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# The role of vocational education and technical training in economic growth: a case of Botswana

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**Abstract:** Over time, there has been a significant rise in vocational education and technical training in Botswana. This article shows that there is a positive and significant relationship between economic growth and vocational education and technical training in the country. However, job creation in the formal sector is limited, given the size of the domestic market. It is necessary that the expansion of vocational and technical training should be accompanied with appreciable growth in employment in the formal sector. Botswana should produce for the regional market in Southern Africa in order to circumvent the smallness of the domestic market. Outward-looking, export production can loosen the most binding constraints to economic growth with structural change in the country.

**Keywords:** vocational education; technical training; human capital; economic growth; structural change; formal sector; Botswana.

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## 1 Introduction

The development of a skilled labour force makes an important contribution to economic growth of a country. The most cost-effective use of public resources to improve the

productivity and flexibility of the workforce is thus investment in education, vocational training and skills development. Countries need to improve productivity in their economies if they want to compete successfully in an era of rapid economic and technological change.

This article analyses the role of vocational education and technical training in economic growth and uses Botswana as a case study. In Section 2, the article briefly reviews the contributions by other researchers on the relationship between vocational education and technical training and economic growth. This is followed, in Section 3, by a discussion on vocational and technical training that has evolved in Botswana. This discussion also shows how vocational education and technical training are defined in Botswana. Section 4 outlines the model and discusses the empirical findings. This is followed by conclusions and policy recommendations.

## **2 Vocational education and technical training and economic growth**

Interest in analysing the importance of education and vocational training in economic growth has led to an upsurge of empirical analyses of why some nations grow faster than others (Schultz, 1961). In the first instance, education may increase the human capital of the labour force, which in turn increases labour productivity (Mankiw et al., 1992). Second, education may increase the innovative capacity of the economy (Lucas, 1988). Third, education may facilitate the diffusion and transmission of knowledge needed to implement new technologies (Benhabib and Spiegel, 2005).

The size of human capital can be enhanced through formal and informal education at school and at home, and through training, experience and mobility in the labour market. Human capital activities involve not merely the transmission and embodiment in people of available knowledge, but also the production of new knowledge which is the source of innovation and of technical change which propels all factors of production. Like other capital, human capital could be increased through investment in, and commitment to human factors such as education, training and healthcare.

Although human capital takes at least eight years to mature and requires constant support, its returns are fundamental for improvement. Investment in human capital has proven successful in many developing nations especially in the Asian continent. Unlike increases in GDP, increases in the quality of human capital show the extent to which development has reached the population. While economic progress benefits educated and high-skilled labour, low-skilled labour increasingly comes under pressure. It is crucial to invest in both human and physical capital but the accumulation of human capital is more important for economic growth and development (Schultz, 1961).

The effects of education in economic growth have been examined by various authors. First, education raises the skills of the labour force, which, in turn, increases labour productivity (Mankiw et al., 1992). Secondly, education increases innovation and the acquisition of new knowledge (Lucas, 1988). Thirdly, education facilitates the diffusion of new technology (Benhabib and Spiegel, 2005). Education raises the skills of labour. These factors raise labour productivity and economic growth. Huffman (1974) analyses the role of education in Midwestern US farmers' use of nitrogen fertiliser in corn production. He observes that farmers with more formal education are more adaptable to new knowledge in farming. Rahm and Huffman (1984) study the impact of human capital and other variables among Iowa farmers in the adoption of conservation tillage. They find

that investment in human capital is a significant factor that explains the adoption of conservation tillage. Keller (2004) stresses the importance of human capital in the international diffusion of technology and how a relatively few developed countries generate new technology in the world. The extent to which countries benefit from this new technology depends on the level of human capital in the recipient countries. Heckman (2002, p.3) asserts that 'a more educated workforce is a more flexible workforce'.

Vocational and technical training are about skills training. Skilled workers and technicians enhance the quality and efficiency of production and also supervise and train workers with lesser skills. Training in specific skills is more effective when it builds on a strong foundation of general education. Primary and lower secondary education provide this foundation for many traditional crafts and trades. As the conceptual content of jobs is increasingly high and manual skills correspondingly less important in modern manufacturing and services sectors, the broad competencies gained through good quality education and training are significant, not only to immediate productivity, but also to the ability of workers to learn new skills throughout a career.

