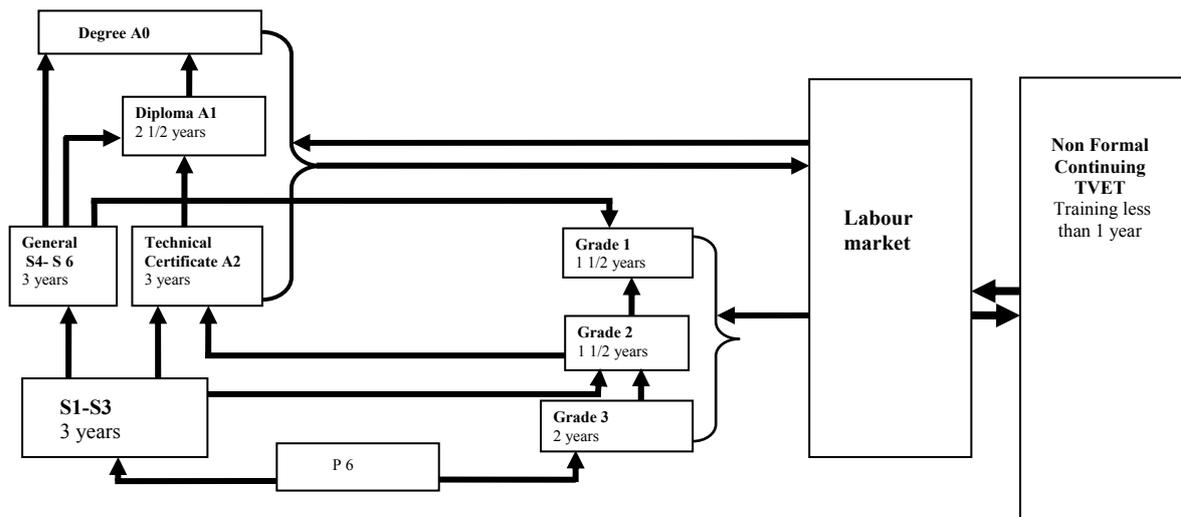
This paper invariably addresses the two fundamental indicators of quality based TVET of, Infrastructure and Training Equipment, and TVET Quality and Competence of instructors or trainers. To a lesser degree it also touches on another two seminal indicators regarding fitness for purpose, and cost effectiveness of TEVTs.

Rwanda comprises of five (5) provinces and thirty (30) districts. The Government of Rwanda introduced fee-free primary education (FFPE) in 2003 in order to enable its citizens to gain greater access to primary school. This was a policy option that was designed to ensure that no child was denied the right of access to basic education. It was also one of the generic measures for poverty reduction. Introduction of the FFPE has brought about a significant increase in the enrolment figures in primary schools, which necessitates early planning to provide diverse and acceptable alternative routes of further training of the primary school graduates.

The issues that surround the environment or the critical support system of education are important. They have the potential to catalyse the linkage between primary education and the many positive developmental outcomes that are so frequently advocated for in the primary cycle of education. The issues emphasise the relationship of primary education to the broader umbrella education environment; and between education and the wider social and economic context.

To be sustainable, the development of education must be balanced. It must also reflect a system that produces students at different levels, and with qualifications that conform to the demands of the labour market. Technical education should ideally be ordered according to the recommended ratio of 1 Engineer (A0) to 5 Technicians (A1) to 25 Artisans (A2) to 125 casual labourers, and must conform to the Ministry of Education's TVET policy (MINEDUC, April, 2008).

The Ministry of Educations TVET policy (MINEDUC, April, 2008) captures the fundamental concept that skills development should be based on a holistic system of education that integrates primary education, secondary education, technical and vocational education, and tertiary education, into a coherent entity, as seen in Figure 1. The figure shows, amongst other things, the pathways for entering the labour market and opportunities for continuation with learning within institutions beyond basic education. The system shown however has several shortcomings, which have been suitably addressed in section 4.1 of this paper, by way of appropriate adaptations.



Note: Entry requirement into Initial Vocational Training from Non formal and continuing training:

Figure 1: The Structure of the Rwandan Education System (MINEDUC, April, 2008)

For effective comparison and competitiveness, it is necessary that the information given in Figure 1 be compared to the systems that are in place within the East African region. These other systems are presented here in Figures 2 – 4. It is critical too that the rationale behind these other systems be properly understood. Such insights additionally foster possible future harmonisation of all these systems. They also ensure that points of entry for graduates of the local system into the regional labour market and institutions are clearly understood (Ngerechi, August, 2003), (Farstad, December, 2002), (MINEDUC & GTZ, February, 2009) and (Buyela & Mubiligi, 2006).

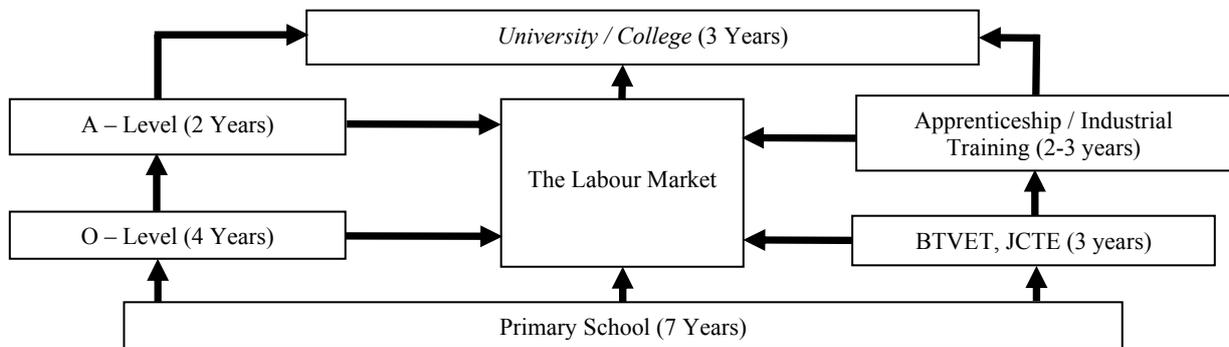


Figure 2: The Structure of the Ugandan Education System (Farstad, December, 2002)

