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Prospects for Technology as Insurance against Poverty in Botswana's Poor

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Abstract
In this paper it is argued that judged on a global scale, Botswana does not seem to have achieved a great deal in technology. This has meant that technology has had very little impact on the rural poor. Therefore if we accept that technology is an important component of economic development, the rural areas have had little economic growth in the form of technology. The paper nonetheless acknowledges that whilst Botswana comes across as a technology non-achiever globally, it possesses the requisite infrastructure (such as telecommunications main lines that are 100% digital) to make technology work for her populace. The paper further advocates massive investment in training in science and technology, research and development to generate the critical mass of skilled researchers upon whom Botswana's technology-led development can be anchored. However any investment in building a human resource capacity that can support and maintain science and technological needs should be coupled to a strong desire to make use of the outcomes of research.

Introduction
Many surveys (Labelle 2002, UNDP HDR 2001, SARIMA 2002) report evidence that appropriate technologies, including information and communication technologies (ICTs), can be harnessed by the poor to sustain themselves. According to Labelle, ICTs can also help attack ignorance and illiteracy that are regarded as "the outriders of poverty and disenfranchisement." From the available literature it is reasonable to propose that leveraging technology to alleviate or even eliminate poverty is no longer an open question. The only question that remains relates to the context and circumstances under which technology is able to do this. For this paper, it is necessary to define the concepts and ideas embodied in the topic. The word technology is herein given a much wider meaning than the usual one of *mechanical art and applied sciences*. Technology therefore includes all processes that are an improvement on the norm. Poverty on the other hand is understood to mean a want of necessities of life including food, shelter, hope, employment, health and dignity. The causes of poverty are invariably multivariable, spanning drought, unemployment, decline in agricultural producer prices, high fertility, attitudes, policy failures and many others.

The Botswana situation can best be understood by providing a poverty map. The map will help explain the causes of poverty as well as give pointers as to how best to apply technology in order to ensure that Botswana's poor emerge out of poverty. This is the major focus of our paper and it derives its legitimacy from Botswana's declared vision (Vision 2016) of, "a prosperous, productive and innovative nation." The orthodox thought is that prosperity (meaning lack of poverty), productivity and innovation are products of the application of technology (UNDP, HDR 2001), meaning that Botswana requires technology as a tool to facilitate the realisation of its national vision.

Poverty and Technology Achievement Index

There are global indicators that place a country's position vis-à-vis poverty and/or prosperity. Amongst the more commonly used ones are the development indices that the UNDP publishes annually, Human Development Index (HDI), Gender-related Development Index (GDI) and Human Poverty Index (HPI). Another index which is of particular interest to this paper is called the Technology Achievement Index (TAI).

The HDI measures the overall achievements in a country in three basic dimensions of human development – longevity, knowledge and a decent standard of living. Conversely, the HPI reflects the distribution of progress and measures the backlog of deprivations that still exists. Using the same dimensions and indicators as the HDI, the GDI captures inequalities in achievement between women and men, with a lower index indicating lack of gender equity. The TAI, introduced since 2001, "aims to compute how well a country is creating and diffusing technology and building a human skill base – reflecting capacity to participate in the technological innovations of the network age." (UNDP HDR 2001). The components of the index are four in number:

i) Creation of technology which is decomposed into the number of patents granted per capita (to reflect the level of invention activity) and receipts of royalty and license fees from abroad per capita (reflecting market value of past innovations).

ii) Diffusion of recent innovations measured by the diffusion of the Internet and by exports of high- and medium-technology products as a percentage of all exports.

iii) Diffusion of old innovations in the form of telephones and electricity.

iv) Human skills reflected by the mean years of schooling and gross enrolment ratio (GER) of tertiary students enrolled in science, mathematics and engineering. (It is likely that vocational training will be incorporated in future).

Gauged against the standards set by the TAI, Botswana, with no discernible patents nor high-value manufactures, is struggling to be competitive. However if one were just to assess Botswana's efforts and achievements to date, a different picture from that painted by the TAI would perhaps emerge.

