The Centrality of ICTs as A Catalyst for Economic Transformation and Growth in Zimbabwe

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Abstract—The emergence and rapid developments in information and communication technologies (ICTs) has remained at the centre of global socio-economic transformations. ICTs affect the performance, growth, expansion and new products/services of any business or organization. Zimbabwe faces a sustainable economic development problem, where the GDP growth rate has been revised down from 6.1% in January to about 3.1% in December, 2014, and the economy is facing a challenge to stimulate production for economic recovery under the Zim-Asset programme. The purpose of the paper is to investigate on the centrality of ICTs as a catalyst in economic transformation and growth, and use of technology affordances to the diffusion of mobile connectivity and applications in Zimbabwe.

The research largely used the quantitative methodology where the research design was a survey. The qualitative approach was used where Focus Group discussions were held at a workshop attended by 87 participants in Zimbabwe, on 13th November, 2014. Diffusion of mobile technology is assessed mainly through the trends in usage patterns with respect to the major ICT indicators such as teledensity, mobile density and internet penetration levels. Data on Infodensity covered 23 selected African countries, mainly in East, Southern, West and North Africa for the period 2000 to 2013 to benchmark against Zimbabwe. The technology acceptance model (TAM) proposes that perceived ease of use and perceived usefulness predict applications usage. Results showed that perceived usefulness is more important in determining intention to use the technology than attitude toward using. However, the costs for bandwidth per month is a major obstacle to the fast diffusion and adoption of ICTs in Zimbabwe.

The purpose of the paper is to investigate on the centrality of ICTs as a catalyst in economic transformation and growth, and use of technology affordances to the diffusion of mobile connectivity and applications in Zimbabwe. The level of innovation associated with ICTs is measured as the degree of interaction between the tool and the user, called the affordance. An affordance is often taken as a relation between an object, or an environment, and an organism that affords the opportunity for that organism to perform an action (Kabanda G., 2014). Affordances are the interactions between users and tool, i.e. the perceived and actual properties of an object that determine how it could possibly be used. The tool prompts, guides, or constrains the users depending on their previous experiences (Salomon G., 1990). Technology affordances exist in the following forms:

- Perception and action
- Metaphor and learning (A metaphor is a figure of speech, e.g. “She is a walking dictionary”).
- Techniques for Input and Output

A knowledge economy requires a scientific and technological literacy, critical thinking about sustainable economies, global competence, diverse cross-cultural leadership skills, and students who can learn how to learn and adapt to rapid change (Kabanda G., 2013). The four pillars for establishing a knowledge economy are:

1. Human capital - an educated and skilled population to create, share, and use knowledge well;
2. ICTs - a dynamic information infrastructure to facilitate the effective communication, dissemination, and processing of information;
3. Institutions – an efficient innovation system comprising academia, firms, consultants, SMEs, etc.;
4. An enabling policy and legal framework - an enabling environment with supportive economic and institutional mechanisms.

“Sustainable development” is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development has remained elusive for many African countries.
Africa’s efforts to achieve sustainable development have been hindered by conflicts, insufficient investment, limited market access opportunities and supply side constraints, unsustainable debt burdens, historically declining levels of official development assistance and the impact of HIV/AIDS (Kabanda G., 2012).


- Poverty reduction
- Nutrition improvement
- Health gains
- Life-long learning
- Gender equality and empowerment
- Water and energy sustainability
- Economic growth
- Inequality reduction
- Urban development
- Environmental protection/resilience
- Peaceful, just and inclusive societies

ICTs affect the performance, growth, expansion and new products/services of any business or organization. The impact of ICTs on business is illustrated by Figure 1 below.

The ICT revolution, at institutional and regional collaboration levels, requires extensive investments into people (labour) and capital for the infrastructure and equipment (Kabanda G., 2008). The Cobb-Douglas production function relates the revolutionary technological change or productivity levels from ICT to labour and capital. A Cobb-Douglas production function of the form

\[ Q = A K^a L^b \]

is used for the analysis of technological progress and attended economic growth, where \( A, a \) and \( b \) are empirical parameters.

- \( K = \) capital input (very meaningful mounts)
- \( L = \) labour input (high technical competence)

1.2. Overview of the Zimbabwean Economy

At the beginning of 2014, the Zimbabwean economy was projected to record a strong growth of about 6.1%, premised on the implementation of the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIM-ASSET) programme. Positive projections were also anchored on strong recovery in the agricultural sector and improved performance in the mining and construction industries. However, due to the persistence of the negative factors mentioned above, the GDP growth rate has been revised down to about 3.1% in December 2014 (CZI, 2014).

