

Teledensity Technological Growth Strategy for Africa's LDCs:  
'Viagra' Development Strategy or Sustainable Development Strategy?—The African  
Telecommunications Stakeholders Speak

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**Abstract**

*Over-dependence of African countries on the West has been reflected in various socio-economic dimensions. Such dependence has also been reflected in the telecommunications industry of Africa's LDCs in a bid to solve its low teledensity (number of main telephone lines per one hundred inhabitants) problems. African LDCs are greatly behind other regions of the world in utilizing information and telecommunications technologies, which in turn, has repercussions such as the great digital divide that leaves African LDCs far behind other regions of the world. Various technological-oriented obstacles account for the low levels of teledensity in these countries. This therefore calls for a debate on what strategies can be adopted to solve this problem: use the 'viagra' approach by totally depending on the West to come in for a short term, vigorously solve the problem, and leave thereafter an infrastructure with nobody to manage it, or use a self-sufficiency approach and an African Foreign Alliance approach to solve the technological-oriented obstacles. Therefore use of the term 'viagra' in this context is to imply a quick and easy solution. Using Friedman's Test, factor analysis, and multivariate analysis of variance (MANOVA) statistical procedures, this study examines the perceptions of Africa's telecommunications stakeholders on strategies to solve the technology-oriented obstacles. The findings suggest that Africa's LDCs should adopt a self-sufficiency approach and create alliances with foreign countries in order to realize sustainable development of their telecommunications infrastructure and hence promote growth of teledensity.*

HICSS 01 paper code number: CLCDV05

Keywords: Teledensity, Telecommunications Stakeholders, Least Developed Countries, Africa  
BRT Keywords: BA, BD

## Introduction

One of the major prerequisites of economic integration in a both modern and complex society is the development of sound infrastructure in the telecommunications sector. The establishment of a modern, reliable, and rapidly expanding telecommunications infrastructure contributes considerably to the promotion of a variety of activities of economic expansion (World Bank Telecommunications Sector Reports, 1991). Some researchers have associated the level of a country's telecommunications infrastructure to teledensity. (Saunders et al, 1994; Gille, 1986). Teledensity refers to the number of main telephone lines for every one hundred inhabitants.

There is a great disparity between the level of teledensity of Lesser Developed Countries (LDCs) and that of developed countries. For example, the average teledensity for LDCs is about 0.29, whereas it is 11.57 for the world, 31.95 for Europe, 68.31 for Sweden, and 60.17 for the United States. The total number of telephone main lines in the 48 LDCs is about 1.5 million, which is about 1% of the total number of lines in the United States (Rorissa, 1999). Lesser Developed Countries (LDCs) are defined as low-income countries suffering from long-term constraints against growth. In particular, these growth constraints include low levels of human resource development and severe structural, economical, social, and political weaknesses (Austin, 1990). Currently, there are 48 LDCs as defined by the United Nations. Of the 48 LDCs, 30 are in Africa, which constitutes more than 60 % of the world's LDCs.

## Background / Statement of the Problem

Modern telecommunications technologies and facilities, which initially catered to the information communication, and entertainment needs of expatriate colonial officials, were introduced to African countries during the colonial era (Hachten, 1971; Boafo, 1991). The political leaders and administrators who emerged in post-independence Africa were mainly what Boafo (1990) calls "nationalist-politician-journalists" who led their people in the fight for independence. Once the nationalist leaders assumed the reins of government, they tended to move into their new roles as policy-makers and political leaders—with little or no clear vision to improve the telecommunications infrastructures of their countries. As a result, their countries now suffer from low levels of teledensity and a poor state of telecommunications infrastructure when compared to other parts of the world.

Obstacles to the growth of teledensity in LDCs include the use of outdated and inadequately maintained equipment. Inadequate maintenance is primarily due to the lack of sufficient and qualified maintenance engineers (ITU, 1998). This results in poor quality of service, loss of revenues, and extremely long waiting periods for customer repairs.

This paper focuses on the technological obstacles to growth of teledensity in Africa's LDCs. The next section discusses the differences in perceptions to solve the technology-related obstacles to growth of teledensity in Africa's LDCs.