Botswana's Technology Scorecard

The Global (TAI) Perspectives The 2001 UNDP HDR has five categories or ranks of countries in terms of their TAI as follows; Leaders (meaning 18 of the OECD countries[1]), potential leaders (amongst them Costa Rica at position 36), followed by dynamic adopters (such as South Africa, position 39 with an index of 0.340, and Zimbabwe at 59), the fourth being marginalised (including Ghana at 67 and Mozambique at 72), and finally others. Botswana is in the final grouping of countries whose TAI could not be evaluated for lack of information. The report further indicates that Botswana had only 1 patent granted by 1998 per 1 million residents pointing to a truly unattractive picture as indicated earlier. Although the latest estimates from SARIMA indicate that at least one patent came out of Botswana annually over the last 6 years, they equally concede that only one patent has been turned into a product which might explain the UNDP statistics of just one patent. If Botswana wishes to achieve more in technology it needs to work on turning more of its patents into products, in addition to maintaining or increasing the rate of production of patents in the first place.

In general, Sub-Saharan Africa (SSA), Botswana included, has not fared very well in world trade over the last 20 years. Figures from UNCTAD indicate that whereas

SSA had 2.5% and 2.1% of world exports and imports respectively in 1980, by 1999 the situation had worsened to 0.9% and 1.0% (UNCTAD 2001). The Botswana government statistics are clearly in support of under-achievement in technology in that primary commodities still constitute more than 80% (by value) of the country's exports.

In 1998 Botswana's overall expenditure in science and technology (S&T) was guesstimated at less than 1% of GDP (S&T Policy 1998) compared to the industrialised countries norm of between 2 and 3%. A recent estimate of Botswana government expenditure on research and development (R&D) (through the various government parastatal organisations) was given as a more definite figure of 0.12% of GDP (SARIMA 2002). This shows it is still far short of the necessary 2-plus percent of OECD countries if R&D must bear economic fruits for the country. There must be at least a twenty-fold increase in investment in R&D for Botswana to just get into the door for innovation in science and technology. The SARIMA document further reports that there are only nine research scientists and engineers per ten thousand people (0.09%) in the workforce. This is further affirmation, if any was needed, of the glaring technical skills shortage in the economy.

Perhaps couching Botswana's technology in indices is a little impervious and hence bound to be somewhat misleading. Table 1 below gives a snapshot of both the positive and negative achievements that Botswana currently has on a global scale.

Table 1: Botswana Technology Scorecard

Positive Achievements	Negative
Water provision is widely diffused	Traditional utilities (electricity and telephones) are not that diffused
Cellular technology has expanded teledensity	Technology neither accessible nor affordable
Growing general literacy (improves technology use)	Information and Communication Technology (ICT) not yet pervasive in all we do
100% digital main telecommunications lines[i]	No implementation of the S&T Policy of 1998[ii]
A Science and Technology (S&T) Policy is in place	No research capacity
Existence of a number of technology organisations	Ineffectual technology organisations
A national university with faculties of science and engineering and technology	Lack of highly trained citizen researchers

[i] Botswana is one of a very few countries with this capacity in the world

[ii] There is in place since May 2002, a National Commission for Science and Technology tasked with guiding the implementation of the S&T Policy and advising Government on S&T matters

Table 1, though only a snapshot, says a lot about Botswana's preparedness to begin to exploit technology for development. The existence of the S&T Policy coupled with the massive investment in a telecommunications network with 100% digital main lines are very positive starting points towards a higher TAI. However for Botswana to fully utilise the already existing technology for the benefit of the poor, it is necessary to implement the S&T Policy in such a way that technology becomes accessible, affordable and appropriate, meaning the user can find tangible benefits in its application, (UNDP HDR 2001).

Whilst this paper advocates a technology-mediated poverty alleviation process for Botswana, it does not regard technology as an end in itself, but rather as a prop that a nation leverages the livelihoods of its peoples upon. Technology is therefore never a panacea to deprivation. Its utility is purely in the mobilisation of human will to do better, exploiting the tools that technology avails. In order to achieve these as well as adapt technology to the needs of Botswana, there is also a need to restructure and refocuss some of the public research establishments. The limited capacities in the many such institutions makes it imperative that they should join forces and invest their financial and intellectual resources in pursuing nationally set research agendas.