Easterlin (1981) shows that modern economic growth is mainly the result of the diffusion of new technology, which depends on the level of formal education. Vocational and technical training enables the trainees to acquire knowledge and skills that are demanded in the labour market. The following case study of Botswana shows the levels at vocational and technical training may be attained. Clearly, the levels vary across countries, but country specific examples shade light on the meaning of vocational and technical training.

### **3 Vocational education and technical training in Botswana**

The roots of vocational education in Botswana can be traced in 1962, when the government started a national trade testing system at the Botswana Training Centre, in the Ministry of Labour. In mid-1960s, the unemployment of primary school leavers worsened, and as a solution to the problem, Brigades were started. 'A Brigade is a small community organisation which offers vocational training at the semi-skilled level and also engages in income-generating production activities and rural development projects', [Republic of Botswana, (1993), p.196]. Brigades grew rapidly in the 1970s. As a result, the government of Botswana established, in 1977, the Brigades Development Centre in the Ministry of Education to coordinate Brigade operations and to administer government funding to Brigades.

Through the years, concerted government efforts have been made to fine tune education policy in Botswana. In 1976, the government appointed the First National Commission on Education, whose recommendations were the basis for the 1977 National Policy on Education (Republic of Botswana, 1991). In 1992, the government constituted the Second National Commission on Education, and its recommendations led to the 1994 Revised National Policy on Education (RNPE). After further consultations, the government adopted the National Policy on Vocational Education and Training in 1997 (Republic of Botswana, 1997).

However, prior to the establishment of the Second National Commission on Education in 1992, Botswana had already achieved a milestone by passing the Apprenticeship and Industrial Training Act in 1983. The Act set junior secondary

school to be the minimum qualification for vocational training. It also institutionalised employer-based training conducted through apprenticeships. Under the provisions of the Act, the Department of Labour of the Ministry of Home Affairs dealt with the apprenticeship while the Department of Technical Education in the Ministry of Education provided training through Vocational Training Centres (VTCs). The VTCs are large institutions in urban or densely populated areas, unlike the Brigades, which are small or medium sized establishments located in rural and remote areas. The VTCs are government institutions under the Ministry of Education while the Brigades are autonomous and community-based institutions.

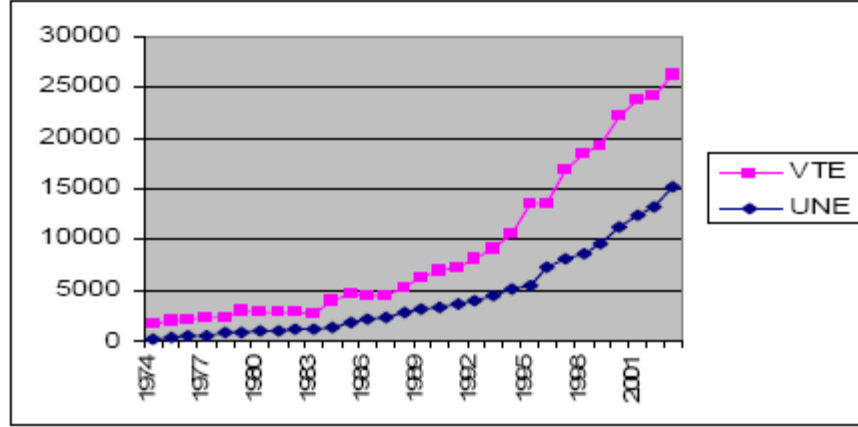
In 1986, the government consolidated and expanded the trade testing system and established the Madirelo Training and Testing Centre. The revised system certifies many vocational training programmes conducted by government institutions, parastatal corporations and private employers. In 1994, the vocational training was consolidated under one unit, the Department of Vocational Education and Training (DVET). Furthermore, in 2006, the government announced that the DVET would takeover the running of the Brigades. There were by then 41 Brigades in the country, and the government takeover was designed to update and transform some of them into technical colleges or satellite campuses (Baputaki, 2007; Polelo, 2007; Van Rensburg, 2007b; Ontebetse, 2008).