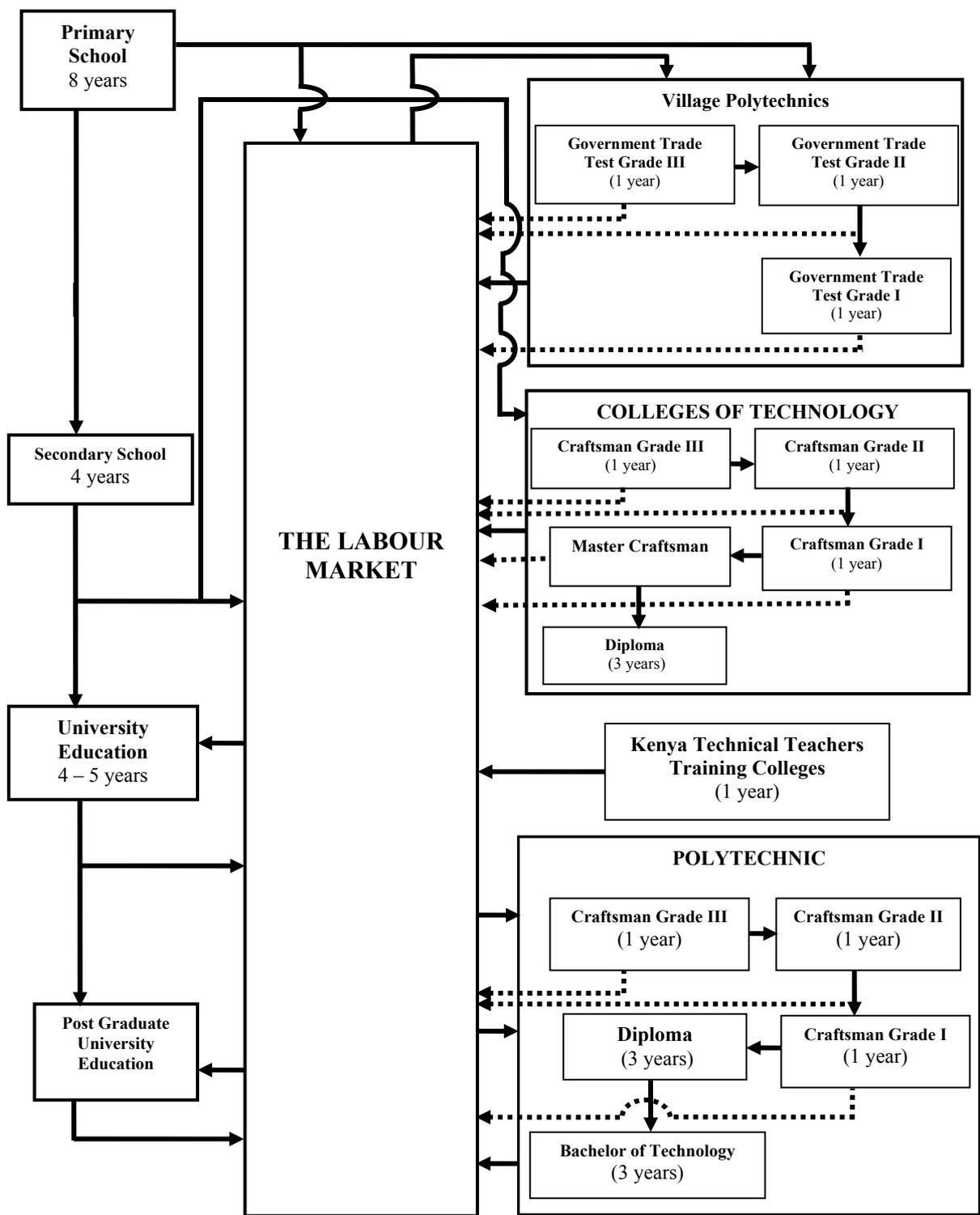


Figure 3: The Structure of the Kenyan Education System

The dotted lines in Figure 3 above represent a return to work loop at the end of one year each of Trade Test and craftsman training before continuing on with further institutionalised skill training.

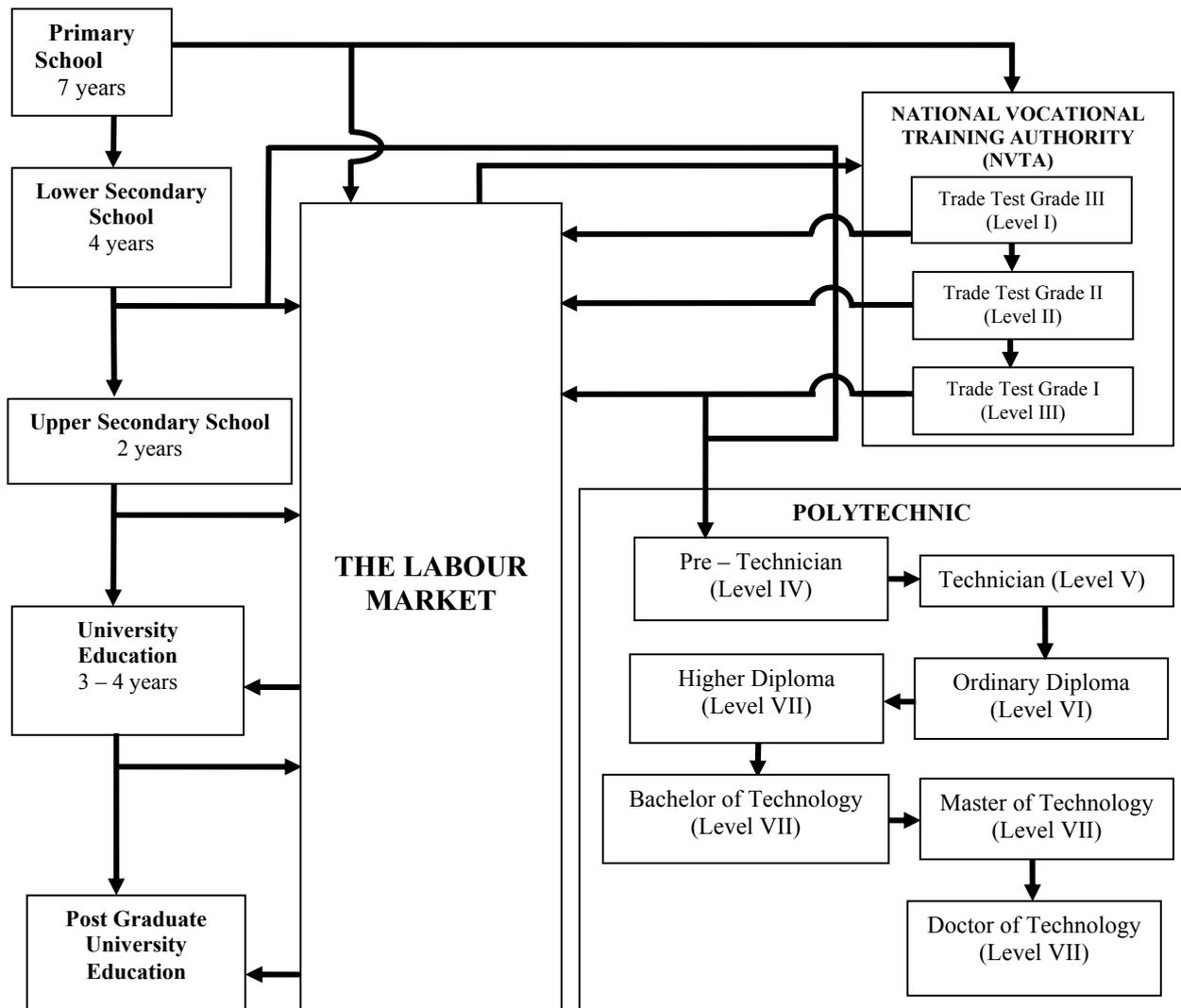


Figure 4: The Structure of the Tanzanian Education System (Kayiranga and Mfinanga, August, 2008)

The key roles in Rwanda of Science and Technology, as well as Vocational and Technical Training in economic development presently and in the future are emphasised in the Education Sector Strategic Plan of 2006 – 2010 (MINEDUC, April, 2006). Their contribution to economic growth and poverty reduction in the country are underscored in the Economic Development and Poverty Reduction Strategy (EDPRS) (MINECOFIN, July, 2007). Section 3.4 of the EDPRS, identifies the priorities of poverty reduction and economic growth through technical, professional, and vocational training as requiring analysis in order to evolve clear policies towards these goals (MINECOFIN, July, 2007). The need to develop skills for a knowledge-based society is also recognised in this document, which further

projects a rise in the absorption rate of TVET graduates in industry from 25% in 2006 to 75% by 2012.

SITUATIONAL ANALYSIS AND PROBLEM IDENTIFICATION

Technical training ideally addresses the entire range of skills needed from the level of artisans up till the level of technicians. This range needs to be reflected within the technical education system of Rwanda in a balanced manner. In order to determine the needs for intervention in the existing system it is essential first to carry out an audit of this system. This engenders the identification of inherent constraints and shortcoming, and in this way help put forward informed possible solutions to these empirically identified challenges.

Tables 1 and 2 contain information on the spatial distribution of both public and private technical institutions in the country, and the programs run in them respectively. As a result, the tables inform planning well on equity of access and possible points of intervention. In this respect the tables uniquely supply critical information that anchors the evolution of a system that responds positively to the desired fitness for purpose indicator of Quality based TVET systems.

