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Impacts of information technology (IT) outsourcing on organizational performance: A firm-level empirical analysis

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TOWARDS A RESEARCH FRAMEWORK FOR A HUMAN DEVELOPMENT-BASED "BOTTOM OF THE PYRAMID" ICT DEVELOPMENT STRATEGY IN SOUTH AFRICA

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Abstract

There is a wealth of knowledge linking Information and Communications Technologies (ICTs) to human development, but Africa's leaders have not used it well to develop its human capital. The continent has the lowest global levels of ICT diffusion and human development. This paper proposes a way of developing Africa's vital access to knowledge through ICT, by reviewing and using the human development record of South Africa to develop a research framework for a human development – based ICT development strategy. The framework comprises a research-based bottom-up participative action program that responds directly to the specific information needs of the country's socio-economically marginalized communities, the so-called "Bottom of the Pyramid" (BOP), by ensuring their maximum participation in the research and development process. The proposed framework draws liberally from the vast accumulated knowledge about human development and its principal tool, the ICTs, especially from Asia where similar development activities are delivering impressive results. The multi-cultural and multi-lingual characteristic of South African society, including its recent socio-political history, presents numerous challenges for balanced human development, but also unique opportunities to build an effective model for improving the usefulness of ICTs for human development in the country and by extension, in Africa as a whole.

Keywords: Human Development; ICT for Development, South Africa, Bottom of the Pyramid

1 INTRODUCTION

Soweto, South Africa, 2008: "Bra" (brother) Peter Wembe is a 64 year-old Soweto based jazz musician known as "Piwe" by his friends. He obtained a Bachelor of Music degree from a leading South African university in 1985. He lives with his wife, two unemployed daughters and a musically talented 15 year-old grandson Nelson. Nelson's father, said to have been a budding musical genius himself, died of HIV/AIDS soon after Nelson's birth. Piwe's main source of income is an informal "Spaza" shop, a modified shipping container out of which the family sells basic groceries, cigarettes, soft-drinks and pre-paid telephone cards to the local community. The total family income from this informal business ranges from R2000 to R3000 per month (approximately US$2 per person per day). This income is supplemented by a few local jazz concerts each year, a few "Corporate Gigs" during end of year festivities, occasional international musical tours arranged by international jazz music celebrities who appreciate Piwe's style and talent, and a small income from royalties on past recordings. Nelson attends an "informal" school near his home, but has largely lost hope of academic achievement. He rehearses diligently in the hope of emigrating to Europe or the USA as a professional jazz artist. Nelson has appeared on several local television talk-shows and documentaries promoting local young talent, but his contribution to the family's income is minimal. The Wembe family have basic ICT literacy, an old personal computer with dial-up connection to the Internet, and they dream of establishing a small music studio from which they can produce and market their own commercial recordings. They also worry constantly about security, and their foreign-sounding surname which may provoke xenophobic violence against them, as has happened to many similar families in other informal residential enclaves throughout the country in May 2008 (HSRC 2008, UN 2008). Piwe is a third generation South African, his grandfather was an early migrant mine-worker from the then Belgian Congo.

The semi-fictitious story of the Wembe family is based loosely on a living family residing in Soweto at the time of writing this paper. Their names, ages and other identification features have been changed, but their lifestyle, their daily challenges and their hopes and fears are representative of the majority of South Africans residing at the bottom of South Africa's social pyramid (BOP) (IFC, 2007), also called the "Second Economy", a description coined by South Africa's former State President Thabo Mbeki (du Toit and Neves, 2007). Their story puts a human face to this development discourse, and provides a useful foundation for addressing their needs to access information and knowledge via the global ICT infrastructure that will enable them to help themselves out of the vicious poverty cycle that afflicts so many South Africans.