State policy is also specific on the requirements for technical training. A technician is someone who should have advanced and intensive training in engineering disciplines. 'The technician is a person who requires a substantial amount of technical knowledge and knowledge skills in order to do his or her function, and who can work with little or no supervision' [Republic of Botswana, (1993), p.198]. Therefore, technical training is for senior secondary school leavers, and is for two to three years of full-time study, after which most students are awarded certificates or diplomas.

Initially, technicians were trained at the National Centre for Vocational Training. In 1979, the Centre was upgraded and renamed the Botswana Polytechnic. This is the major institution for technician training in Botswana, and it offers certificates and diplomas of the City and Guilds London Institute; in civil, mechanical and electrical engineering. Other institutions involved in the training of technicians are the Botswana College of Agriculture and the Botswana Institute of Administration and Commerce. The Botswana College of Agriculture is part of the University of Botswana.

Figure 1 shows the enrolments at the vocational and technical institutions and at the University of Botswana. It is clear from the figure that, over time, there has been an exponential rise in the enrolments in vocational education and technical institutions in Botswana. The figure also shows that the enrolments in vocational and technical institutions have been higher than university enrolments. This reflects the priority of government on skills training. Simply stated, the government found it necessary to invest more in the expansion of vocational and technical training than in university education, which is sometimes considered to be academic and suited only for white collar jobs. It is apparent from Figure 1 that vocational and technical training in Botswana has raised appreciably since the 1990s. Given the considerable emphasis on this type of training, it is necessary to determine whether or not the training matters for economic growth in the country. Can we prove empirically that there is a significant relationship between vocational and technical training and economic growth in Botswana? Is it the case, as some analysts have argued, that this type of training is insignificant for economic growth in Botswana?

**Figure 1** Enrolments in vocational education and training in Botswana (see online version for colours)



Notes: VTE are the enrolments in vocational and technical institutions.

UNE are the University of Botswana student enrolments.

Source: Republic of Botswana (2003)

#### 4 The model and empirical results

The model used to estimate the impact of vocational education and technical training in Botswana is the standard neoclassical growth model with human capital variables (see for instance, Mankiw et al., 1992; Andreosso-O'Callaghan, 2002):

$$Y = f(K, L, HK) \tag{1}$$

where  $Y$  is gross domestic product ( $GDP$ );  $K$ ,  $L$  and  $HK$  are capital, labour and human capital, respectively. Besides these factors, the estimation included exports and total government expenditures because these variables have been found to be significant determinants of economic growth in Botswana (Mupimpila, 2008). Thus, the estimated equation in the present study is:

$$GDP_t = \beta_0 + \beta_1 LAB_t + \beta_2 INV_t + \beta_3 UNE_t + \beta_4 VTE_t + \beta_5 XPT_t + \beta_6 GEX_t + \varepsilon_t \tag{2}$$

where  $GDP_t$  is real  $GDP$  in millions of Pula, the domestic currency (1980=100). The growth in real  $GDP$  in this study measures economic growth. The variable  $LAB_t$  denotes labour force in thousand and measures the contribution of the labour to economic growth. The variable  $INV_t$  is real investment in millions of Pula. This is defined as gross fixed capital formation plus changed in stocks. This variable measures physical capital, as distinct from human capital. In this study, the human capital variables are university ( $UNE_t$ ) and vocational education and technical training ( $VTE_t$ ) enrolments in thousands. The additional variables added as determinants of economic growth are exports ( $XPT_t$ ) and total government expenditures ( $GEX_t$ ). The data fitted to equation (2) are for the period 1974–2004 and were obtained from various statistical bulletins and education

statistics published by the Central Statistics Office in Botswana. The coefficients are the  $\beta$ s and  $\varepsilon_t$  is the error term. The  $t$  subscript shows that the variables are functions of time, but is not shown elsewhere in this article for convenience in notations. PcGive was used for estimation because it is able, among other things, to generate values of partial R-squared for the independent variables.