Table 1: Overview of the Training Focus of Programs in the Country's Public Technical Secondary Schools (Mfinanga et al, August, 2007)

Province	District	Institution	Programs Run
Northern	Rurindo	-	-
	Musanze	*E.S.T.B Busogo	Construction
Southern	Huye	*E.T St Kizito Save	Electrical, Electronics with Information Technology, Public Works
	Muhanga	ETO Gitarama	Auto mechanics, Construction, Electrical, Electronics & TelCom., Public Works
	Nyanza	*G.S.Mater Dei Nyanza	-Electrical, Electronics
Eastern	Bugesera	ETO Nyamata	Construction, Carpentry, Electrical, Maintenance Mechanics, ICT Info, Tailoring
	Ngoma	ETO Kibungo	+Auto mechanics, Construction, Electrical, Maintenance Mechanics
	Nyagatare	Umutara Polytechnic	Construction
Western	Karongi	ETO Kibuye	Auto mechanics, Electrical, Maintenance Mechanics
	Ngororero	ETO Gatumba	Construction, Electrical
	Rubavu	*ETAG Gisenyi	Auto mechanics +(Maintenance Mechanics)
Kigali City	Kicukiro	E.S.Kicukiro	-Fine Arts and Sculpturing
	Nyarugenge	ETO Muhima	Auto mechanics, Construction, Electrical, Electronics and Telecommunication, Maintenance Mechanics, Public Works

*Evidently, each province has three ETOs, excepting of the Northern and Eastern provinces (the latter as there are proposals to phase out Umutara polytechnic), and Kigali City.

Table 2: Overview of the Training Focus of Programs in the Country's Primary Private Secondary Schools (Mfinanga et al, August, 2007)

Province	District	Institution	Programs Run
Northern	Musanze	E.T.Karuganda	Construction
		I.T.B. Musanze	Electrical
Southern	Kamonyi	ISETAR Runda	Construction
	Muhanga	E.T Kabgayi	Auto mechanics, Electrical
	Nyanza	Collège Maranatha Nyanza	Electrical
		Inst.T de Hanika	Auto mechanics, Electrical
	Ruhango	E.T.Mukingi	Construction
		G.S. Indangaburezi	Electrical
Eastern	Gatsibo	Col.de Bethel	Electronics and Info. Tech.
Western	Rubavu	E.T.P Nyarurema	ICT Information Tech
	Rusizi	E.T.Nazaréen intern	Construction
Kigali City	Gasabo	Collège de Giheke	Electrical
		Samuduha Integrated	Electrical
		International	Carpentry, Electrical
		G.S.ADB Nyarutarama	Auto mechanics, Electronics and Telecommunication
	Nyarugenge	E.T.SOS Kinder	ICT Information Tech
		College (SICO)	Auto mechanics
		E.T.A.K. (Kimisange)	Auto mechanics, Construction, Electronics and Info. Tech.
		E.T.St Joseph	Construction
		Solidarity Academy	Electrical, Maintenance Mechanics
		E.T. Muhazi 2	Auto mechanics
	Nyamirambo	Public Works	

* Kigali City has a conspicuously high concentration of private technical institutions.

Situational Analysis

The situation prevailing in the ETOs at the time of this study in the year 2007, was one in which, of the 119 technical teachers in place then; 10.7%, 24.8%, 48.8 and 15.7% had AO (1st Degree graduate), A1 (A- Level graduate), A2 (O-Level graduate), and below A2 qualifications, respectively (MINEDUC, 2006). Based on a set minimum ETO technical teacher qualification of A1, the foregoing percentages indicate that only 35.5% of the technical teachers working in ETOs then were qualified to teach there (Mfinanga et al, August, 2007). This underscored an urgent need for recruitment of new technical teachers, coupled with training to upgrade the qualifications of many that were already in employment in the ETOs. The shortcoming thus identified was addressed through proposals for recruitment and training. These were furnished complete with schedules and accompanying costs. It was further proposed to establish A1 programs at Tumba College of Technology (TCOT) and conversion of ETO Kicukiro into an A1 offering College of Technology (Mfinanga et al, November, 2007). Further a proposal was made to the effect that the proposed Kicukiro College of Technology (KCOT) double up as a technical teachers training centre, in order to quickly provide capacity in the country to sustain and develop technical education.

Figures 5 – 7 inclusive give useful insights into the professional emphasis of technical secondary education in the country presently, in terms of the number of students studying the various programs offered in both public and private technical secondary schools.

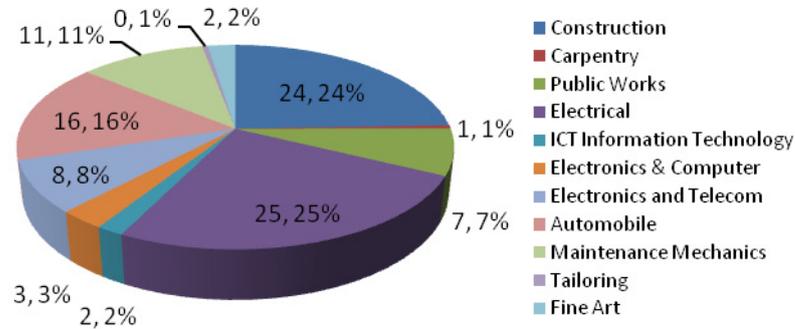


Figure 5: Percentage Distribution of Students in Various Programs Offered in Public Technical Secondary Schools (MINEDUC, 2006)

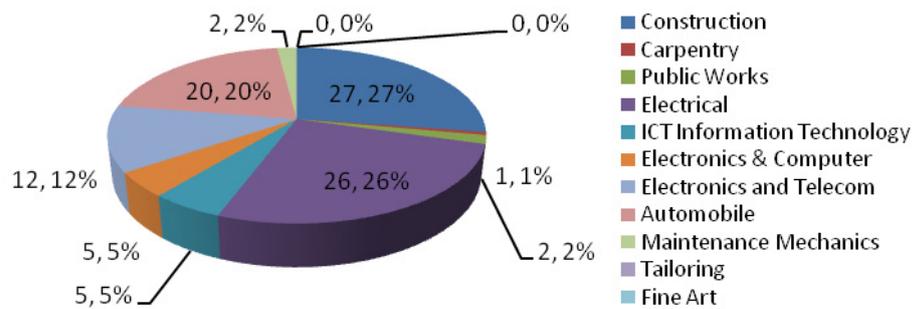


Figure 6: Percentage Distribution of Students in Various Programs Offered in Private Technical Secondary Schools (MINEDUC, 2006)

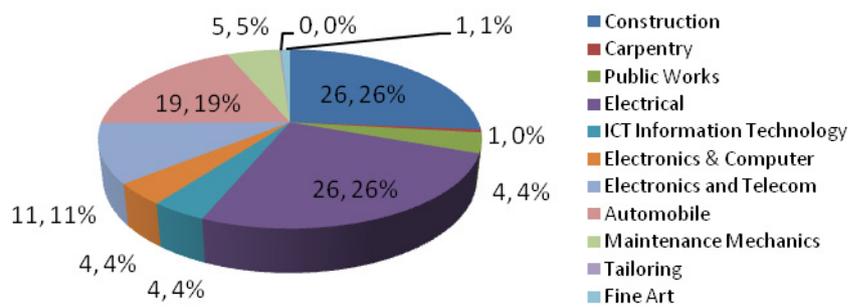


Figure 7: Percentage Distribution of Students in Various Programs Offered in Both Public and Private Technical Secondary Schools (MINEDUC, 2006)

It is evident from these figures that the traditional programs of Construction, Electrical and Automobile were at the time of this study still the most popular and numerous, while Fine Art, Tailoring, Carpentry and ICT Information Technology were the least popular.

It is important, in any planned additional ETOs as well as in the existing ones, to lay more emphasis on modern technologies such as Electronics and Computer, as well as Electronics

and Telecommunication, both of which account for only 12% and 17% of the total programs offered in public and private technical institutions, respectively, at the time of this study. This would ensure that the choice of programs on offer is not limited to the setup that prevails then, but that it is also consistent with emerging trends in the world as well.

Because of poor industry/technical secondary school linkages and poor advertisement for jobs (Buyela and Mubiligi, 2006), available figures on employment cannot alone be relied on to guide decisions on investment in technical education. The employment and work practice figures, such as the ones evident in Figures 8 and 9 for ETO Gitarama, an ETO whose workshops are the best equipped of all ETOs in the country are very low. This statistic belies the high demand in the market for skilled manpower, which continues to import skilled personnel from the neighbouring countries, while simultaneously complaining of poorly trained ETO graduates (MINEDUC and SOS Kinderdoff, September, 2007), (Buyela and Mubiligi, 2006). Even as this last fact would on the face of it point to a need to improve standards of training in the nation's ETOs, it may also indicate the existence of an illicit market for cheap and not necessarily better skilled workers. This possibility demands the establishment of an employment system that will ensure the person with the right skills gets the job and for the right wage.