Local Perspectives: Botswana's Engagement in Science and Technology Although the Botswana technology situation is not ideal, it is not all doom and gloom. There is on-going rationalisation of government S&T institutions such as the combination of the Botswana Bureau of Standards (BOBS) with the Department of Weights and Measures of the Ministry of Trade, Industry, Wildlife and Tourism. An Industrial Development Policy though not specifically targeting the poor, is in place and can and must in fact be adapted to at least have some identifiable focus on rural industrialisation to address poverty. The centralised photovoltaic (PV) power station commissioned by the Botswana Technology Centre (BOTEC) in Motshegaletau village is a commendable effort of applying available technology to bring services to rural areas. These services are prerequisites to a sustainable program of fighting poverty. The Rural Industries Promotion Company (Botswana), RIPCO (B), through its subsidiary Rural Industries Innovation Centre (RIIC), has trained and equipped many rural area dwellers with artisan skills such as blacksmithing, tanning and baking. All these have been positive skills transfer schemes to the rural communities that have given trainees self-employment skills and some the impetus to set up businesses that now employ more than just the sponsors. The only complaint with these schemes might be over scale – there are too few people benefiting from them. RIIC has equally developed agricultural implements targeted at small-scale farmers, hence lessening labour demands for farming. Some of these are ploughs, single and double row planters, cultivators, mills, threshers and chuff cutters. One could not be faulted in assuming that these implements should be having positive poverty-reducing impact.

The recently launched UNDP Human Development Report for the year 2002 (UNDP HDR 2002) records Botswana's poverty situation as worsening, which therefore is an indication that even with the engagement in S&T just summarised above, their impact has not been deep and far-reaching enough. So what could be the problem? The paper suggests Botswana must exorcise the three demons of policy failure, (technical) ignorance and mindsets if she should have technology as a partner for development.

Policy Level Issues

Water Water is the basis of good health. Easy access to water has the net effect of releasing the productive energies of a majority of the rural people to be applied in areas

other than on fetching it. Water reticulation and access is one area in which the government has moved commendably as far as human consumption is concerned. The biggest omission is where production/commercial requirements are concerned. For the rural farmer (read rural poor), if extension services were both technically equipping as well as water having been availed for irrigation, the majority, which is food-poor, would have graduated out of this deprivation.

Agriculture The continued neglect of agriculture has resulted in the sector that contributed 42.7% to the GDP in 1966 (NDP8) now contributing less than 4% in 2002. As indicated in the study by BIDPA in 1997 the number and proportion of people living in poverty (estimated as 62% for poor and very poor) was substantially higher in rural areas (BIDPA 1997). A more recent statistic quoted in the Agricultural Master Plan for Agriculture and Dairy Development (NAMPAADD 2002) states that 50% of Botswana's population still lives in the rural areas and of these 50% are engaged in (subsistence) agriculture. The marked decline in agricultural contribution to the national cake has therefore very profound implications and effects on the rural poor. The agricultural sector, which is their economic, social and cultural capital, has stagnated and has generally had the undesired effect of sidelining the rural poor in the affairs of the nation. The situation does not look like improving for the most of them, since the newer government focus in the form of NAMPAADD will regard their estates as too small for meaningful commercialisation. This group may neither have the sophistication nor the inclination to form syndicates advocated by the policy document to bring their collective holdings to the minimum 150 hectares. Hence the sector of society with any hope of tapping into NAMPAADD will be people with holdings of 150 hectares and above, not the two to ten hectare plot that most rural farmers possess. Therefore only the former group, who may not necessarily be resource-poor will stand to attract government assistance in the new arable and dairy development emphasis of the program.

The new agricultural policy seems to be a concession by government that previous policies failed to adequately educate farmers on proper and best animal husbandry practices, tillage systems, application of fertilisers and the choice of economic crops. The end-result is that because most rural people have remained food-poor, and therefore less likely to be receptive to change (technological and otherwise), the country has missed creating a socio-economic dynamism in rural Botswana. This dynamic would have resulted in more usage of technology and improved standards of living through more employment, higher returns and meaningful engagements, which are dignity-restoring processes. For had government seen the value of a technology /research driven agricultural sector, farm inputs (e.g. irrigation schemes, farm machinery, better seeds, farm management systems) would have been extended to the communities rather than the deployment of half-interested extension officers and Namola Leuba[4] handouts. The latter scheme which has proven an economic drain and hence not at all sustainable, has had the additional effect of pulling labour away from agriculture (BIDPA 1997), which has completely demotivated farming communities. A related contributory fact to the poor state of agriculture is the lack of technology at village level, meaning even a farmer who thought of changing to a more technological operation had nowhere and no one to assist and motivate them further along that route.