In the neoclassical growth model, an increasing population growth rate reduces the steady-state capital per worker because a large population spreads the available physical capital thinly among workers (Abel and Bernanke, 1995; Mankiw, 1997). However, Botswana is sparsely populated. The 2005/06 Labour Force Survey estimated the country's population to be 1.7 million people [Republic of Botswana, (2006), p.1]. It is argued that this level of population hinders large-scale industrial production and structural change. According to the Bank of Botswana (1999, p.117), the small size of the domestic market constrains job creation and limits the expansion of the domestic industry in Botswana. Under these circumstances, growth in population and labour force should have a positive effect on the economy. This is the reason we expect  $\beta_1$  to be positive in this study. Therefore, all the independent variables are expected to have a positive and significant effect on real *GDP* growth in Botswana.

Preliminary tests were made on data to establish its normality and stationarity. Table 1 gives the estimation results of equation (2) with log transformed variables. The F-static is significant, showing the independent variables jointly explain growth in *GDP* in Botswana. The R-squared and the adjusted R-squared are very high while the D-W statistic shows that there is no problem of serial correlation. All the variables have the expected signs. The most significant variables that determine economic growth in Botswana are physical capital (*INV*), vocational and technical education (*VTE*) and exports (*XPT*). The coefficients of these variables are significant at the 1% level. The coefficient of total government expenditures (*GEX*) is significant at the 5% level while those of labour force (*LAB*) and university enrolments (*UNE*) are significant at the 10% level.

From Table 1, it is clear that the physical and human capital variables have a positive and significant impact on economic growth in Botswana. Not surprisingly, the country has one of the fastest growth rates in the world. The World Bank (2005) cites Botswana as one of the developing countries with rapid economic growth since the 1980s. Botswana is one of those that have registered rapid economic growth in a short span of life. The countries in this category are: Botswana, Brazil, China, Hong Kong, India, Indonesia, Japan, Malaysia, Oman, Singapore, South Korea, Taiwan, Thailand and Vietnam [Mmegi/The Reporter, (2008), p.7].

The phenomenal economic growth in Botswana is traceable to the mid-1980s when mining became the dominant sector of the economy. In particular, diamond mining has generated windfalls that have been a catalyst to Botswana's economic growth. The government of Botswana owns 50% of the diamond mining company called Debswana. Besides the equity holdings in Debswana, the government also benefits through company income tax on Debswana and royalties on the output of diamonds (Mupimpila, 2005; Tsegaye, 1993; Wright, 1997). Some of the noticeable achievements are investments in human capital. There has been a significant expansion of primary and secondary education since the mineral boom started. Figure 1 also shows an exponential rise in vocational and technical training, as well as university education. With this record, we should expect a positive and significant relationship between economic growth, on the one hand, and physical and human capital, on the other. The coefficients of physical

capital and vocational and technical training are significant at the 1% level. The partial R-squared for physical capital (0.61) is about the same as that of vocational and technical training (0.60).

**Table 1** Modelling LGDP by OLS

<i>Variable</i>	<i>Coefficient</i>	<i>Std. error</i>	<i>t-value</i>	<i>t-prob</i>	<i>Partial R<sup>2</sup></i>
Constant	-1.34361	0.4968	-2.70	0.012	0.2336
LLAB	0.089817	0.04424	2.03	0.054	0.1466
LINV	0.151817	0.02476	6.13	0.000**	0.6103
LUNE	0.113275	0.05544	2.04	0.052	0.1482
LVTE	0.185814	0.03241	5.73	0.000**	0.5779
LXPT	0.457837	0.04433	10.3	0.000**	0.8163
LGEX	0.216969	0.07308	2.97	0.007*	0.2686
R <sup>2</sup>	0.9996		Sample		1974 to 2004
F(6, 24)	1.001 [0.000]		No. of observations		31
RSS	0.041684526		DW		2.0