The Human Development concept was introduced by the United Nations Development Programme (UNDP) in 1990 to replace GDP per Capita as the main measure of national development. UNDP publishes annual Human Development Reports (HDR), with each year focussing on a different theme of concern to humanity as a whole. The theme for HDR 2004 was "Cultural liberty in today's diverse world", a theme that harmonizes well with South Africa's currently fragmented multi-cultural society. This paper draws extensively from the most recent HDR 2007/2008 (HDR 2007) which focuses on climate change and the search for human solidarity to combat the global threat, but also provides an extensive database of human development indicators. A full history and description of the concept is beyond the scope of this paper, however an excellent description of the evolution of the concept has been prepared by Stanton (2007). A broad definition of human development favoured by the OECD is "the process of enlarging people's choices. Their three essential choices are to lead a long and healthy life, to acquire knowledge and to have access to the resources needed for a decent standard of living" (OECD, 2003). The human development index (HDI) is a composite index used to gauge development across these three choices (HDR, 2007).

The authors of this paper share the opinion that the most important human development choice is the choice to acquire knowledge. Without this choice, all the other human development choices will be undermined by the lack of historical and current knowledge of how they can best be achieved.

Information and Communications Technologies (ICT) are the most efficient knowledge dissemination tools today. They enable unrestricted information flows that support the creation and use of global knowledge for the full range of human development, bridging cultural, gender, geographic and even knowledge divides. ICTs have been closely linked to all the Millennium Development Goals (MDG), (Gilhooly, 2005), and their importance to global development has been stressed by Payaril (2005) who observes that "the divide between the income rich and the income poor, the technology haves and the technology have-nots, the information rich and the information poor, has become the most serious political economic problem facing the world today". This paper draws on the accumulated knowledge of both human development and ICTs, with specific reference to the South African experience, typified by the semi-fictitious Wembe family. In the next section, the human development challenges in South Africa are discussed. This is followed by discussions of ICT development in South Africa. Finally a brief outline of the proposed framework for ICT development at the BOP is provided in Section 4. The conclusion provides a speculative discussion of how the Wembe family and BOP compatriots could benefit from the proposed research.

2 HUMAN DEVELOPMENT IN SOUTH AFRICA

South Africa has the largest economy on the African continent with purchasing power parity gross domestic product (GDP PPP) of nearly US$470 billion in 2007, closely followed by Egypt with US$404 billion, and nearly twice that of Nigeria, the most populous and third largest economy on the continent. Despite this, South Africa faces one of the severest human development challenges on the continent. The human development statistics that follow quantify South Africa's human development challenges, drawing statistical data from the UNDP Human Development Report (HDR 2007), the IMF World Economic Outlook for 2008 (IMF, 2008), Statistics South Africa (Stats SA, 2007), the South African Development Indicators (2008), and ICT-specific data from the International Telecommunication Union's (ITU) World Telecommunications ICT Indicators 2007 (ITU, 2007).

2.1 HDI Indicators

South Africa (HDI rank 121 in 2005) was one of 17 countries that suffered a reversal in human development between 1980 and 2005. After steady growth from 1980 to a peak of 0.745 circa 1995, a major decline ensued which resulted in the HDI reversing to 0.674 by 2005, the third steepest global decline after Zimbabwe and Swaziland. The country's HDI global rank fell 36 places from 1990 to 121st in 2005 (HDR, 2007). Figure 1 compares South Africa's HDI to the averages of each major development region.
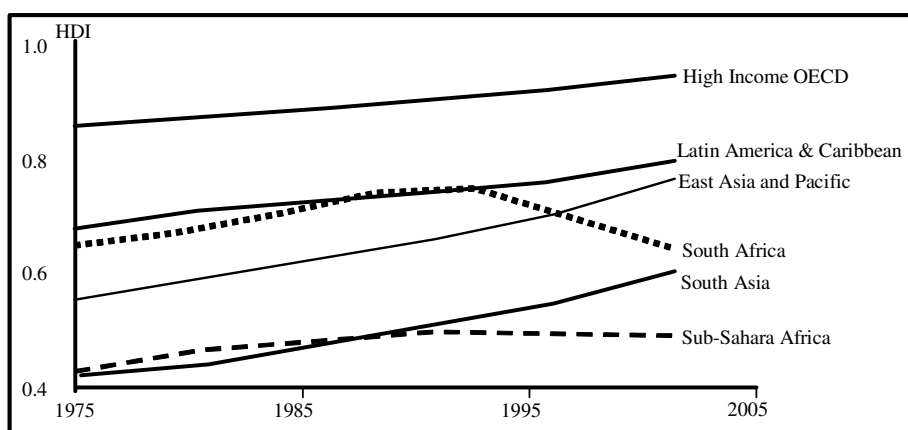