Brigades The brigades movement of the 60s and 70s came about as an answer to two problems as they then existed: lack of training opportunities for young school dropouts (and out of school youth and adults), but the more important reason being the inadequacy of technical/artisan skills in the economy, more so in the rural areas. Brigades thus

sprouted all over rural Botswana as answers to local skills needs, where they trained people in carpentry, building and construction, welding and fabrication, dress making, horticulture, apiary, auto-mechanics and latterly TV production, computer programming as well as TV and computer repairs. The skills imparted to the trainees formed the basis for the growth and development of a vibrant small, medium and micro enterprises (SMME) sector in rural Botswana principally focussing on import substitution. The unfortunate reality of the Botswana situation is that brigades have been allowed to lose focus and instead become academic-inclined units with no differentiation between the different centres, though they are meant to service the needs of dissimilar localities. Had the brigades remained true to their original mandate and intent, regional variation would be evident, emphasising the comparative needs and advantages offered by the differing local cultures and natural resources, as well as the peculiar developmental needs of any given area.

The results of this new development has been that the rural populace has remained information-starved, with no technical skills to sell to those enterprising few who may otherwise have exploited opportunities such as the Local Procurement Program (LPP), EU/ACP, AGOA and other concessionary trade arrangements availed to most developing countries.

Illiteracy and Ignorance The unintended outcome of this new focus for brigades has been technical illiteracy of rural communities. Even government literacy programs such as offered by the Department of Non-formal Education are not functional in nature – the acquired skills are not productivity enhancing. For literacy programs to be meaningful, they must impart skills (geared towards lessening the burden of existence for the communities) to the learners through structured programming with set, measurable goals. These skills must invariably lead to higher productivity from the individual learners. If these programs are not tied to the dominant economic activity for the learners - a good example being the Farmers School in Kenya where literacy is tied to improved farming techniques, so that graduates of the program (mostly women) become increasingly better producers - then the program must be regarded as a failure. Non-traditional students who are not given education with a (practical) purpose, or more commonly referred to as Education with Production (EwP), will invariably fall back into illiteracy at the end of their studies. Combining non-formal education with skills training would have laid the foundations for further quest for learning that is sadly lacking in the current program.

Access to Utilities In the context of agriculture, the telephone diffusion will herald a breakthrough technological innovation for rural communities since it will link farmers with information generators in the form of government, universities and researchers. These resources could equally be exploited by extension officers to both update their knowledge as well as for transmitting appropriate information to the communities they serve. The fact that Botswana still has less than 20% teledensity (land lines)[5] means that the rural poor remain excluded from the information age.

Electricity Similarly the lack of access to electricity for most Batswana, but more critically for those living in the countryside, means they lack devices such as television that could bring knowledge to them in an impactful graphical form. As is universally acknowledged, that which you see (a picture) is many times better understood and retained in the brain longer than what you hear (radio is the major source of information for the rural areas). Because lack of electricity translates into lack of opportunities for influencing decision

making for the communities, they will remain unempowered and not a factor in governance. Since this scenario does not enhance a sense of self-worth in the rural poor, the fight against poverty is rendered that much more difficult.

The fact that Botswana has achieved little in technology, as indicated earlier, requires that both old and new technologies such as the internet be diffused. The lack of diffusion has meant that a large proportion of the population is information-starved and will continue in that state of ignorance, deprived of a vehicle for gaining self-worth, needed to kick-start the process of getting out of poverty. After all, to be able to utilise technology in a beneficial manner, it must first be accessible. Accessibility is enhanced by the availability of information, from which knowledge is built.

