

Technology and Poverty Eradication: Pre-Conditions for Effectiveness

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Abstract

New technology has been identified as one way to alleviate poverty in developing nations. This is because it makes available cheaper drugs, cheaper inputs such as fertilizers and new seed varieties that are needed by the poor to improve their lives. New technology also connects producers with quick and easy access to overseas markets and sources of inputs through the internet, for example. However, in order for the poor to make use of these new methods to improve their lives, they need to be able to access the new technology. In order for anybody to use the internet, for example, they need to have access to it: it should be available and affordable, in the rural as well as urban areas. They also need to have the basic education that enables them to use and even appreciate such new technologies. This paper argues that the poor in Botswana do not have access to the new technology because of lack of education. They also do not have the "old technology", such as electricity and the telephone, that are pre-requisites for access to the new technology. Therefore, if new technology is to work to alleviate poverty in Botswana, emphasis should be put on making the old technology available and affordable. Education should also emphasize science and math curricula.

1. Introduction

The use of technology in development and poverty alleviation is a relatively new approach. Traditionally, new technology has been associated with the perpetuation of underdevelopment, basically because new techniques are developed in the west, where unemployment is not a critical problem and labour costs are high, and where therefore the idea was to devise techniques that are labour-saving. Needless to say, given the direct relationship between employment creation and poverty alleviation, labour-saving techniques of production would not be associated with poverty alleviation.

This approach to technological developments and the perpetuation of poverty, however, did not look at the other side of the coin, which is the role of technological innovation in the development of new commodities or ways of doing things and how this can alleviate poverty. For one thing, new and cheaper drugs are being developed to fight diseases. One of the most hailed breakthroughs was the development of oral dehydration therapy at Bangladesh's International Centre for Diarrhea Disease Research. They developed the salt and sugar solution that, if combined in the right proportions, can combat diarrhea much cheaper than the intravenous drip (UNDP, 2001).

Contemporary new technologies have been found to dramatically increase access to information and communication, through the internet, for example. One of the benefits of easier and quicker access to information is the positive impact it has on manufacturing (and agriculture) output, thereby making it much more profitable. This is particularly imperative where emphasis is placed on export-oriented industrialisation, because of the need to have access to information on markets, on cheaper sources of inputs, etc.,

thus enhancing competitiveness. This would enhance the productivity and profitability potential of developing-country industry, thereby enhancing their capacities to create employment and thus alleviate poverty. At the same time, through the internet, retailers and therefore consumers have access to lower prices for food and other basic commodities, such as clothing and footwear.

In this new era of globalization, greater employment creation depends on economies having the capacity to use the new techniques to enable them to compete internationally. Through developing comparative advantage in high-technology industries, Costa Rica was able to penetrate the markets of the western economies, primarily the US markets (UNDP 2001). All in all, new technologies create potential for developing countries to expand their exports, thereby expanding their employment and thus alleviating poverty. Botswana is no exception to potential gains from these possibilities. One way to alleviate poverty in Botswana is through diversification of the economy through development of export-oriented industry. This means that computers, the internet and other new technologies should not be seen as a luxury, or as avoidable factors of production. New and improved methods of production in agriculture and manufacturing need to be adopted.

It is accepted that not all countries need to be developers of cutting-edge technology; but for developing countries to benefit as importers of new technologies, they need to be able to adapt and adopt the new technologies. Several pre-conditions exist to enable developing countries to benefit from new technologies. First, they need to have the capacity to adapt the technology to suit their environment. This requires an educated labour force, particularly in science and mathematics. This was how Costa Rica managed to attract high-tech investors, by educating its labour force in those subjects in particular. But even acquiring just basic education creates awareness by the producers, for example farmers, of the advantages of using new technologies.

Second, new technology needs to be diffused, and that requires availability and access to 'old' technology, in particular access to electricity and telephones. Without electricity and the telephone, producers are cut off from the rest of the economy, or of the world. Communication is important to break the barriers of knowledge, and to access markets. Therefore, when we talk of how modern technology can be used to improve the lives of the poor, we need to also examine whether the environment exists for this modern technology to be accessible.

This paper examines the pre-conditions for new technology to be accessible and effective in alleviating poverty. The argument presented here is that the preconditions are not adequate for new technology to be used to alleviate poverty in Botswana: in particular that education is not adequate, in both quantity and quality terms. Also, access to old technology in Botswana, in particular, electricity and the telephone, is relatively poor in general and for the poor in particular. Therefore the extent to which the new technology can be used to alleviate poverty is limited. In order for the new technology to benefit the poor, there is need for the old technology to be widely accessible. There should at the same time be wider access to education, at the primary, secondary and tertiary levels, while at the same time reorientation of the curriculum towards science and mathematics is necessary.