An analysis of these challenges shows that the economy has failed to sustain the strong growth trajectory stimulated by the liberalization of the foreign exchange system in 2009 after failing to attract critical offshore financial inflows (both foreign direct investment (FDI) and long-term lines of credit). These would be critical for replacing the short-term expensive loans that have been granted by local financial institutions since the commencement of the multiple currency system. The Zimbabwean economy continues to face challenges which reflect some structural rigidities, inadequate domestic and foreign investments and lack of long-term funding. Economic activity degenerated from 10.6% in 2012 to an estimated 4.5% in 2013, in real terms. As indicated above, Government has revised GDP growth for 2014 to 3.1%.

Inflation, however, has remained low and was in the negative territory from February to June 2014. The rate of inflation reached deflationary levels mainly due to low aggregate demand coupled with a price correction process since Zimbabwean prices have been generally higher than those obtaining in neighboring countries.
In July 2014, inflation increased to 0.3% from the June level of -0.8%. It is anticipated that inflation will remain below the one percent level for the rest of 2014.

According to the Reserve Bank of Zimbabwe (2014), the Zimbabwean economy is currently facing the following major challenges:

- A severe and persistent liquidity crunch which has made it very difficult for local productive sectors to access sufficient credit to oil the wheels of our economy;
- Lack of competitiveness of locally produced goods due to high costs of production resulting in the huge importation of finished goods, hence the widening current account deficit;
- Infrastructure bottlenecks especially around key economic enablers such as energy, transport, communication, etc. These bottlenecks have eroded viability and competitiveness of local producers in key economic sectors; and
- Inadequate and often erratic service delivery from parastatals and local authorities.

The interwoven economic challenges include the following:
- Tight liquidity conditions;
- Company closures;
- Rising formal unemployment;
- Low production levels;
- Non-performing loans;
- A disproportionate trade balance.

Evidence of the sustainable development problem faced by Zimbabwe can be witnessed by the relatively low cereals production levels, which is one measure of the capacity to feed the nation. The annual cereals yield production of Zimbabwe has remained depressingly too low in comparison with other Southern African Development Community (SADC) countries, as shown on Figure 2 below.

The World Economic Forum Global Competitiveness Report 2014/15, showed that Zimbabwe dropped on the rankings from 123 last year to 124 this year. The report covered 144 countries. The competitiveness of SADC is shown on Figure 3 below and this shows that Zimbabwe is regarded as least competitive among the neighbouring SADC countries.

![Figure 2: Annual cereals production for SADC countries (Kabanda G., 2013)](image1)

![Figure 3: SADC Competiveness](image2)
1.3. Statement of the Problem

Zimbabwe faces a sustainable economic development problem, where the GDP growth rate has been revised down from 6.1% to about 3.1% and the economy is facing a challenge to stimulate production for economic recovery under the Zim-Asset programme.

The two sub-problems are:

a. The education sector is yet to manage the complexity, re-imagine the technological futures in digital learning and amply demonstrate innovation in solving the sustainable economic development problem.

b. The centrality of ICTs can transform and grow the economy. The insightful innovation associated with rapid diffusion of ICTs, such as the internet, mobile connectivity and its applications in Zimbabwe cannot be explained exclusively by the technology gadgets or the people alone but by the affordances of the technology.

1.4. Purpose or Aim

To investigate on the centrality of ICTs as a catalyst in economic transformation and growth, and use of technology affordances to the diffusion of mobile connectivity and applications in Zimbabwe.

1.5. Objectives

The objectives of the research are to:

1. Investigate on the centrality of ICTs as a catalyst in economic transformation and growth.
2. Develop an endogenous model for sustainable economic growth through ICT development indices.
3. Investigate how the notion of affordances can be used to assess the diffusion and explore possible applications of mobile technology and e-learning into Zimbabwe.
4. Establish sustainable capacity building for the adoption and diffusion of ICTs that creates a sustainable knowledge economy.

1.6. Research Questions

The Research Questions are:

1. Is ICT at the centre of global economic transformation and growth?
2. How do we establish the endogenous growth for a sustainable knowledge economy in Zimbabwe?
3. How can we accelerate the adoption, diffusion and impact of ICTs in development?
4. What is the pattern of mobile technology adoption, connectivity and applications in Zimbabwe?
5. How valuable is the concept of technology affordances?
6. Does the application of affordances provide any insightful innovation of mobile technology and e-learning in Zimbabwe?

1.7. Research Hypothesis

“The centrality of ICTs and technology affordances is a catalyst for economic transformation and growth in Zimbabwe”.