Figure 1   HDI Trends: South Africa compared to major world regions
Source: UNDP HDR (2007/2008)

2.2   The Choice of a Long and Healthy Life

The choice to lead a long and healthy life is one of three main indicators making up the HDI (HDR, 2007). A key indicator is life expectancy at birth amongst citizens of a country, with subordinate indicators that include the impacts of specific disease pandemics. The key contributor to South Africa's steep HDI decline shown in Figure 1 was the nation's failure to control the spread of HIV/AIDS. In 2006, South Africa had the 6th highest prevalence with an infection rate of 18.8%, outranked only by the country's neighbours Swaziland (33%), Botswana (24%), Lesotho (23%), Zimbabwe (20%), and Namibia (20%). As a consequence of the HIV/AIDS pandemic, South Africa's life expectancy at birth declined to 53.4 years by 2005, a rank of 145 out of 173 countries, and the national probability at birth of surviving to age 65 years fell to 33.9% for South African males, placing South Africa 160th out of 173 countries in this longevity indicator (UNDP, 2007). For greater clarity on these vital HDIs, Figure 2 compares South Africa with Thailand, Colombia, Turkey and South Korea, selected for their demographic and economic similarities, and for their geographic representation.
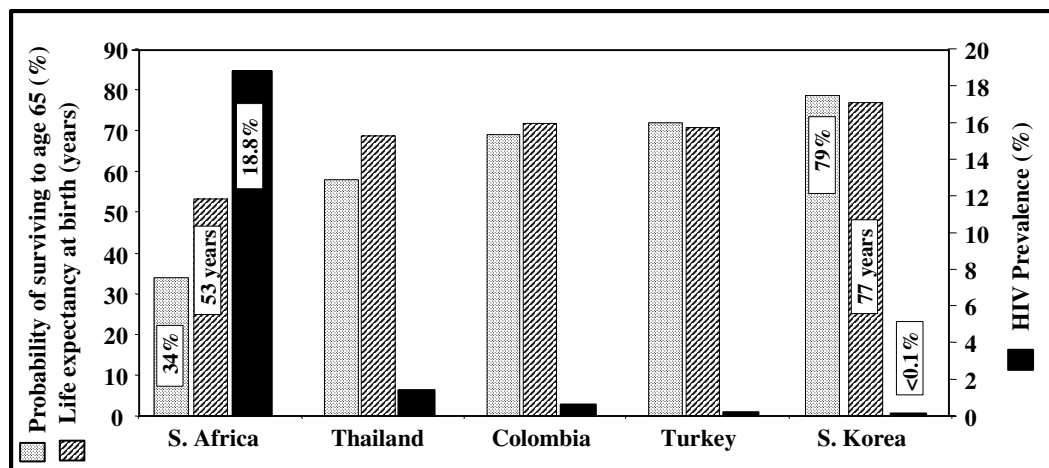

Figure 2   Life expectancy at birth; Probability of surviving beyond age 65 (males)
HIV Prevalence. Data source: UNDP HDR (2007/2008)

2.3   The Choice of Knowledge Acquisition

The choice of knowledge acquisition is another key indicator that makes up the HDI. It is assessed with regards to literacy rates and school enrolment ratios (HDR, 2007). South Africa's national educational achievements have been disappointing. The PIRLS (2006) and TIMSS (2003) international education assessments comprising 40 and 46 countries respectively, ranked South Africa last amongst the participating countries with average achievement scores 61%, 57% and 51% below the global averages for reading literacy (PIRLS 2006), and mathematics and science (TIMMS 2003) respectively. Compounding these disappointing results is their racial characteristic. Data derived from South Africa's 2001 census shows that 16.5% of Black South Africans (pre-colonial indigenous South Africans) had no formal education, compared to 3.1% White South Africans (of European only ancestry), 6% Indian South Africans (ancestry traceable to the Indian sub-continent) and 8.7% Coloured South Africans (descendants of mixed race unions irrespective of ancestral origin) (Stats SA, 2007). At the higher end of education, 12.8% of White South Africans had a diploma or first degree as their highest educational achievement, compared to 1.8% of Black South Africans, 5.9% Indian South Africans, and 1.7% Coloured South Africans. Figure 3 illustrates the educational divides between South Africa's official race groups. The post-apartheid South African government has retained the