Notes: \* .05 significance  
 \*\* .01 significance

The results of the present study show that there is a positive and significant correlation between economic growth and vocational and technical training in Botswana. The results confirm the observation made by Easterlin (1981) that mass education, in contrast to elitist academic education, is conducive to economic growth. Easterlin asserts that diffusion of modern technology depends on the degree to which a large segment of the population has acquired knowledge and skills through formal education. Figure 1 shows that vocational education and technical training enrolments have, over the years, been consistently higher than those of the University of Botswana. Therefore, as suggested by Easterlin, we should expect a significant correlation between economic growth and vocational and technical training. The results in Table 1 show that the coefficient of vocational and technical training is positive and significant at the 1% level while that of university education is significant only at the 10% level. The partial R-squared for vocational and technical training (0.60) is higher than that of university education (0.15). The output elasticity with respect to vocational and technical training (0.19) is also higher than that of university education (0.11). The results in this study suggest that vocational and technical education is vital to economic growth in Botswana.

Evidently, the results of the present study do not support the view held by some analysts; that vocational and technical training does not contribute significantly to economic growth in Botswana (Polelo, 2007; Tabulawa, 2008; Van Rensburg, 2007a, 2007b). It is said that vocational education and technical training has no significant impact on economic growth in Botswana because of the mismatch between the types of the skills of the trainees and the demands of the labour market. Polelo (2007) asserts that the students that enter vocational and technical training colleges are under-achievers who do not qualify for university education. According to the researcher, the earnings of graduates from vocational and technical institutions are minimal. Polelo also cites the results of the 2001 population census of Botswana, which show that graduates from vocational institutions and Brigades have the second highest unemployment rate in the

country. Van Rensburg (2007a, 2007c) and Tabulawa (2008) suggest a solution to the mismatch between skills and the demands of the labour market, and refer to it as 'education with production'. Under the system, schools and higher institutions should be occupational training centres where students learn skills required in the workplace. Other experts view the role of schools, colleges and universities simply as that of educating students and not imparting skills (The Botswana Gazette, 2008).

Plausibly, some analysts view vocational and technical training as insignificant in Botswana because of the problems associated with this type of training. The problems are discernible. The Second National Commission on Education established in 1992 cited a number of problems related to vocational and technical training in Botswana, such as deficiencies in curricula, lack of coordination and the absence of a unified policy among the trainers (Republic of Botswana, 1993). The Commission's report was adopted by the government and was the basis for the RNPE of 1994. Furthermore, in 1997 the government adopted the National Policy on Vocational Education and Training, which was an attempt to solve the problems of vocational and technical training in Botswana (Republic of Botswana, 1997). Recently, the government decided to takeover the Brigades. There are 41 Brigades and these have been managed by communities for over 40 years now, as training and production centres. In 2006, the government announced that it would takeover the Brigades in order to update their training and align it with the demands of the job market in the 21st century (Baputaki, 2007). The government plans to merge some of the Brigades to become technical colleges or satellite campuses (Ontebetse, 2008).

If anything, the mismatch between skills and the demands of the labour market does not just affect graduates from vocational education and technical institutions, but also university students. This is evident from the decision by the government to form school-industry partnerships and to enrol university graduates as interns in various government departments (Republic of Botswana, 1991; Tabulawa, 2008; The Botswana Gazette, 2008). Under the school-industry partnerships, university students will spend some time in industry to gain practical experience required in the labour market. However, school-industry partnerships may be difficult to implement because of the costs and externalities of education (Heckman, 2002; Tabulawa, 2008). The costs require that the partnerships define clearly the source of funding. Private sector funding may be unavailable unless the trainees are tied to the respective companies after graduation. According to Tabulawa (2008), the small size of the private sector in Botswana makes school-industry partnerships unfeasible. The Bank of Botswana (1999) attributes the smallness of the private sector to the size of the domestic market. As indicated earlier, Botswana is sparsely populated, with a population of 1.7 million people. This population size is considered to be a hindrance to large-scale industrial production and structural change. The Bank of Botswana (1999, p.117) explains the problems of job creation in Botswana as follows:

"The structural characteristics of the Botswana economy are such that employment creation is not easy. More obviously, the areas where the economy has a natural advantage in production, such as diamond mining and commercial livestock farming, are not by nature very labour-intensive. Moreover, in contrast with many other developing countries, arable agriculture, where labour-intensive techniques may still be an efficient method of production, continues to show little potential for significant further development."