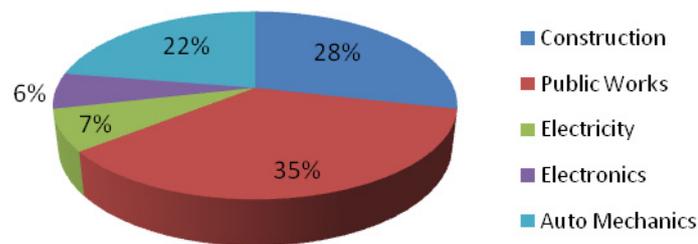


Figure 8: ETO Gitarama Graduate Employment Rates (MINEDUC, June 2007)

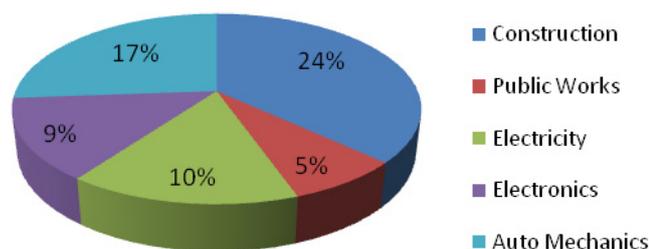


Figure 9: ETO Gitarama Graduate Employment Rates (MINEDUC, June 2007)

An interrogation of the employment industry in the country highlights an ambivalence of opinion on the quality of graduates emanating from the nation's ETOs. Thus for instance, 65% and 55% of 20 enterprises contacted in a tracer study rated the theoretical and practical skills of the ETO graduates as being satisfactory, respectively, but latter in the same tracer study went on to rate the graduates weak in both practical skills and technical knowledge, particularly in scientific competencies, analytical skills, mathematical skills, communication

skills and capacity to use modern technological (Buyela and Mubiligi, 2006). In yet another more recent study industry came through as being unsure of the level and type of skills they required and in certain cases registered unwillingness to finance efforts to train the required manpower (Kayiranga and Mfinanga, August, 2008). The challenge of training persons with quality skills in the country is therefore seen to be compounded, requiring multi-pronged approaches, with interventions both in the training institutions and industry.

The 2006 tracer study that was commissioned by MINEDUC and JICA showed that 56.4% of the total technical labour force in 20 selected enterprises comprised of graduates of ETOs Muhima, Gitarama and Kibungo. The 31 graduates making up this percentage were however a very small proportion (about 9%) of the total output of 341 graduates from the three institutions in the year 2005. This signifies very poor employment rates indeed, particularly given the observed low absorption in the informal sector (Buyela and Mubiligi, 2006).

Not only was the technical education system facing challenges of absorption of its graduates into the labour market, but it was also severely limited in its ability to absorb students desiring to obtain skill training. Figure 10, shows that, of a total of 44,865 students completing tronc commun in the year 2006, 34,503 (76.9% of the total) proceeded with further studies, while the remaining 10,362 (23.1% of the total) did not find placement in the nation's post tronc commun education institutions. Of those who proceeded with further studies 7,644 (22.15%) joined science courses in upper secondary schools, 3,324 (9.6%) joined technical secondary schools (ETOs & Private), 15,890 (46.1%) joined professional schools, and 7,645 (22.16%) joined humanity courses in upper secondary schools.

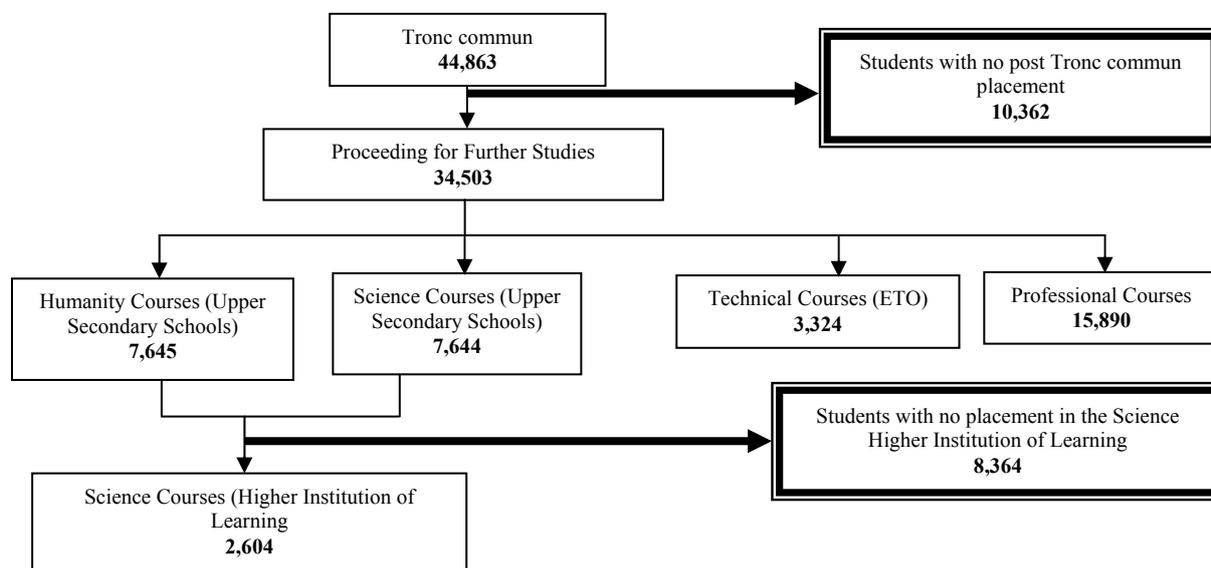


Figure 10: Flow of Students through the Country's Education Ladder (Mfinanga et al, November, 2007)

The important role played by the private technical secondary schools showed up from their student load that was 2.29 times that of the ETOs. The yearly intake of 1011 students into the ETOs was only 24.9% of the total number of 4067 students who sort for places there. This study resolved that the shortfall of 3,056 students will be catered for through proposed

expansion of the existing physical facilities in the ETOs; through an increase in the number of programs offered by each ETO to the identified desirable complement of 8 programs per school; and eventual double streaming of all ETO programs. This is expected to raise intake numbers into the ETOs to 1,530, 2460 and 5,580 students per year in the years 2008, 2009 and 2010, respectively, which is equal to 37.6%, 60.5% and 137.2% of the total demand of 4067 places, registered at the time of this study. The proposal given in this study therefore, not only provided for all the registered demand then, but created space for future increase in demand, while at the same time addressing the need for training placement of the 10,362 students completing tronc commun then who could not find post tronc commun education placing whatsoever.

Identification of the Problem

A general survey of the prevailing situation in ETOs, reviewed several gaps that needed to be addressed urgently if this crucial area of training and subsequent development was to measure up to the national expectations of Vision 2020 (Rwanda, July, 2000), the EDPRS (MINECOFIN, July, 2007), the Millennium Development Goals (Government of Rwanda, United Nations Country Team, February, 2007), as well as the government's 7-year development plan. These included:

- The need to ensure that the country's ETOs offered the full range of technical skills programs within the building, electrical/electronics & IT, as well as mechanical industry.
- The need to ensure even spatial spread of technical institutions nationally in order to provide equitable access. This would address the observed imbalance where the Western and Southern Provinces in the country each had three ETOs, the Eastern Province and Kigali City each had two functional ETOs and the Northern Province none. Kigali city was well served by a number of private technical secondary schools in addition to the one functional public technical secondary school.
- The need to optimise the present non-optimal usage of existing physical facilities and the land that each one of the ETOs was located on. This would address the observed under utilisation of the ETOs in terms of the number of programs offered and their possible expansion.
- The need to rehabilitate existing physical facilities and to provide extra facilities where these did not exist. It had been observed that the physical facilities in most ETOs had over the years experienced significant dilapidation, as a result of general neglect, vandalism and the absence of inspection and maintenance schedules. In certain cases the full complement of physical facilities that ought to normally support such institutions was not in place.
- The need to upgrade the existing equipment, as a good number of the equipment and plant had over the years fallen into disuse, becoming absolute, while some had been vandalized.
- The need to ensure the existence of a student/technical teacher ratio that was sensitive to the high level of contact expected in technical training, in order to guarantee the quality of technical training. The number of technical teaching staff in most ETOs was inadequate considering the student population already in place, let alone those that were planned for, as is evidenced by the fact that national average student/technical teacher ratio lay between 30:1 and 25:1, compared to the desirable internationally accepted student/technical teacher ratio of 10:1 for technical education.