apartheid legacy of race-based classification as a means of monitoring progress in reversing apartheid era racial segregation and discrimination.
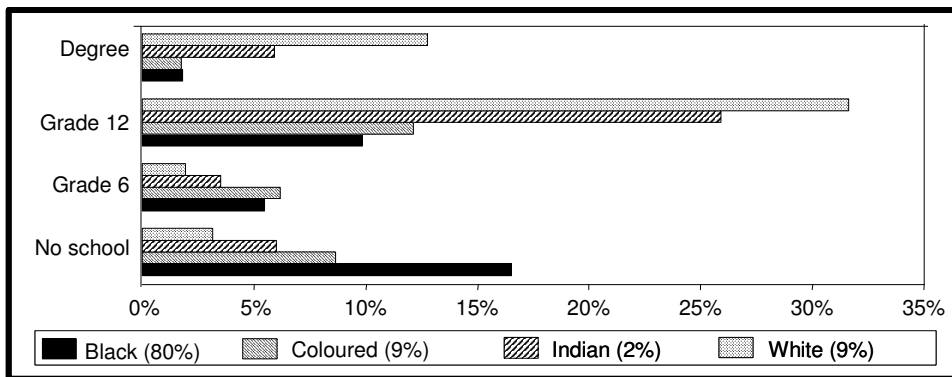

Figure 3.   Highest levels of educational achievement within South Africa's race groups. Data source: Stats SA (2007) population census 2001.

2.4   Access to Resources

The choice of having access to the resources needed for a decent standard of living is the third indicator that makes up the HDI (HDR, 2007). National poverty and wealth, the distribution of both, and inequality extremes are the popular measures of this choice. South Africa has the highest GDP in Africa, but also one of the highest levels of economic inequalities in the continent and the world. A popular measure of economic inequality is the Gini coefficient. A nation or community that shares its wealth equally amongst its members has a Gini of 0, while one in which all wealth is consumed by one person has a Gini of 100. UNDP HDR 2007/2008 reports a Gini of 57.8 derived from year 2000 surveys, while the South African government reports a Gini of 69 for year 2005. The rising level of economic inequality is recognised by the South African government and its development partners as one of the most challenging aspects of human development. Due to historical reasons, the country's inequalities have a strong racial characteristic. Statistics derived from South Africa's Development Indicators 2008 (PCAS, 2008) show that Black South Africans who constitute 80% of the population live off an average gross national income (PPP) of approximately US$2500, equivalent to that of Bangladesh and Haiti, while their White compatriots enjoy an equivalent income ten times higher, equivalent to high income economies like New Zealand (HDI rank 19) and South Korea (HDI rank 26).

South Africa's unemployment levels are similarly skewed along racial lines, with 30.5% unemployment amongst Black South Africans, compared to 4.5% for their White compatriots (Stats SA, 2007). Inequalities of this magnitude are a source of conflict and social instability. Stewart (2000) concludes that in every major conflict, group perceptions and identities are enhanced by sharp differentiation in political participation, economic assets and income, and social access and well-being. These inequalities present a strong environment for conflict. Cramer's (2005) analyses of conflict and inequality quotes Plato (circa 400 BC): "We maintain that if a state is to avoid the greatest plague of all - I mean civil war, though civil disintegration would be a better term - extreme poverty and wealth must not be allowed to arise in any section of the citizen-body, because both lead to both these disasters" to argue that the debate is as old as mankind's strive for peaceful societies. By relating Cramer's (2005) and Stewart's (2000) analyses to South Africa's inequalities and various media reports of historical and current conflicts throughout the world, troubling parallels emerge.