Precisely then, unemployment of graduates from vocational and technical institutions is high because job creation in Botswana is not easy, not because the graduates are under-achievers, as some analysts would have us believe. The non-mining, non-agricultural sectors are unable to create jobs at rate that matches the output of graduates from colleges. The limited capacity of formal sector job creation is due to the size of the domestic market. Outward-looking, export production can overcome the smallness of the domestic market. The extraordinary record of the newly industrialising countries (NICs) is well documented (see for instance, James et al., 1987). These countries are Hong Kong, South Korea, Singapore and Taiwan. Their success has largely been attributed to outward-looking, export production. According to James et al., this strategy has enabled the NICs to circumvent the smallness of the domestic market and also to withstand external shocks such as world recession, oil price increases and the world debt crisis. The authors note that agriculture is insignificant in Hong Kong and Singapore and has declined in its contribution to GDP in South Korea and Taiwan. However, James et al. (1987, p.11) state that "...the policy emphasis on labour-intensive exports has made the industrial sector more important in terms of both total output and labour force..." Similarly, Botswana can benefit from an export policy which targets the regional market in Southern Africa.

There is an additional reason why structural change is necessary in the Botswana economy. As noted earlier, the World Bank (2005) cites Botswana as one of the developing countries with rapid economic growth since the 1980s. However, in reviewing the Bank's publication, Rodrik (2006, pp.981-982) makes the following succinct observation about the growth experience of African countries: 'The trouble seems to be not that poor African countries are unable to grow, but that their growth spurts eventually fizzle out.' Following this logic, there is the danger that Botswana's growth experience will soon fizzle out. Rodrik suggests that the search for factors that can sustain growth should begin by identifying the most binding constraints to on economic growth. For Botswana, it is about finding the most binding constraints to growth with structural change. It is about inducing growth and structural change in the non-mining, non-agricultural sectors of the economy. It is about overcoming the small size of the domestic market.

## **5 Conclusions and policy recommendations**

In an era of economic adjustment and change, development is increasingly a matter of managing the human and physical resources of the economy. Successful management of market economies involves rational allocation of resources which in turn is linked to training the manpower and skills development. In most countries, this market-based approach to development must be managed in conjunction with severe constraints on public resources. As a result, institutions face pressures to increase their flexibility in responding to economic change. These pressures fall heavily on the private and public institutions that develop the skills needed to facilitate change and growth. As economies change, so too must vocational and technical education and training.

Education enhances the skills of labour and facilitates the diffusion of technology, which raises productivity and economic growth. Because of the government priority on skills training, Botswana has, through the years, expanded vocational education and

technical training. This study shows that there is a positive and significant correlation between economic growth and vocational education and technical training in Botswana. The results conform to the assertion of Easterlin (1981) that mass vocational education enhances technology diffusion, labour productivity and economic growth. On the contrary, the results do not support the perception held by some analysts that, because of the mismatch between the skills of the trainees and labour demand, vocational and technical training is insignificant for economic growth in Botswana. It is argued in this article that the underlying cause of unemployment in the country is the limited capacity of the formal sector to create jobs, given the size of the domestic market. The non-mining, non-agricultural sectors in the country are unable to create jobs at a rate that matches the output of graduates from vocational and technical institutions.

The policy implications of the study are that the exponential growth in vocational education and technical training in Botswana should be accompanied by policies that enhance job creation. One possible approach that can be used is that of the NICs, namely: Hong Kong, South Korea, Singapore and Taiwan. These countries overcame the smallness of the domestic market and also withstood external shocks by adopting outward-looking, export production (James et al., 1987). It is suggested here that Botswana can enhance job creation and overcome the size of the domestic market by targeting the regional market in the Southern African Development Community (SADC), comprising 14 countries, including Botswana. The SADC includes South Africa, which is considered to have the most advanced economy in Africa.

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