2. Access to 'Old Technologies'

Availability of electricity and the telephone are determined by the kilowatt-hours per capita and telephone lines (both mainline and cellular) per person, respectively. Using the UNDP concept of deprivation, comparisons are made with the best and the worst

countries in the world, to gauge where Botswana lies. In addition, comparisons are made with the best in Africa

When using kilowatt-hours per capita, Botswana has 995, as compared with 3,832 for South Africa, and 24,607 for the highest electricity consuming country in the world (Norway). Of all 121 countries in the world for which data is available (UNDP 2001), Botswana ranks 74. A deprivation index is estimated, which indicates the shortfall from the target (which is the maximum). An alternative target adopted by the UNDP, referred to as the *upper goalpost*, is the OECD average. Comparison is made with reference to this upper goalpost as well. Given the data from Table 1, the deprivation index for electricity consumption per capita is estimated.

Table 1: Kilowatt-hours per capita (1998)

Botswana (country j)	955
Maximum (Norway)	24,607
OECD average	6969
Minimum (Ethiopia)	22
Maximum in Africa (RSA)	3832

Source: UNDP Human Development Report, 2001; Statistical Bulletin 2001.

The formula for estimating the deprivation index (DI) is given as:

$$DI_j = (\text{Max } e - e_j) / (\text{Max } e - \text{Min } e)$$

Where e = electricity consumption per capita;

j = country j .

The closer to unity the index, the greater the deprivation, i.e., the greater the shortfall from the target.

Table 2: Deprivation Index of Electricity Consumption for Botswana

As compared with the highest in the world	0.962
As compared with the OECD average	0.866
As compared with the highest in Africa	0.755

The index shows a very big shortfall from the target for Botswana in per capita electricity consumption. Clearly, Botswana is not doing very well in availability of electricity, whether the comparison is made vis-à-vis the best in the world, the OECD average or the best in Africa, which is South Africa. Nevertheless, in comparison with the per capita electricity consumption of its other neighbours, e.g. Zambia (539) and Zimbabwe (896), Botswana has a higher per capita electricity consumption.

New technology is also diffused through use of the telephone. Access to the telephone is estimated by the number of telephones, both mainline and cellular, per capita, or per 1,000 people. Data for 1999 show that in Botswana there were 150 telephones per 1,000 people as compared with the OECD average of 901 per 1,000 people (UNDP 2001). The worst endowed countries in Africa were Ethiopia, Rwanda and Burundi with 3 telephones per 1000 people, while the highest in Africa (South

Africa) had 270 telephones per 1,000 people. Again, it can be argued that Botswana is not doing too badly, by African standards. But in a global world where competitiveness cuts across all countries, it is the best in the world that Botswana needs to strive to reach, if new technology is to be used to improve competitiveness in production and profitability for poverty alleviation.

3. Education and New Technology

While new technology may be available, and the infrastructure for its diffusion also available, this will, however, not be useful for enhancing productivity, competitiveness and therefore poverty alleviation if the workforce does not have the capacity to use it and/or adapt it. There is need for an educated workforce, through primary, secondary and tertiary education. Education enhances the ability to participate in the network age. To this end, countries and governments need to focus on education spending in their budget. Needless to say, the starting point is emphasis on primary education. Countries of the world, both developed and developing, have adopted free, universal and compulsory primary education. With its budget allocations of about 20% (1995-97) of government expenditure going towards education on average, Botswana is comparable with the other countries of the world.

However, it is as much the quality as it is the quantity of the education that is important for modern technologies to be of use to the developing world. There is need for a reorientation of the curriculum towards technical and science/math-based subjects. Attempts should be made to introduce the teaching of computers at even primary levels. The fundamental constraint with such orientation is the lack of equipment such as computers. Added to this would be lack of expertise. This makes such orientation inaccessible or inadequate for most of the developing countries, because of the resource and therefore cost implications. Ironically, while computer-based teaching can be seen to be costly, it also has the potential to lower the cost of education overall. This is because a greater number of students would have access to education materials using computer networks than without such access. A scenario emerges, therefore, whereby greater education is a cause as well as a consequence of modern technology. In order to adopt and/or adapt new technologies, there is need for science and math skill. At the same time, new technologies can be used to enhance the teaching of these subjects.¹

3.1 The Human Skills Index In order to assess a country's achievement in the area of education relative to the best and the worst in the world, the UNDP uses the mean years of schooling index. However, given that it is not just the quantity, but the quality of the education that impacts on the capacity to use or adapt new technologies, another index used is the gross tertiary science enrolment. To determine the human skills index, a simple average of the two indices is calculated. The formulae for the two indices are given as:

$$\text{Mean years of schooling index} = \frac{\text{Observed for country } j - \text{Min}}{\text{Max} - \text{Min}}$$

$$\text{Gross tertiary science enrolment index} = \frac{\text{Observed for country } j - \text{Min}}{\text{Max} - \text{Min}}$$

The closer to zero the index, the greater the shortfall from the maximum achievable educational achievement. Table 3 gives, using the above formulae, comparable indices on education for human skills for Botswana and a number of its neighboring countries.