As, Cramer (2005) and Stewart (2000) argue, South Africa's deep inequalities may not provoke internal instability, but conditions exist for this to happen. The outbreak of xenophobic violence in

May 2008 (HSRC, 2008) represents a disturbing harbinger of this possibility. In a related development, an important outcome of the World Summit on the Information Society (WSIS) was the establishment of a global research unit and think-tank of how ICTs can be used prevent conflict, and to help societies to recover from it after an outbreak (Mansell and Nodenstreng, 2007). The Switzerland based ICT4Peace Foundation is the UN specialized organ coordinating the global search for ICT applications that prevent and reduce the threats of conflict (Stauffacher et al., 2005).

3 TECHNOLOGY DIFFUSION - ICT

In this section, South Africa's ICT development is compared to those of Colombia, South Korea, Thailand and Turkey, four countries with demographic and economic similarities with South Africa over the last 20 years. Table 1 illustrates these similarities, and shows that South Africa led the group in both economic and ICT indicators in 1980 and 1970 respectively, but lagged in both by 2005. South Korea's impressive growth record has been attributed to aggressive mass education and rollout of ICTs, typified by the country's early 1980's policy to provide a telephone line to every family in the country (Reynolds et al. 2005). This policy has served South Korea well. The fixed line telephony infrastructure was the key to the country's recent dominance in broadband access and Internet usage, the provision of cost-effective xDSL services on existing copper cable telephony infrastructure. South Africa has been slow to leverage the installed telephone cable capacity for broadband and other ICT services derived from it, even after studying and supporting the concept of Local Loop Unbundling (LLU) that is critical to its success. (DoC 2007).

Country	Population (Millions)	% Urban Population	GDP/Capita (US$ Current Prices)			Telephone Density (%)	
			1980	2005	CAGR (%)	1970	2005
S. Korea	48	81	1679	16444	10%	1.5	49.5
Colombia	45	73	1368	2669	3%	2.8	16.8
Thailand	63	32	696	2710	6%	0.3	11.0
Turkey	73	67	2235	7110	5%	1.0	25.9
S. Africa	48	59	2764	5166	3%	4.1	10.0

Table 1:   Key data similarities between the benchmark countries. GDP/Capita expressed in current US$ prices; ICT data from ITU World Telecommunications ICT Indicators 2007 (ITU, 2007); demographic data from HDR (2007/2008)

Country	Internet Users (%)		Mobile phones (%)		Fixed phones (%)		PCs (%)	
	1995	2005	1995	2005	1995	2005	1995	2005
Colombia	0.2	10	0.7	48	10	17	2	4
S. Korea	0.8	68	3.7	79	42	49	11	53
S. Africa	0.7	8	1.3	72	10	10	3	8
Thailand	0.1	11	2.2	48	6	11	1	7
Turkey	0.1	15	0.7	60	21	26	1	6

Table 2:   Basic ICT Statistics in the four benchmark countries. Data derived from ITU ICT database 2007 (ITU, 2007).

Table 2 provides basic ICT data for the four benchmark countries in years 1995 and 2005. Except for mobile telephony, South Africa's ICT growth was lowest in the group. One disturbing feature of the data in Table 2 is that South Africa's penetration of Internet users, fixed line telephones, and personal

computers aligns with the country's racial demographics. It is mainly White South Africans and a small but growing number of Black "First Economy" South Africans who enjoy the services of these knowledge-rich ICTs. The "Second Economy" population depends almost entirely on costly mobile telephone services for their information needs. Recent research by Skuse and Cousins (2007) concluded that the success of mobile telephony in South Africa had introduced an unexpected negative outcome: chronically poor mainly rural communities developed dependencies on the mobile telephone services, while their high usage fees effectively deepen chronic poverty.