- The need to even out the distribution of technical teaching staff per programmes in the ETOs in accordance with need as it did not presently match the corresponding distribution of students and programs already in place.
- The need to ensure that training was only offered by persons that were at the very least holders of a technical certificate that was higher than the one they were expected to train students for. It was noted that the qualifications of technical teachers in a lot of cases fell short of this minimum standard as seen from the following facts :
 - Out of a total of 119 technical teachers working in the ETOs, 13, 30 and 59 had AO, A1 and A2 qualifications, respectively, while the remaining 17 had qualifications that were below A2.
 - This translated to 10.7%, 24.8%, 48.8 and 15.7%, for the four categories, respectively. Since the highest level of training offered by the ETOs was A2, the foregoing figures implied that only 35.5% of the current 119 technical teachers currently working in ETOs were qualified to teach at this level, by the standard mentioned above.
- The need to ensure that teachers in ETOs possessed the required industrial exposure they tended to lack in order to facilitate them to offer effective practical skills transfer. Quite a large number of teachers in employment at the ETOs were found to be raw graduates of academic institutions of higher learning, with no technical training or industrial work experience whatsoever; a very undesirable situation indeed.

EMERGING OBJECTIVES

The interventions proposed in this study were guided by the following basic objectives. These in turn were derived from the challenge of technical education and national development in Rwanda identified, and arising from the foregoing synthesis of available information:

- 1) to achieve even access to quality, competitive technical education within ETOs, in all provinces of the country.
- 2) to increase the capacity of ETOs in the country in order to increase their absorption rates of pupils completing *tronc commun*.
- 3) to avail a broad range of technical skill training programmes within ETOs, which comprehensively addressed the development needs of the country.
- 4) to enhance and improve the quality of technical skills training in the ETOs by upgrading or replacing existing equipment in the institutions and purchasing of such equipment as was considered necessary.
- 5) to enhance and improve the quality of technical skills training in the ETOs by tagging the staffing needs of the various programmes offered in them on acceptable student/teacher ratios, as well as relevant qualifications.

PROPOSED INTERVENTIONS

The interventions proposed in this study purposed to improve the quality of technical education offered in ETOs in Rwanda, through the enhancement of physical facilities, equipment and technical teaching staff in the institutions. In order to ensure proper implementation and sustainability of the implemented work, it was also proposed that the Ministry of Education together with any other institutions given responsibility for the

implementation and management thereof of the completed project, all be correspondingly strengthened in respect of necessary human resources and other required needs.

Intervention Strategies

The study proposed an increase in the capacity of the ETOs initially, by raising the existing programmes to a recommended full complement of 8 programs namely; Automotive Mechanics, Maintenance, Electrical, Electronics and Information Technology, Electronics and Telecommunications, Plumbing, Carpentry and Masonry, the last three instead of the original Construction and Public Works, in each institution. All these programmes were thereafter to be double streamed at a selected period in time.

The study further proposed that the drive to put in place all 8 programmes for every ETO be spread over a period of two years. Moreover, half of the additional programmes in each ETO were to be set up in each of the sequential years 2 & 3 of implementation. Double streaming would follow the same pattern, where in each ETO 4 programmes would be set up in each of years 4 & 5 of implementation.

The study also proposed that 2 new ETOs in the Northern Province and the expanded Umutara ETO in Eastern Provinces be built within a 2-year period starting from the beginning of the implementation period of all these proposals; with 4 programmes being facilitated in each year for each of these three new ETOs.

Recruitment of technical teachers for the existing ETOs, aimed at bringing the number of technical teachers to a recommended number of 9 per programme was proposed to start at the beginning of the year 2008. The recruitment of technical teachers for the years 2009 and 2010 was proposed to start in mid 2008 and 2009 in order to ensure that all required teaching staff members were in place on completion of all proposed works on physical facilities for the years 2008 and 2009, respectively.

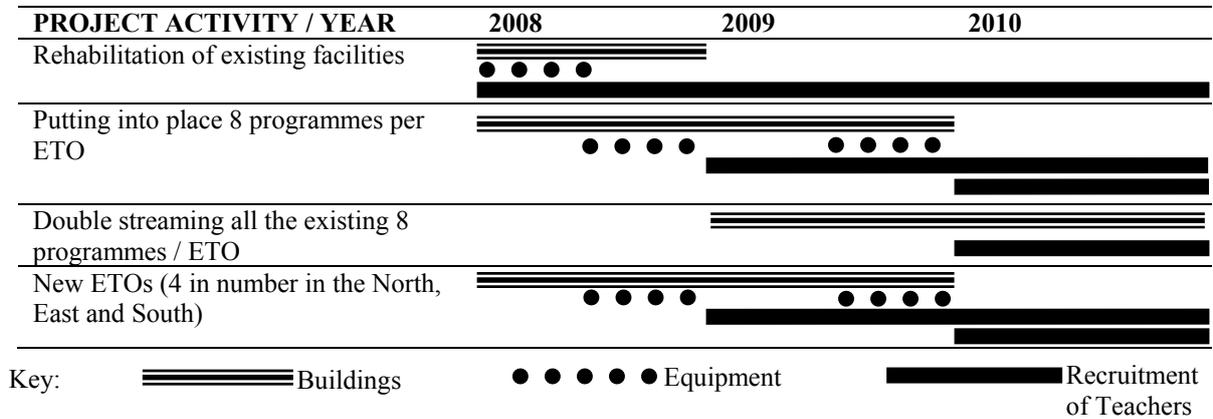
This 6 months recruitment and one year employment phasing was proposed for each subsequent year of implementation of the rehabilitation and enhancement of the physical facilities. The operational costs (salaries for technical teachers and teaching as well as workshop materials) for each phase of the physical facilities proposed works were therefore budgeted to run one year behind all the costs for physical facilities throughout the proposed implementation period.

The proposal put forward therefore, had three aspects; rehabilitation, capacity building or expansion, and double streaming of ETOs, as shown, and with the necessary overlaps. It was conceived to span a project period of 5 years as shown in Table 3.

The table gives details of the project implementation cycle of 5 years, from 2008 – 2012 for the infrastructural development, purchase of equipment and operational costs for ETOs. The equipment and staffing facets of the project were planned to follow the building cycles of rehabilitation of existing structures, expansion of physical facilities to cater for a full complement of 8 programs, and double streaming and construction of new ETOs. Double

streaming was proposed in order to utilise the workshop facilities fully as with a single stream these only experience utilisation levels of up to 48%.

Table 3: 5-Years Development Plan for the Improvement of ETOs, (Mfinanga et al, August, 2007)



A budget summary of the activities shown in Table 3 above is presented in Table 4 below.