Societal Mindsets To address the question of attitudes and orientation of a society to its poor members, let us start with a question. What are the attitudes of Botswana society to the poor? Are they viewed as a problem or as a resource? The story of Muhammad Yunus and the Grameen Bank[6] is a shining testimony to the human will and the ability to fight one's way out of poverty if only given some dignity in the process. Yunus' view is that (Muhammad Yunus, 1997) "poverty is not created by the poor people. Poverty is created by the institutions that we have built around us. I think it's a responsibility of all societies to insure human dignity to every member of that society. And I don't think we have done very well on that part. We talk about human rights, but we don't link human rights with poverty. If you look at it in a different way, poverty is a denial of all human rights." The Botswana government choice of some of its programs, e.g. drought relief, is not only unsustainable; it is premised on the recipients getting handouts since they are incapable of helping themselves. A more sustainable and dignified process would involve programs/projects that can be continued even after government withdraws her temporary assistance. Most drought relief projects do not fall in this category (BIDPA poverty study 1997). The net effect of this approach is to dehumanise recipients making them less likely to get out of the cycle of poverty, generation after generation.

Another manifestation of the wrong attitudes or orientation that fail to connect with the poor (or at least the illiterate who customarily constitute the majority of the poor) is the language of communication. The national television (BTV) is replete with examples of Ministers opening major developmental projects in villages and yet addressing the gatherings in English, a language that the majority are hardly competent in. Ministers and other senior government officials are not the only ones inflicting this malaise, even the State President is known to address Kgotla meetings half in English or starting out in Setswana but then drifting uncontrollably into English during the process. Surely if government cannot communicate in an appropriate and locally relevant language to the illiterate, it will fail to dent/address the abhorrent poverty in the nation.

Making Technology Work for Botswana's Poor

Policy Interventions Working from the premise that poverty is not created by the poor people but by the institutions built around them, one then has to look at the institutional measures necessary to address rural poverty. Since the majority of the poor are in the rural areas, and the major economic activity there is agriculture, the institutional changes must impact on this sector. What is on offer? The government is in the process of launching an agricultural master plan (a product of a consultancy given an Israeli consortium) called National Master Plan for Arable Agriculture and Dairy Development (NAMPAADD). This endeavour, though commendable, will not address rural poverty, since its beneficiaries will be almost exclusively people who are at the moment not that

affected by poverty - these are people who are by rural standards, large land owners (150 hectares plus), and was not meant to address poverty per se but agricultural production. Policy interventions must refocus on smallholder agriculture if they are to be poverty reducing. This can be done in parallel with NAMPAADD by availing targeted assistance to farmers in the form of information, infrastructure (roads, water for irrigation) and a marketing service for the produce - through what the policy refers to as a "socially oriented approach".

To enhance this policy intervention process, an ICT strategy must be put in place and a specific chapter on agriculture with a model that will connect extension services with the Department of Agricultural Research, Ministry of Agriculture, Botswana College of Agriculture (BCA), Botswana Agricultural Union and markets and pricing models for produce for the ultimate benefit of the farmers. A process along these lines will begin to address the pervasive poverty in the rural areas.

Utilities especially electricity and telephones must be deployed with reduced costs of usage. These could include local dial-up services of the internet (information store) and if needs be these can be subsidised to improve access. To reduce costs of setting up by the internet service providers (ISPs), a wireless technology route should be taken and enhanced. The Botswana Telecommunications Corporation (BTC) is already using a radio frequency technology termed "Wireless Fast Connect" to reduce its waiting list for connections and spread even in sparsely populated rural areas. To encourage take-up by potential users, fast deployment and activation must be guaranteed. Botswana's 100% digital main telecommunications lines should provide the necessary backbone to provide fast and reliable information to users and in a language they understand. The latter point means therefore that the Internet pages with .bw domain names must increasingly have local content in local languages. Local content is key. Lisham Adam (Connectivity Project Office at the UN Economic Commission for Africa, as quoted in article by Gumisano Mutume, Africa Development: More than just Internet Connections Required, IPS June 24 1997) warn most developers/commentators about the content and uni-directional flow of information and whether the Internet is "really going to serve the poor rural communities." Another proven method of bringing technology (internet) to the remotest of villages is through collective ownership of ICT resources, including pooled resources like public phones, cellular phones, (free) community information centres acting as digital libraries and internet points (Mike Jensen 2002). More of these need to be piloted in this country if we are not to import the large have and have-nots divide into a digital divide between the urban and rural communities; the minority elite and the majority poor.