High ICT user prices have been recognised by all South Africans and their international development partners as significant barriers to national development, as noted by South Africa's Minister of Communications, Dr. Ivy Matsepe-Casaburri in her budget vote speech (Budget Speech, 2008). Figure 3 quantifies the depth of this barrier to development, and verifies the concern expressed by Parayil (2005).
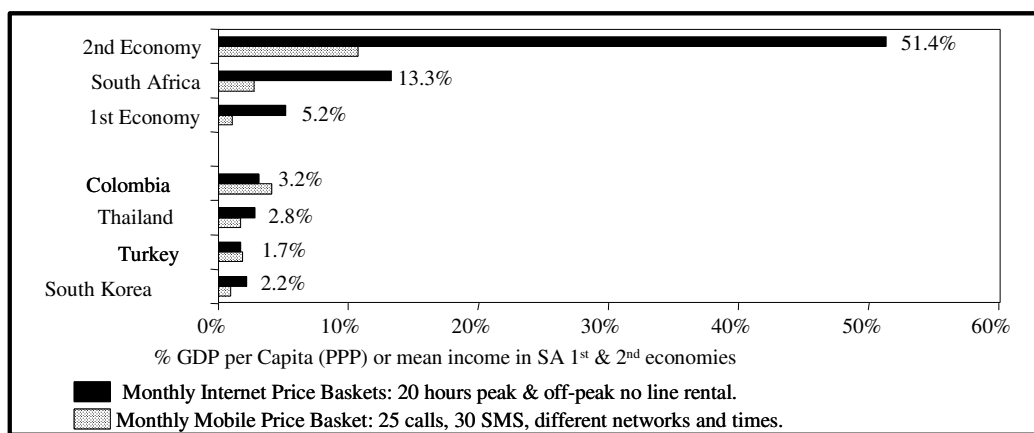

Figure 3:   *Mobile Telephony (2006) and Internet Access Price Baskets (2005). Derived from Nation Master: http://www.nationmaster.com, accessed 12 December 2008.*

3.1   South African ICT Policy and Regulatory Environment

Historically inherited race-based inequalities clearly dominate nearly all South African discourse on human development and its complex multiple facets. The national ICT policy and regulatory processes have not been immune. Costly and often damaging compromises between the need to ensure Black South African ownership and management of the critical ICT industry within the framework of national Black Economic Empowerment (BEE) policies, and the need to develop the nation as a whole have had to be made. A recent study by the Centre for International Development at Harvard (CID), a partnership that includes the National Treasury of the Republic of South Africa, poses the research question: Is Black Economic Empowerment a South African Growth Catalyst? (Or Could it Be…) (Andrews 2008). Andrews' conclusions note numerous disappointing outcomes of the BEE policy, but remain positive that it could be a growth catalyst. One key conclusion proposed is that government should focus its BEE policy on the middle and bottom of the economy, the primary focus and helm of this paper.

A classic example of the conflict between implementation of the BEE policy and national poverty alleviation through ICT development is the recent case of broadband wireless spectrum allocation. On 17th June 2008, South Africa's state regulator ICASA published a strict BEE policy for awarding the valuable 2-3 Ghz spectrum (ICASA, 2008). This required applicants to prove 51% Black South African ownership with an emphasis on women, unspecified Black South African participation in management and control, and skills development in line with national BEE policies (ICASA, 2008).

Just 3 days later on 20th June 2008, the USA Federal Communications Commission (FCC, 2008) published its approach to allocating this same spectrum. The FCC planned to license a single nation-wide operator that would be obliged by regulation to reserve 25% of its network capacity for free pro-poor broadband access, 50% coverage of needy Americans in the first 4 years, rising to 95% by the time the license expires after 10 years (FCC 2008). The contrasts are stark. South Africa, a developing country chose to use invaluable broadband wireless spectrum as a political tool to reverse historical injustices, while the United States of America, arguably the biggest economy on earth, chose to use the same technology to bridge its socio-economic divide. A useful research question could be: of the two approaches, which one was more likely to reduce South Africa's severe socio-economic inequalities and promote Black South African participation in the economy?

The complex uniquely South African dilemma of balancing historical injustices with future growth is beyond the scope of this discussion; however, valuable insights can be obtained from numerous studies and analyses. For example, Hodge (2008).provides a detailed fifteen-year review of South Africa's telecommunications policy, observing the numerous failures to solve the pro-poor access and price conundrums. Horwitz and Currie (2007) provide a critical appraisal of the country's ICT policy dynamics, highlighting in some detail the conflicts between liberalization, privatisation and BEE ownership, and the costly errors that resulted from these conflicts. Fleming (2002) explores the role of ICT in developing the democratic processes in South Africa, and Brown and Brown (2008) propose a radical shift in South Africa's definitions and perceptions of ICTs so as to enable policy-makers to focus more on their human development utility.