Table 4: Summary of the Budgetary Requirements for the Proposals given, (Mfinanga et al, August, 2007)

Category	Item Description	2008	2009	2010	2011	2012	Total (Frw)	Percentage Cost of Total (%)
	Cost of teaching and workshop materials	156,666,667	178,333,333	225,000,000	331,666,667	506,666,667	1,398,333,334	1.5 / 1.4
	Salaries for technical teachers without expatriates	126,696,000	151,188,000	214,476,000	337,536,000	508,656,000	1,338,552,000	0.2 / 0.2
OPERATIONAL	Salaries for technical teachers with expatriates (if required)	483,096,000	738,588,000	1,178,076,000	2,238,336,000	3,379,656,000	8,017,752,000	7.9 / 7.4
CAPITAL	Building costs	21,432,350,630	32,428,521,875	12,044,500,000			47,268,552,505	80.0 / 75.2
	Equipment and books	4,521,341,255	5,689,439,755				10,210,781,010	17.3 / 16.2
	Without expatriates (Frw)	26,202,143,760	38,498,252,275	12,988,144,610			59,051,720,645	
TOTAL	With expatriates (Frw)	26,500,787,410	39,287,999,240	15,729,032,450			62,880,999,100	
	Without expatriates (USD)	48,077,328	70,638,995	23,831,458			108,351,781	
TOTAL	With expatriates (USD)	48,625,298	72,088,072	28,860,610			115,377,980	

- The last column 1st and 2nd percentages are based on totals without and with expatriates, respectively.
- A unit cost of Rwf 5,000,000/00 /program/year, was used in arriving at budgetary estimates for teaching and workshop materials.
- The salaries for technical teachers are based on monthly salaries of Rwf 113,000/00, 90,000/00, 50,000/00 and 30,000/00 for AO, A1, A2 and A3, respectively, and US \$ 1,000/00 for expatriate staff.
- The budget for building is based on the three categories of rehabilitation of existing buildings, expansion of existing ETOs & COTs to cater for the full complement of programs and construction of new buildings to take in double streaming and for the setting up of new ETOs. The basic unit for new buildings and for rehabilitation is taken to be US \$ 500 (Rwf 271,000/00) and US \$ 50 (Rwf 27,100/00) per square meter, respectively.

- The equipment costs are for raising the complement of equipment to what is considered normal for each workshop, existing or newly constructed.

The objectives guiding the proposals made in this study tie in with the Economic Development and Poverty Reduction Strategy (EDPRS) - 2008 to 2012, draft document of 9th July 2007, as enumerated in item 7 on page 11, item 3.12 in section 3.3 on page 42, section 3.3.3 on the same page, Table 3.2 on page 38, item 4.35 on page 48, item 4.30 on page 49, Table 7.2 on page 106 and Table 7.3 on page 107 (MINECOFIN, July, 2007), and is also in conformity with the nation's Vision 2020 (Rwanda, July, 2000), as well as the Millennium Development Goals (Government of Rwanda, United Nations Country Team, February, 2007).

If implemented the proposals put forward in this study will give rise to an increase in the total number of ETOs in the country to 12, in accordance with the 7 year national development plan. The quality of technical education offered in the ETOs will be ensured through implementation of the recommended improvements in the physical facilities, equipment, numbers as well as levels of qualifications of the technical teaching staff, while at the same time limiting class sizes to 30 students per programme, initially. Two (2) new ETOs will be constructed in the Northern Province and ETO Umutara (Umutara Polytechnic) in the Eastern Province will be expanded in order to address the identified shortfall in these two Provinces.

Training will also be restructured to offer a full complement of 8 recommended programmes in each ETO. The total student enrolment per year is expected to grow from the registered figure at the time of the study of 1011 through to 1770 (due to the rehabilitation and expansion of existing ETO to offer 4 full programmes, the associated increase in the number of technical teachers in the programs to a full complement of 9 per programme, and setting up of new ETOs), 5040 (due to the expansion of existing ETOs to offer a full complement of 8 programs, double streaming of 4 programs per ETO and setting up of new ETOs), and 6720 (due completion of double streaming of all programs in all ETOs) during the period of the proposed project.

Space Needs, and Growth Plans in ETOs

It was proposed that all physical development in this project be guided by the pertinent schedule of the Rwanda legislation, on standards of the physical facilities for universities and post primary/secondary institutions in Rwanda. Further that it was also to rely on the Building Code and its constituent by laws, the Local Government (Adoptive by-laws) (Building) and The Local Government (Adoptive by-laws) (Grade II Building). Reference was also to be made to the Kigali City Council (KCC) fire guidelines to architects, designers and developers in Kigali and the factories' Act.

Tables 5 and 6 give details of the recommended complement of facilities and scale of development, for every ETO, respectively.

Table 5: Recommended Complement of Facilities for Each ETO, (Mfinanga et al, August, 2007)

S/No.	Category of Item	Description of Facilities
1	Non-Residential Campus	Classrooms and lecture rooms. Departmental areas, staff offices and seminar rooms. Central administration offices. Library. Auditorium or lecture theatre. Staff common rooms. Student common rooms with indoor recreation facilities. Outdoor recreation facilities: games or sports facilities. Drainage system, proper sanitation and water supply. Dispensary.
2	Additional Items for a Residential Campus	Kitchen and dining facilities. Student accommodation including adequate laundry and storage facilities.

Table 6: Description of Proposed Sizes and Composition of Classrooms, Workshops, Offices and Other Support Structures for Each ETO, (Mfinanga et al, August, 2007)

S/No.	Description of Type and Scale of Development
1	On implementation of these proposals, each ETO is expected to be running 8 programs, each with durations of 3 years of study. Though the optimum number of students in a technical education class is 20, a class size of 30 students is adopted here in response to the prevailing high demand for technical education in the country today.
2	It is proposed that each ETO has a normal capacity of one stream of training, and an expanded target of an extra full stream.
3	In order to guarantee quality of teaching, this expansion comes with a full complement of academic staff, equipment, and all physical facilities (and in some cases with necessary expansion of existing facilities).
4	It is proposed to have one and two stream arrangements in each ETO and then to time-share each of the proposed 8 workshops @ of 600m ² plinth area, 3 laboratories @ of 200m ² plinth area, 2 seminar rooms @ of 200m ² plinth area, and 16 classrooms @ of 200m ² plinth area. The single stream auditorium of 400m ² plinth area though will need to grow to 800m ² of plinth area.
5	The single stream student complement will be 720 students attracting a hostel space need complement of 360 rooms @ of 7m ² plinth area, and a total space need therefore of 2520m ² . The double stream situation will enrol 1440 students, with a hostel space demand of 720 rooms @ of 7m ² plinth area and an overall space need therefore of 5040m ² .
6	The auditorium or assembly hall (of a multipurpose nature) for the single stream setting will seat not less than 50% the students and therefore have an area of 400m ² . For the double stream this needs to grow to 800m ² .
7	Despite the Information technology revolution, hardcopy stocking for long-term regular referencing remains a critical support for effective teaching. A spacious library of an overall area amounting to 944m ² rounded of to 1000m ² (comprising of 216 reader stations that take up 432m ² , and a stack area of 240m ² , a periodicals and referencing space of 24m ² , and staff and services space of 160m ² , and support services and distribution spaces of 88m ²) would be needed for the single stream option. This would grow in size to 1888m ² rounded of to 2000m ² for the double stream full development (comprising of 432 reader stations that take up 864m ² , and a stack area of 480m ² , a periodicals and referencing space of 48m ² , and staff and services space of 320m ² , and support services and distribution spaces of 176m ²).
8	Catering facilities for a 720 student single stream mode take an area of 2880m ² , while the double stream option calls for a space provision of 5760m ² .
9	These being technical programs, student staff contact are kept at a maximum. It is assumed for working purposes here that each stream in an ETO will have 72 academic staff members, who then ideally, will each require office of on the average 9m ² , to generate an overall academic staff office space need of 648m ² . The double stream is expected to be supported by 144 academic staff. These

will require creative design adaptation of the single stream staff office facilitation especially in respect of the furniture layouts to assure effective accommodation of the extra staff. Double occupancy of offices will be an option here.

- 10 It is proposed to have adequate central administration offices of an area of 400m² for the single stream situation which same can with careful furniture layouts be adapted to accommodate the double stream full phase.
- 11 A starter area of 250m² would suffice for a modest on-campus dispensary, pending much more thorough determination of needs. Growth to 500m² can be assumed for the double stream, as an eventuality.

Recommended Workshops Equipment for the ETOs

Technical training is practical in nature and therefore requires adequate equipment to ensure that trainees gain competence in the use of various types of equipment common to their trade. It is necessary therefore, to carry out an audit of available equipment against a set standard in order to guide decisions on future needs.