Another policy intervention, and one that in its implementation would be very radical indeed, must be a government-led technology transfer mission. The axis of this should be from town and city to the village; and from village to the lands and farms in addition to the traditional North-South one. For this virtuous situation to be realised, the country must take a deliberate policy stand that none of its raw materials (or very little) will be exported unprocessed. A gradual process could be put in place, say over five years to achieve this mission. This would not only have the effect of more people becoming technology-savvy as they do the processing, but additionally more will be employed in the processing industries, thus further denting unemployment which is one of the primary causes of poverty. Since processing involves the use of technology, the country's utilisation of technology will be expanded. This will in turn increase the TAI (exporting manufactures as opposed to commodities) (UNCTAD 2001), which would be confirmation enough that the baseline human development index for Botswana is on the increase.

Relevant Content Local content in the context of the internet is equally true of communicating in fora where we interact with the public. The tendency to speak a language not understood by the audience must be fought and ended if Botswana is to begin to impact positively on her information-starved and food-poor communities. By giving people a sense of self-worth or dignifying their existence (the feeling "I matter"), they will in turn reciprocate by picking themselves out of the worst deprivation – a sure way of beating poverty in the longer term.

Whilst all the above are critical to exploiting technology in the fight against poverty, for this process to be sustainable, Botswana must begin to be a generator of knowledge in the form of patents and high-value technological products. Hence implementation of the consultancy report (New Zealand Consortium 2000) on the S&T Policy of 1998 must be speeded up. The reorganisation of government S&T institutions must be finalised as a matter of urgency and their productivity and effectiveness measured against the world trends. All this calls for increased S&T personnel, thus making it imperative that more school leavers must be incentivised to follow a science and technology career. It will no longer be enough to have 6% or so of tertiary students following S&T. The numbers must double and even triple for there to be meaningful and sustained results.

Investment in Research and Development Personnel Above all else, the country must embark on a massive and highly focused program of training research scientists, engineers and technologists necessary for the country to begin to generate intellectual capital in the form of patents, as well as improving the skills base for the commercialisation of these patents and innovation into high-value products.

Conclusions

Unless Botswana invests more in research and development (R&D), human capital and technology development, it cannot (and should not) expect to reap the associated economic and social benefits. But to begin to address rural poverty, Botswana must set in place processes that will ensure that the rural communities have access to technological innovations, which must be affordable and flighted to them by in-tune extension officers in a non-paternalistic manner. If the declared vision of a prosperous and productive nation is to become true - the poor majority must graduate out of that status. This requires policy interventions that are poor-friendly and which give dignity and a sense of self-worth to the recipients. Botswana certainly as a country has huge potential to graduate from being populated by a largely poor rural population, if she could aggressively exploit the excellent telecommunication infrastructure to bring knowledge to the remotest of settlements. The country must build on this to improve on her very small score on technology achievement.

Notes

An earlier version of this paper was presented at the seminar on "Making technologies work for poor people" organised by the UNDP and the Department of Economics, University of Botswana, October 17th 2001, on the occasion of the observance of the International Day for the Eradication of Poverty (IDEP).

[1] OECD, which stands for Organisation for Economic Cooperation aand Development, groups the rich Northern Hemisphere countries plus Australia and New Zealand.

[2] Botswana is one of a very few countries with this capacity in the world.

[3] There is in place since May 2002, a National Commission for Science and Technology tasked with guiding the implementation of the S&T Policy and advising Government on S&T matters

[4] Namola Leuba refers to the Drought Relief projects, which are mostly labour-intensive, which have from anecdotal evidence, discouraged some people from pursuing agriculture and instead opt for these relatively less back-breaking tasks, that are mostly executed at very relaxed pace.

[5] Cellular technology is diffusing rapidly and has already overtaken the number of land lines in the country and seems like (if prices were to decrease significantly) it could play a critical role in connecting rural communities with information sources.

[6] There was skepticism on the poor paying back loans that Yunus extended to them, through his micro-credit scheme that he started to help the poor have access to banking, but not a charitable endeavour.

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