## African Telecommunications Stakeholders and their Differing Perceptions

African Telecommunications Stakeholders (ATS) have shown the desire to improve the level of teledensity for their countries. They are responsible for managing the telecommunications infrastructures of LDCs. The United Nations (UN) characterized ATS as governmental and non-governmental stakeholders. the governmental stakeholders include government and parastatals, and

telecommunication operators (government controlled). The non-governmental stakeholders include telecommunication operators (non-government controlled), academia, research centers and IT experts, and international/regional organizations.

These African telecommunications stakeholders have suggested different strategies to solve the low teledensity problem of their countries. In order to understand the differences in the stakeholders' perceptions mentioned earlier, one can look at the issue of ownership telecommunications infrastructure and the regulation of the telecommunications industry. Clearly, no single formula or approach for telecommunications regulation applicable to any national situation has been found. Telecommunications stakeholders have adopted a vast range of approaches or models toward regulatory activities (Snow, 1986; Foreman-Peck and Muller, 1988; Bruce, 1989b; Schaumburg-Muller, 1992). This is an indication that the stakeholders do not agree on what should be regulated service and what should not. For instance, some stakeholders believe the telecommunications operator should be a government-controlled monopoly for reasons of national security. On the other hand, some stakeholders believe the telecommunications operator should be liberalized to allow for free entry, thereby promoting competition, which will benefit the National economy (Mbarika et al., 2000a).

Thus, African LDCs have no clear guidelines for taking action in their efforts to reform the telecommunications sector. If, however, it is determined that private sector involvement in the telecommunications sector is desirable, it would appear that a reasonable first step would be to decide on the structure of the ownership of the telecommunications infrastructure. Similarly, there will be a need to establish performance criteria.

## **Research Objectives**

This study borrows from past literature to examine the technology-oriented obstacles to growth of teledensity in LDCs. The obstacles are then matched with specific strategies drawn from the literature. In this regard, a survey was developed to help confirm the strategies proposed from the literature. Survey participants were solicited to critically analyze the provided current and future strategies and to modify, enhance, or add new insights to the strategies.

The survey participants were African telecommunications stakeholders. These stakeholders were charged with the responsibility of managing and improving the telecommunications infrastructures of LDCs. They constituted both governmental and non-governmental stakeholders. Since the telecommunications sector extends beyond the traditional boundaries of the industrial and services sector (UN, 2000), the formulation of telecommunications strategies can only be achieved through a broad-based participatory process.

## **Research Questions and Methodology**

The premise of this study is to investigate African telecommunications stakeholders' perceptions of strategies to promote growth of teledensity in African LDCs. The two main research questions will be approached as follows:

### **Research Question 1**

What are African telecommunications stakeholders' perceptions of technological-oriented strategies to overcome technological-oriented obstacles to growth of teledensity in African LDCs? To examine this question, the survey participants were asked to assess, using a scale from 1 (strongly disagree) to 7 (strongly agree), how critical each strategy is to promote growth of teledensity in African LDCs. First, a Factor Analysis was conducted to confirm groups of strategies (Babbie, 1989, pp. 450-453). Second, a rank order of each category of strategies was evaluated using Friedman's Test (Kerlinger, 1986, p 271).

## **Research Question 2**

How do African Governmental Telecommunications Stakeholders' (GSH) and African Non-Governmental Telecommunications Stakeholders' (NGSH) perceptions of technological-oriented strategies to overcome technological-oriented obstacles to growth of teledensity in African LDCs differ?

In order to examine differences of perceptions among affiliation (Government and Parastatals; Telecommunications Operators--government controlled; Telecommunications Operators--non-government controlled; Academia, Research Centers and IT experts; and International/Regional organizations) and between group (GSH and NGSH) for each of the 7 main categories of strategies, a Multivariate Analysis of Variance (MANOVA) was computed for each of the factors that constitute the technological-oriented strategy.

A pilot test of the questionnaire was conducted by randomly selecting participants from the through the Afrik-IT listserv<sup>1</sup>. The pilot test involved about 15 participants. Results from the pilot test will indicate to the researchers whether or not the questions were well understood.