Table 3: Human Skills Indices

	Mean Years of Schooling Index	Gross Tertiary Science Enrolment Index
	2000	1995-97
Botswana	0.491	0.055
Zambia	0.420	—
Zimbabwe	0.411	0.055
South Africa	0.473	0.121
Nigeria	—	0.062

Source: Data from UNDP 2001; own calculations of indices.

The indices presented by Table 3 indicate a relatively low level of time spent in schooling for Botswana as compared with the best in the world, although Botswana seems to be doing better as compared with its neighbors. However a disturbing feature of the data is the shortfall in terms of tertiary science enrolment.

From the foregoing analysis, a picture that emerges is that capacity to use new technologies is not being adequately developed in Sub-Saharan African countries in general, and Botswana in particular. Clearly, there is need for greater reorientation towards science in the educational curriculum, as well as more of the educational institutions that focus on such subjects at the tertiary levels.

3.2 Post-Primary Technical Institutions and Poverty Alleviation An increase in gross tertiary science enrolment addresses the issue of poverty alleviation by equipping the students with the necessary tools. However, given that enrolment in tertiary institutions is low in Botswana, whether science-based or not, the ‘catchment’ is lower, and not necessarily focusing on the potentially ‘poor’ sectors of the population. Therefore, in order to make it more poverty alleviation-focused, there may be need to develop *post-primary* technical institutions. The poor people are those who are not employed, or who are in the informal sector, with little or no education. The tendency is for these to have achieved no secondary schooling. It seems appropriate therefore, for policy to also incorporate provision of technical training at that level. This would not only make this class of disadvantaged people to be literate in the use of modern technology and therefore employable, but they would also be empowered for self-employment.

4. Conclusions and Policy Recommendations

Modern technology has been identified as an effective tool in alleviating poverty (UNDP, 2001). This is due partly to development of lower-price commodities such as cheap drugs, fertilizers, etc. Also, because of modern technology, access to information on markets or cheap sources of inputs is made easier, and this enhances productivity and therefore competitiveness. Developing countries do not need to engage in research and

development (R&D) in order to benefit from this. But they do need to have the capacity to adopt the technologies, and where necessary even adapt them, to suit their individual environments. This means that as users of the technologies, developing country producers need an educated labour force, particularly in the area of science and mathematics. There is need for simple skills such as how to operate equipment like the computer. Ability to use the technology also calls for availability of old technologies, such as electricity and the telephone.

The arguments presented in this paper are that Botswana is still lagging behind in development of the 'enabling environment' for modern technology to be effective. The human skills, particularly in the field of science have very low enrolment ratios, relative to the rest of the world. Access to electricity and the telephone, the 'old technologies' necessary for modern technology to be used, are also lagging in comparison with the rest of the world. Relative to its neighbors, Botswana is doing well in these areas, but if global competitiveness is to be cultivated, then it is the best in the world that it should strive to reach.

In order for modern technology to effectively alleviate poverty, especially through enhancing the productivity of the producers, there is need for the environment to be made more conducive. Government spending on education in general, with greater spending on science/math-based education in particular, should be emphasized. In other words, the focus should be on increasing the quantity as well as quality of the education.

The private sector could also be encouraged to invest in education, both on the job as well as formal off-the-job training. In order to create an incentive for greater private sector participation in provision of education, general tax allowances could be given to the investors according to the rate of training they engage in. Malaysia and Thailand are said to give a 200% tax deduction to smaller firms that engage in training (UNDP 2001).

Botswana could also examine possibilities of introducing technical training that targets the poor, at a level that does not require post-primary qualification.

Finally, there is need for a greater orientation towards provision of electricity, the telephone and water to the poor. Not only should these facilities be more widely available, such as in the rural areas, but they should also be made affordable to the poor. In particular, small firms should be assisted to have access to electricity and the telephone, if new technologies are to be made to work for the poor.

Notes

¹ An example of a case where computers are used to enhance the quantity and quality of education is the "Liberty Learning Channel" in South Africa, which conducts tutorials in subjects such as English Literature, Science and Mathematics, and students can phone in to ask questions and seek further clarifications.

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