4 A RESEARCH FRAMEWORK FOR BOTTOM OF THE PYRAMID ICT DEVELOPMENT IN SOUTH AFRICA

The brief quantitative review of human development in South Africa presented in preceding sections of this paper justifies an urgency to take corrective action. Action research has been recognised as a means of ensuring relevance and applicability of ICT research to practice (Baskerville and Myers, 2004). A research framework for carrying out an action-based study is outlined in this section. The components of the framework are neither original nor unique. They draw liberally from the vast quantity of knowledge about ICT and development that has been accumulated throughout the nearly 250-year evolutionary history of electronic ICTs. They also benefit from the experiences of fully developed countries, newly industrialised countries, developing countries, and failing or failed states. An extensive database of knowledge about ICTs for development, and the successes and failures of different nations has been complied to support the research framework. The major departures from traditional approaches to ICT research and development are:

- The primary focus is on the complex components of human development: the information and knowledge needs of South Africa's socio-economically marginalised communities, and of the people tasked with supporting their development efforts. Prior research has shown the weaknesses of approaches that are techno-centric, where the focus is on technology rather than people (Roode et al., 2004).

- The complexity of human development demands that multidisciplinary and multi-institutional approaches be adopted. Each human development challenge, be it economic depravation, knowledge acquisition, health related challenges, or inequitable distribution and high prices of ICTs are intricately intertwined. Fragmented approaches to reducing these challenges have generally been total or partial failures in most African countries. The low comparative levels of human development on the continent are clear proof of these failures. An alternative integrated approach is proposed in the framework, one in which research and development in all human development challenges are conducted simultaneously, and the ICT support solutions built from the results of this research, rather than taking a technological determinist view of ICT (Licker, 2001);

- A balanced "Evolutionary" and "Clean Slate" approach to technological innovation for BOP-ICTs will be used. The challenges facing human development at the BOP have an uncanny resemblance to the challenges facing the evolution of the Internet (Schwarz da Silva 2007, Sung-Su Kim et al, 2008) - evolutionary tweaking versus radical redesign to overcome significant current problems. In this research framework, a balance between using traditional ICT networks, evolving networks in the form of Next Generation Networks (NGN) that tend to cater exclusively for the needs of the economically endowed, and totally new innovations for pro-poor ICT applications will be developed. The research emphasis will be on the information and knowledge needs, not on the technological means of delivering them, as advocated in techno-centric approaches (Roode at al., 2004);

- A "bottom-up" approach will be used. The research focus will be on people residing at the BOP, the full range of sociological factors that influence their human development, their capacities to adopt, afford and use advanced ICTs, will be the innovation drivers. A strategy to integrate the "bottom-up" solutions with current and planned "top-down" development solutions will be a key factor of the framework. Purely top-down approaches to ICT strategy development are known to have limited success (Segars and Grover, 1999).

In developing the research framework, the complexities of creating and managing a multidisciplinary multi-institutional research and development team have not been underestimated. They have been accommodated in the research schedule with allowances for continuous review and adjustment. Thus far, the research process has been initiated, the initial proposal has been drafted and initial communications and canvassing support from potential researchers and funding agencies has begun. Intricate details of the emerging framework are beyond the scope of this paper, however, an outline is provided in Annexure 1. It is anticipated that a Steering Committee will have been formed by mid June 2009, and will be tasked with setting up the required management and research teams, their operational structures, and initiating the four phases of research activities over the planned duration of three years. A key outcome of the research will be to chart the path for continuous ICT for BOP development in South Africa, accounting for changing socio-economic environments and technologies (Avgerou, 2008).

5 CONCLUSION

This paper provides a short background on the key factors that should guide a human development-oriented ICT development strategy in South Africa. The challenges are immense, but they can be eased significantly by focusing attention on South Africa's BOP market, or the "Second Economy" as it is popularly known locally. A concerted single-minded search for ICT solutions for this population group that are both effective and affordable is not beyond the national capability, especially with the support of modern ICTs. A detailed description and discussion of the proposed research framework aimed at addressing these challenges is beyond the scope of this paper, but expected and speculative outcomes can be discussed in relation to the fictitious Wembe family used to introduce the paper:

Soweto, South Africa, mid-2012: "Bra" Peter Wembe is now 69 years old. He travels less now, but enjoys the growing success of his grandson Nelson, whose growing international reputation as an avant-garde jazz saxophonist with a distinct African flavour reminds many global jazz fans of jazz legends like Charlie Parker and John Coltrane. The family has a more comfortable income: they extended their "Spaza" shop to include a jazz café with live music at the weekends, which is becoming a popular tourist destination. The café is managed by Peter's daughters, and doubles as an Internet café during the day. They use a low-cost broadband service to source goods and services for their business. This service helped launch Nelson's international career: he promotes his and Granddad's original music compositions and performances through online streaming to the global jazz market-place, and receives a growing number of lucrative live concert contracts as a result. They still dream of a recording studio, but this is getting more remote as real-time online opportunities emerge. Their

primary broadband access is derived from the excess capacity of the neighbouring supermarket's fibre optical connections and servers. The supermarket was allowed by new regulatory provisions to follow the UK's "Tesco Telecoms" model of reselling excess capacity to the local community (Tesco Telecoms, 2003). Peter's Internet café servers provide fixed VoIP services to the homes of twenty neighbours who pay a fixed monthly fee of R50 for unlimited national voice services. An extended family relative maintains these and other similar services in the community. Peter thinks he could derive more revenues by reselling broadband, but that is in the pipeline waiting for his granddaughter to graduate with an IT diploma from the local polytechnic. Life for the Wembes has improved since the arrival of fast internet.

6 ANNEXURE 1: THE RESEARCH FRAMEWORK OUTLINE

Project Title	Promoting the use of Information and Communications Technologies (ICTs) for Human Development from South Africa's Bottom of the Pyramid (BOP).		
Lead implementing institution	**Monash University's South African Campus**		
Narrative Summary	**Objectively Verifiable Indicators**	**Means of Verification**	**Assumptions and Risks**
Goal: To develop ICTs that support Human Development at South Africa's BOP.	Increasing use of ICT for HD by BOP citizens.	ICT growth indicators, e.g. ICT Development Index (IDI)	Access to local and international databases and statistics.
Purpose: To add new knowledge of ICT for HD and introduce BOP-friendly ICT networks and supporting policies and regulations.	Published scientific papers; increased use of ICT for HD.	Number of published papers; statistical reports	Speed of ICT adoption at the BOP relative to R&D schedule, levels of investments in Bop-ICTs
Outputs: 1. Reports and publications.	Published papers	Number of published papers and the final report	Time to publication relative to R&D completion
2. BOP ICT infrastructure and services	Functional BOP ICT networks, services, applications & content	Final Project Report, sectorial reports and IDI indicators	Policy, regulatory & commercial interest barriers
3. Pilot and small scale ICT projects	Functional BOP ICT projects	Project and sector reports by users & developers	Policy and regulatory entry barriers, financing
4. Equipment and network innovations for capex & price reductions.	ICT services affordable by BOP citizens	Project reports and market growth.	Effective R&D partnerships, entry barriers
5. Business models developed for BOP SMMEs, in ICT	New entries by SMMEs to ICT business sector	Company registrations, reports.	Business entry, regulatory barriers, costs
6. Macro and micro economic and business models	Reports, publications, SMME ICT businesses	Final project reports and development proposals.	Policy & regulatory barriers
7. ICT policy & regulatory development	Reports published and submitted to relevant authorities.	Final project reports.	Political willingness to promote BOP market development.
8. International R&D partnerships established.	Number of international R&D partnerships	Project reports.	Budgetary resources, international collaboration.
Activities:			
1. Phase 1: Finalise R&D proposal & first planning workshops	Working draft research project proposal, Steering Committee functional	Correspondence& reports	Budgetary provision for phase 1 activities
2. Phase 2: Establish R&D teams, management structures; detailed project planning, equipment procurement. Set up communications systems	Final research plans; equipment delivery; communications networks and website tested.	Accepted research proposal, equipment audits, communication systems tested.	Project funding.
3. Phase 3: Implementation	Research teams dispatched and research in progress	Project reports	Project funding
4. Phase 4. Project completion and follow-up strategy development	Evaluation workshops and reports.	Final Project Reports.	Project funding.

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