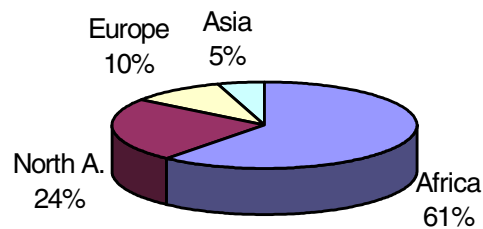
## **Results**

### *Data Collection*

There were two hundred and twelve questionnaires sent to individuals. Of those, 71 were returned, representing a 33.5% response rate. A regional distribution of the responding participants is shown in Figure 1.

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<sup>1</sup> Afrik-IT is an African network of IT experts and professionals.



**Figure 1:** Regional distribution of participants in the survey

Distributions of the participants across group and affiliation are summarized in Table 1. Twenty-nine participants that responded were governmental stakeholders, and forty-two were non-governmental stakeholders.

**Table 1: Participants in the Survey**

Stakeholder Affiliation	Group	
	Gov't S. H.	Non-Gov't S. H.
Telecommunications Operator	6 (21%)	8 (19%)
Telecommunications Regulator	20 (69%)	4 (10%)
Academia, Research Centers, Development Agency	3 (10%)	30 (71%)
Total	29 (100%)	42 (100%)

Note: Percentages enclosed in parentheses are rounded up to whole numbers.

## Scale Assessment

### Reliability

Cronbach alphas were computed for each factor under the technological-oriented strategy (Table 2). A description of the items under each factor is presented in Table 5. Overall, the cronbach alpha for the entire instrument was .89. In terms of the individual factors, the consideration was to see whether the factors formulated in the survey (from past literature) were measured reliably by their component questions in this particular set of data.

**Table 2: Factors and their corresponding Cronbach Alphas for Technological-Oriented Strategy**

Factor	Cronbach Alpha	Number of Items
Self-sufficiency	0.62	3
African Foreign Alliance/Joint Ventures	0.67	2
Total Foreign Dependency	0.81	3

These values of alphas assured the researchers that the items associated to these factors coalesced together adequately to measure the factors. Scaled values for the factors were computed by averaging the responses across the items identified as best representing the factors.

### Factor Analysis

A factor analysis approach was conducted to confirm groups of strategies (Babbie, 1989, pp. 450-453). The values of the eigenvalues and percentage of variance indicate that it may be possible to factor the constructs to a smaller set of factors that could explain the phenomenon under study (Table 3). The criterion used here is the percentage of variance criterion. This criterion requires interpretation of the cumulative percentage of variance accounted for by the factor solution. The factors explaining a small percentage of the variance are deemed to be of little practical significance. In the social sciences, it is common to consider a satisfactory solution as one that accounts for 60% of the total variance.

**Table 3: Eigenvalues and percentage of variance for the extraction of component factors for Technological-Oriented Strategy.**

Factor	Eigenvalues	% of Variance	Cumulative %
1	2.678	33.474	33.474
2	1.892	24.901	58.375
3	1.060	12.000	70.375
4	.677	8.460	78.835
5	.593	7.409	86.244
6	.468	5.845	92.089
7	.393	4.918	97.007
8	.239	2.993	100.000

From the results above, it can be observed that the first three factors for technology-oriented strategy accounted for more than 60% of the variance (Table 3). The eigenvalues for the first three factors under the Technological Strategy were greater than or equal to 1. This led the researcher to conclude that the three factors in each case could be used to summarize the groups of strategies used in this study (Green et al., 1997). An orthogonal VARIMAX factor rotation was used to confirm which items loaded on the three factors under each group of strategy. The rotation converged in three iterations. The results are shown in Table 4.