The equipment for each ETO in the proposal made in this study were specified both for the existing and extra programmes required to raise the total number of programmes to a full complement of 8 identified programmes, in order to ensure that each ETO was adequately equipped. Once fully equipped the workshops would be capable of catering for double streaming given the reality of the fact that normally the workshops experience only up to 48% utilisation levels. Double streaming would also be made easier by the fact that programmes commonly access more than one workshop at a time, each addressing different practical skills.

Table 7 gives details of workshops that were expected to be audited for possible upgrading of equipment in order to support the existing programmes, a full complement of 8 recommended programmes and double streaming, as well as the equipment needs for the proposed new ETOs.

Table 7: Auditing Needs of Workshops for Possible Upgrading and Purchase of Equipment in the ETOs, (Mfinanga et al, August, 2007)

		2008
PROGRAMMES	WORKSHOPS	ETOS REQUIRING UPGRADING OF WORKSHOP EQUIPMENT
Construction	Carpentry	E.S.T.B Busogo, E.T. St. Kizito, Gatumba, Gitarama, Kibungo, Muhima, Nyamata.
	Masonry	
	Plumbing	
Electrical	Electrical Installation, Basic Electricity, and Electrical Machines	E.T. St. Kizito, Gatumba, Gitarama, Kibungo, Kibuye, Muhima, Nyamata, G.S. Mater Dei Nyanza.
Electronics & Telecommunication	Electronics & Telecommunication	E.T. St. Kizito, Gatumba, Gitarama, Kibuye, Muhima, G.S. Mater Dei Nyanza.
Electronics & Information Technology	Electronics & Information Technology	E.T. St. Kizito, Gatumba, Gitarama, Kibuye, Nyamata, G.S. Mater Dei Nyanza.
Mechanical Maintenance	Machine tools	E.S.T.B Busogo, ETAG Gisenyi, Gatumba, Gitarama, Kibungo, Kibuye, Muhima, Nyamata.

	Welding and Fabrication Including Sheet Metal	E.S.T.B Busogo, ETAG Gisenyi.
Automobile Mechanic	Auto Mobile (Including Auto Electrics / Electronics)	E.S.T.B Busogo, ETAG Gisenyi, Gitarama, Kibungo, Kibuye, Muhima.
Drawing	CAD (Computers + Software)	E.S.T.B Busogo, E.T. St. Kizito, ETAG Gisenyi, Gatumba, Kibungo, Kibuye, Muhima, Nyamata, G.S. Mater Dei Nyanza.
Tailoring	Tailoring	Nyamata.
Books		E.S.T.B Busogo, E.T. St. Kizito, ETAG Gisenyi, Gatumba, Gitarama, Kibungo, Kibuye, Muhima, Nyamata, G.S. Mater Dei Nyanza.
2009		
PROGRAMS	WORKSHOPS	ETOS REQUIRING UPGRADING OF WORKSHOP EQUIPMENT
Construction	Carpentry	ETAG Gisenyi, Kibuye and G.S. Mater Dei Nyanza.
	Masonry	ETAG Gisenyi, Kibuye and G.S. Mater Dei Nyanza.
	Plumbing	ETAG Gisenyi, Kibuye and G.S. Mater Dei Nyanza.
Electrical	Electrical Installation & Basic Electricity	E.S.T.B. Busogo and ETAG Gisenyi.
	Electrical Machines	E.S.T.B. Busogo and ETAG Gisenyi.
Electronics & Telecommunication	Electronics & Telecommunication	E.S.T.B. Busogo, ETAG Gisenyi, ETO Kibungo and Nyamata.
Electronics & Information Technology	Electronics & Information Technology	E.S.T.B. Busogo, ETAG Gisenyi, ETO Kibungo and Muhima.
Mechanical Maintenance	Machine tools	E.T. St. Kizito, Gatumba and G.S. Mater Dei Nyanza.
	Welding and Fabrication Including Sheet Metal	E.T. St. Kizito, Gatumba and G.S. Mater Dei Nyanza.
Automobile Mechanic	Auto Mobile (Including Auto Electrics / Electronics)	E.T. St. Kizito, Gatumba, Nyamata and G.S. Mater Dei Nyanza.
Drawing	CAD (Computers + Software)	E.T. St. Kizito.
Tailoring	Tailoring	Nyamata.
Books		E.S.T.B Busogo, E.T. St. Kizito, ETAG Gisenyi, Gatumba, Kibungo, Kibuye, Muhima, Nyamata, G.S. Mater Dei Nyanza.

Proposed Recruitment of Technical Teachers for the ETOS

The cumulative total number of technical teachers nationally during the baseline year as well as during the 3-year proposed implementation period, the corresponding cumulative total number of students and total number of programmes offered in the ETOS are shown in Table 8. In this table, each full stream year is shown as a programme, for purposes of evaluating the budgetary figures for the purchase of teaching and workshop materials.

Table 8: Number of Technical Teachers, Students and Programmes in ETOs in the Baseline Year (2007) and During the Project Years 2008 – 2010, (Mfinanga et al, August, 2007)

Teacher / Program / Student Numbers	Baseline Year		Project Years			
	2007	2008	2009	2010	2011	2012
Technical Teachers	113	97	132	189	288	435
Programmes	93	94	107	135	199	304
Student Population	3,032	2,910	3,960	5,670	8,640	13,050
Students Annual Enrolment	1,011	970	1,320	1,890	2,880	4,350

The quality of technical education is partly dependent on both the qualification and numbers of technical teachers available in each programme. The percentage cost of paying salaries for technical teachers in the proposal given amounted to a mere 1.34% and 5.02% of the total project costs without and with expatriates, respectively. The cost of investing in adequate numbers of technical teachers is thus seen to be comparatively much smaller than the other costs in the proposal given, thus clearly highlighting the fact that there was little to be gained from reducing the numbers of technical teachers below the recommended levels. Technical teachers are required to have a good background in technical education and should ideally have grown through the technical education system. The proposal underlined the importance of ensuring that higher levels of academic training were not mistaken for qualification to offer instruction in technical schools, as they certainly do not qualify as so. It was further noted that the practical nature of technical education demanded a high teacher/student ratio, thus placing constraints on the class sizes.

At the time of this study, there was in the country a shortfall of 187 technical teachers within the existing programmes offered in ETOs based on the ideal student / technical teacher ratio of 1:10. However due to the current high demand for skills training in the country, an initial class size of 30 in the ETOs was proposed, in the circumstances. This for a student/technical teacher ratio of 10:1 implied a staffing requirement of 3 technical teachers per programme. It was proposed that this requirement be fulfilled by one A0 and two A1 technical teachers in every programme as a minimum. The number of technical teachers employed then would, with this ratio and class size, be adequate for the existing programmes. However, only about 65% of them had qualifications below A1, in addition to their not being distributed evenly in the various courses and ETOs. This therefore raised the challenge of training and redistribution of both cadres within programmes and ETOs.

With the proposed expansion in capacity and the addition of 2 new ETOs in the Northern Province, the total number of technical teachers required was projected to rise to 456; which are 337 more than the 119 in the system at the time of the study. It was proposed therefore that aggressive recruitment be done internally and externally as well, starting from the beginning of the year 2008. TVET in Rwanda at the time of conducting the study was characterised by very poor retention of technical teachers, particularly those with A1 and A0 qualifications. It was recommended therefore that measures be put in place to ensure that the remuneration package for national technical teachers was attractive enough to ensure retention. This would guarantee long term availability of a stable and reliable pool of technical teachers in the country. It was further recommended that the remuneration package

be made in such a way that it realistically addressed the productivity, qualifications and needs of the staff employed, while also taking into account the remunerations offered within alternative or competing job markets that were available to the technical teachers.

Figure 11 shows some proposed adaptations to the system shown in Figure 1. The proposed adaptations (presented in broken arrows and boxes in this figure) are aimed at ensuring that each level of formal Grade level skill training is followed by one year of work in industry in order to ensure that the skills acquired in training are firmed up before proceeding to the next level. The same approach should be adopted for non-formal vocational training for the same reasons proffered.