**Table 4: Rotated Factor Matrix for Technological-Oriented Strategy.**

	<b>Factor1</b>	<b>Factor2</b>	<b>Factor3</b>
	Loading	Loading	Loading
Item 1	.534	-.002	.393
Item 2	.654	.009	.154
Item 3	.541	.439	.232
Item 4	.108	.860	-.498
Item 5	.239	.542	.001
Item 6	-.515	.165	.623
Item 7	-.388	.121	.699
Item 8	-.153	.321	.433

### Strategies to Overcome Obstacles to Growth of Teledensity

This section discusses results of the ranking of the factors under the technological-oriented strategy identified in this study. The first sub-section will summarize the factors identified in the literature. The second sub-section will present a rank order of the factors under the technological-oriented strategy, and the third sub-section will address differences among stakeholder categories with respect to perceptions of the technological-oriented strategy to teledensity growth.

## Identified Strategies

The questionnaire concerned technological-oriented strategy to promote growth of teledensity in African LDCs. As mentioned earlier, the items under this strategy were derived from past literature on developing countries in general.

Mean value and standard deviation were computed for each factor under Organizational/Policy-Oriented strategy. Collectively, the three factors viz. self-sufficiency, African foreign alliance, and total foreign dependency had means of 5.82, 5.52, and 4.78, respectively. A description of these factors is presented in Table 5.

**Table 5: Descriptions of factors under Technological-Oriented Strategy**

Factor		Description
Self-Sufficiency	Item 1	African LDCs should review the possibilities for local or regional manufacture of telecommunications equipment.
	Item 2	Operators and manufacturers should enhance the training opportunities they offer to telecommunications staff of African LDCs.
	Item 3	African LDCs should be trained to carry out monthly routine maintenance of already existing equipment.
African Foreign Alliance	Item 4	African LDCs, with assistance of funding organizations, should set up long-term contracts to buy new knowledge from developed countries (i.e. advocate for joint ventures).
	Item 5	Development organizations should conduct seminars to improve the qualifications of experts of African LDCs.
Total Foreign Dependency	Item 6	African LDCs should solicit help from developed countries to build and install their telecommunications equipment.
	Item 7	When purchasing equipment from foreign countries, African LDCs should ensure that the contract includes commitments on the supply of spare parts and post-installation review.
	Item 8	African LDCs should hire foreign experts to perform thorough routine maintenance of already existing equipment.

The results of the rank order of the means revealed that the self-sufficiency and African foreign alliance factors were equally ranked highest, whereas the total foreign dependency factor was ranked the lowest. Table 6 shows the rank orders of the mean scores for the three factors.

**Table 6: Worldwide Rank Order of Means for Technological-Oriented Strategy**

Rank	Mean Rank	Mean	Std. Deviation	Factor
1	2.24	5.82	1.01	Self-Sufficiency
2	2.24	5.52	1.61	African Foreign Alliance
3	1.52	4.78	1.76	Total Foreign Dependency

$\chi^2 = 31.13$ ; d.f. = 2; Significance = .000<sup>++</sup>

### Similarities and Differences of Perceptions

A 3 x 2 factorial multivariate analysis of variance (MANOVA) was carried out to determine if there were any statistically significant differences according to affiliation or group, or any interaction between affiliation and group. Table 7 presents the MANOVA results.

**Table 7: MANOVA results for Technological-Oriented Strategy**

Effect	F-value	P-value
Affiliation <sup>2</sup>	1.562	.171
Group (GSH vs. NGSH)	5.783	.003**
Affiliation * Group	.373	.894

\*P < 0.05; \*\*p < 0.01; \*\*\*p < 0.001

Note: The F and P Values used are based on Pillai's test.

From the results above, we observe that there is a significant difference in stakeholders' perceptions on Technological-Oriented strategy based on group membership. As a result of this, stakeholders did differ in their perceptions depending on whether they were governmental stakeholders or non-governmental stakeholders. However, there was not enough evidence of any significant affiliation main effect or of any interaction effect (affiliation \* group). The result of the post-hoc ANOVA for the effect of Group is shown in Table 8.

**Table 8: ANOVA results for the effect of Group**

Factor	Effect	df	Sum of Squares	Mean Square	F
Self-Sufficiency	Affiliation	2	.856	.428	.529
	Group	1	5.565	10.163	12.560**
	Interaction	2	.223	.111	.138
African Foreign Alliance	Affiliation	2	4.474	2.237	.883
	Group	1	.367	.367	.145
	Interaction	2	2.277	1.138	.450
Total Foreign Dependency	Affiliation	2	15.761	7.881	2.786
	Group	1	10.163	5.565	1.968
	Interaction	2	3.097	1.548	.547

\*P < 0.05; \*\*p < 0.01; \*\*\*p < 0.001

<sup>2</sup> The three levels (categories) of Affiliation were: Telecommunications Operators, Telecommunications Regulators; and Academia, Research Centers, IT experts and International/Regional organizations.



These ANOVA results show the strongly significant differences in perceptions of GSH vs. NGSB, or their self-sufficiency perceptions. The GSH were stronger in their perception on self-sufficiency in terms of Technological-Oriented strategy than the NGSB. The means for the GSH and NGSB were 6.67 and 5.28, respectively.

## **Discussion of Results**

### ***'Viagra' Technological Development Strategy or Sustainable Development Strategy?***

Use of the term 'viagra' in this context is to imply a quick and easy solution. Overall, the three factors viz. self-sufficiency, African Foreign Alliance, and Total Foreign Dependency had means of 5.82, 5.52, and 4.78, respectively. The results of the rank order of the means revealed that the Self-Sufficiency and African Foreign Alliance factors were equally ranked highest. The Total Foreign Dependency factor was ranked the lowest.

In ranking Self-Sufficiency and African Foreign Alliance highest, the stakeholders are saying that both factors are very important Technological-Oriented strategies. With the Self-Sufficiency strategy, African LDCs should review the possibilities for local or regional manufactures of telecommunications equipment, and operators and manufacturers should enhance the training opportunities they offer to telecommunications staff of African LDCs. Furthermore, African LDCs should be trained to carry out monthly routine maintenance of already existing equipment.

Total Foreign Dependency was ranked the lowest. The stakeholders were essentially saying that African LDCs should not entirely depend on developed countries to build and install their telecommunications equipment. The stakeholders also thought that when purchasing equipment from foreign countries, African LDCs should be weary of tying themselves into contracts that include long-term commitments on the supply of spare parts and post-installation

Furthermore, by ranking Total Foreign Dependency the lowest, stakeholders are saying that African LDCs should not always rush to hire foreign experts to perform routine maintenance of already existing equipment. Over-dependency on foreign experts has been the trend in most African LDCs (IDRC, 1990). Furthermore, the preference for foreign experts is symptomatic of the lack of confidence of African technical experts, administrators and policy-makers in their own (national) professionals (Mbarika, 2000a).

### **Similarities and Differences of the assessment between GSH and NGSB for the Technological-Oriented Strategy**

There was a significant difference in stakeholders' perceptions on Technological-Oriented strategies based on group main effect ( $p < .001$ ). Therefore, stakeholders did differ in their perceptions depending on whether they were governmental stakeholders or non-governmental stakeholders. However, there was not enough evidence of any significant affiliation main effect. Therefore, stakeholders may not have differed in their perceptions based on whether they were telecommunications operator, telecommunications regulator, and academia, research centers, or/and development agency. Also, there was not enough evidence of any interaction effect (affiliation \* group).

Looking at the post-hoc ANOVA results, the GSH were stronger in their perception on Self-Sufficiency in terms of Technological-Oriented strategies than the NGS. This was kind of surprising, in that the results suggest that the governments feel stronger about local production than their non-government counterparts. On the other hand, this could be a way the governments use to have more control over local manufacturing than if foreign countries become too involved.

### **Research Contributions and Conclusion**

In conclusion, the findings of this study can be used to provide prescriptive directions to policy makers of Africa's LDCs and development agencies who are in charge of improving the teledensity of these countries. These policy-makers and development agencies explore and analyze the strategies mentioned above as well as examples of countries that have used similar Technological-Oriented strategies to improve on their levels of teledensity. This can be done considering that certain developing countries that were once LDCs, both large and small in size, have been able to establish high quality telecommunications services, as well as some developed countries, despite their poor economic conditions. This demonstrates that with a well-managed telecommunications industry, even the poorest country can have an efficient telecommunications network and services and hence, high levels of teledensity.

References available from the authors upon request