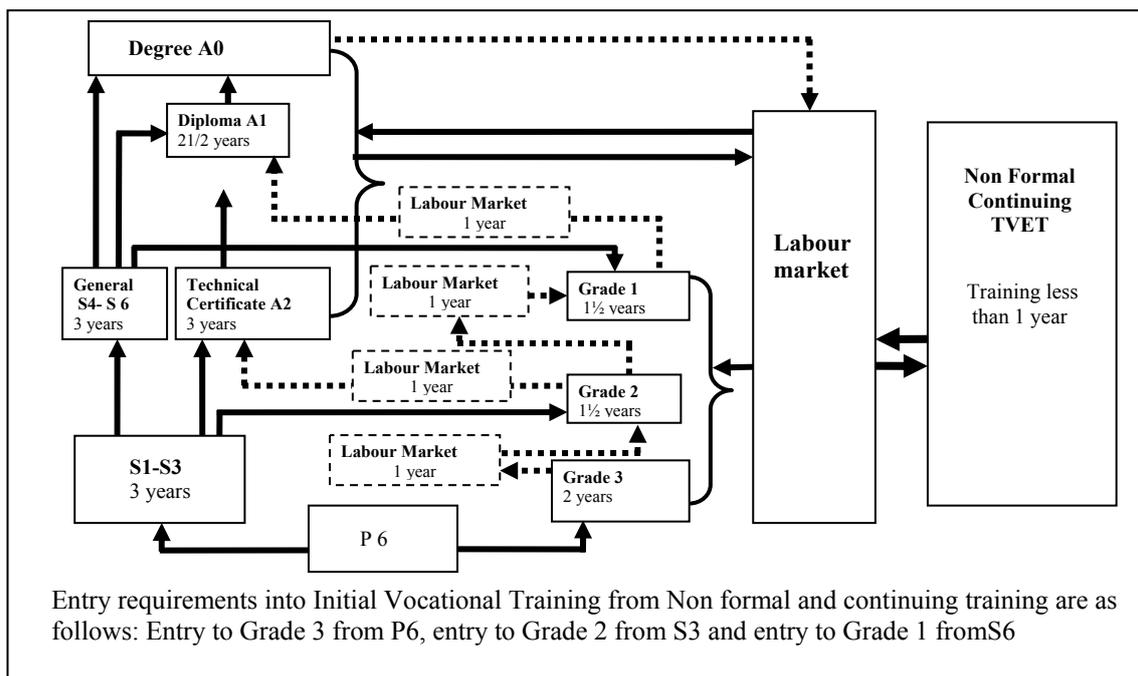


Figure 11: A Holistic Education System Showing TVET Grades, as Well as Vertical and Horizontal Mobility, within the System

The main challenge expected in meeting the requirement of a one year industrial attachment as shown in Figure 11, is the shortage of industries to attach trainees in. It will be necessary to reclassify industry and pull in small and medium scale industries and other small scale enterprises, as has been done in one neighbouring country. This not only gives the trainees the desired practical experience, but also exposes them to the real life experiences of upcoming small businesses. This is exposure that is likely to serve the students well in possible attempts to set up their own enterprises in future.

EXPECTED BENEFITS OF THE PROJECT

The following benefits are expected to be realised on implementation of the proposals made:

- 1) The existence of ETOs with proper physical infrastructure, in respect of classrooms, workshops, and ample room for other supporting facilities.

- 2) The existence of properly equipped ETOs, in which skill training could be done.
- 3) The existence of a system with the capacity to take in all qualifying students.
- 4) The presence of adequate numbers of technical teachers in the system.
- 5) The presence of technical teachers with relevant and right qualifications in the system.
- 6) The full complement of 8 identified programmes in place and running in the ETOs.
- 7) The establishment of a basis for future expansion of the ETOs.

BENEFITIARIES OF THE PROJECT

The beneficiaries of the proposed project were identified as:

- 1) The nation in the sense of gaining enhanced skills for its nationals in various technical fields, who then are better able to produce technical solutions to the needs of the nation and to create employment.
- 2) The students attending ETOS who will gain good access to well equipped and staffed institutions with good physical facilities; with all such ETOs providing a good environment to develop the various technical skills that the students seek.
- 3) The private sector who will gain access to greater numbers of fully trained personnel, capable of working in their respective technical fields without need for further on-job training.
- 4) The technical teaching staff who will enjoy the advantage of a better working environment and more competitive remunerations that will motivate them in their quest to transfer knowledge and technical skills to their students.

ACKNOWLEDGEMENTS

We are grateful to the Ministry of Education (MINEDUC) of Rwanda for financing this study, Mr. Issa Claver – the then Planning Officer in MINEDUC and Mr. Gerald Karamutsa – the then TVET Officer in MINEDUC, the last two for availing necessary information of the form of tertiary and secondary data, and for sparing time to discuss the study in various review sessions. Our gratitude also goes to the then Minister of Education, Dr. Jeanne d' Arc Mujawamariya, and the then Minister of State in Charge of Secondary and Primary Education, Joseph Murekeraho, for availing time to tirelessly and meticulously peruse the several draft reports produced while undertaking this study and compiling a project document; and also for the useful feedback sessions held with them. The inputs of our professional and academic colleague Mr. Joseph Mfinanga, in developing TVET equipment lists, undertaking its costing, and assisting with the write up of the project document project is also greatly appreciated.

REFERENCES

- Buyela Wepukhulu, Mubiligi Jacques Jean, *Tracer Study on the Employability of Graduates from Technical and Vocational Schools in Rwanda*, Ministry of Education (MINEDUC) / Japan International Cooperation Agency (JICA) October 2006.
- Capacity Data Sheet for Technical Schools*, Ministry of Education (MINEDUC), 2006.
- Economic Development and Poverty Reduction Strategy (EDPRS)*, Ministry of Finance and Economic Planning and (MINECOFIN), July 2007.

- Education Sector Strategic Plan, 2006 – 2010, Sector*, the Ministry of Education (MINEDUC), April, 2006.
- Ensuring Technical Schools Deliver Employable Young People*, Ministry of Education (MINEDUC)/SOS Kinderdoff International Rwanda Conference, 18th September 2007, Kigali.
- Halfdan Farstad, *Integrated Entrepreneurship Education in Botswana, Uganda and Kenya*, National Institute of Technology, Oslo, Norway, December, 2002.
- Kayiranga Gakuba Theogène and Mfinanga Joseph, *Draft Strategic Plan for Technical Education in Rwanda for the Years 2009 – 2012, Inclusive*, Funded by the Ministry of Education (MINEDUC) and the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), August, 2008.
- Mfinanga Joseph, Maringa Maina and Maringa Mwangi, *A Short Term Strategy for the Improvement of Public Technical Schools (ETOs) in Rwanda*, Funded by the Ministry of Education (MINEDUC), August, 2007.
- Mfinanga Joseph, Maringa Maina and Maringa Mwangi, *A Short Term Project for the Improvement of Technical Education in Technical Secondary Schools (ETOs) and Colleges of Technology (COTs), in Rwanda*, Funded by the Ministry of Education (MINEDUC), November, 2007.
- Millennium Development Goals*, Government of Rwanda / United Nations Country Team, <http://www.khi.ac.rw/mdg.pdf>, 2003.
- Ngerechi J. B., *Technical and Vocational Education and Training in Kenya*, Conference on the Reform of Technical and Vocational Education and Training (TVET) - Regulatory Instruments for Quality Assurance of TVET, Gaborone, Botswana, August 4 – 6, 2003.
- Number of Students in Public, Public/Private and Private Technical Secondary Schools*, Ministry of Education (MINEDUC), 2006.
- Strategic Plan for Technical Education in Rwanda for the Years 2008 – 2012, Inclusive*, Ministry of Education (MINEDUC), February, 2009.
- Technical and Vocational Education and Training (TVET) Policy Rwanda*, Ministry of Education (MINEDUC), April, 2008.
- Tracer Study for ETO Gitarama*, Ministry of Education (MINEDUC), June, 2007.
- Vision 2020*, Government of Rwanda, July, 2000.