II. LITERATURE REVIEW

The Zimbabwean economy is growing and transforming to a knowledge economy through an endogenous growth model. The basic driving force behind economic growth is technological change (Kabanda G., 2013). Technological change is endogenous, being determined by deliberate activities of economic agents acting largely in response to financial incentives. The defining characteristic of ideas/knowledge is that once the cost of creating a new set of instructions has been incurred, the instructions can be used over and over again at no additional cost (Romer, 1990). Under this endogenous growth model, high-skilled labour is complementary with capital and low-skilled labour, but high-skilled workers enhance technological innovations and their diffusion. The main implication is that a continuous outflow of high-skilled labour creates the Brain Drain problem. Trade and endogenous growth have been linked to growth through technological and knowledge spillovers and learning (Kabanda G., 2013).

The Technology Acceptance Model (TAM) is an information systems theory that models how users come to accept and use a technology. TAM proposes that perceived ease of use and perceived usefulness predict applications usage. The Technology Acceptance Model (TAM) in which system use is a response that can be explained or predicted by user motivation is directly influenced by external stimulus consisting of the actual system’s features and capabilities (Davis, 1985).
TAM is an adaptation of the Theory of Reasoned Action (TRA), a widely studied model from social psychology which is concerned with the determinants of consciously intended behavior (more general theory) (Chuttur M. Y., 2009). This is illustrated on Figure 5 below. According to TRA, a person’s performance of a specific behavior is determined by his/her behavioral intention (BI) to perform the behavior and BI is jointly determined by the person’s attitude (A) and subjective norm (SN) concerning the behavior in question.

The revised TAM model is the TAM 2 model shown on Figure 6 below.

The Unified Theory of Acceptance and Use of Technology model is very practical in incorporating social influence, performance expectancy and facilitating conditions when one is introducing a new technology in a country. Figure 8 shows the link between technology, organisation and the environment. In summary, information technology adoption in business organisations of different sizes are shown on Figure 9.
The taxonomy of ICT affordances (Wijekumar K.J. et al, 2006) highlights the following key elements in order to maximise innovation opportunities:

a. Accessibility - this is where the Internet ‘affords’ opportunities for accessing information and knowledge in a new way. This affordance faces a primary challenge from finding to selecting relevant information.

b. Speed of change - this refers to attempts to understand the question of how technology can ‘be used to enable students to navigate their way through the myriad of changing information and make more informed decisions’.

c. Other affordances relevant to the learner include diversity, communication and collaboration, reflection, multi-modal and non-linear learning, etc. It is argued that ‘Perhaps new forms of reflection and critique will emerge in response to more transitory and digital text.’ (Wijekumar K.J. et al, 2006).

The concept of technology affordances is instrumental in identifying innovation in e-learning and mobile learning have been conducted and show innovative results in the following areas (Traxler J., 2009):

1. Technology-driven mobile learning where specific technological innovation is deployed in an academic setting to demonstrate technical feasibility and pedagogic possibility;

2. Miniature but portable e-learning that uses mobile, wireless, and handheld technologies that re-enact approaches and solutions already used in conventional e-learning;

3. Connected classroom learning that support collaborative learning and may include interactive whiteboards;

4. Informal, personalized, situated mobile learning enhanced with additional functionality to deliver educational experiences;

5. Mobile training/ performance support to improve the productivity and efficiency of mobile workers; and

6. Remote/rural/development mobile learning that addresses environmental and infrastructural challenges of delivering and supporting education over a wider geographic dispersion.

The recommended model for e-learning and mobile learning is the Frame Model (Koole, 2009), which is illustrated in Figure 10 below.

The advantages of mobile learning (Koole M.L., 2009) are:
Wireless, networked mobile devices can enable learners to access relevant information when and where it is needed at various locations.

The ability to access a variety of materials from anywhere at anytime can provide multiple cues for comprehension and retention.

Learning within specific contexts can provide authentic cultural and environmental cues for understanding the uses of information which may enhance encoding and recall.

Well-implemented mobile education can assist in the reduction of cognitive load for learners. While it is difficult to determine how to chunk information, differing patterns of presentation and amounts of information can potentially help learners to retain, retrieve, and transfer information when needed.

Diffusion of mobile technology is assessed mainly through the trends in usage patterns with respect to the major ICT indicators such as teledensity, mobile density and internet penetration levels. Data on Infodensity covered 23 selected African countries, mainly in East, Southern, West and North Africa for the period 2000 to 2013 to benchmark against Zimbabwe. Data on infodensity was obtained from the International Telecommunications Union (ITU) (http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx).

Data on Infodensity was obtained from ITU and assessed:
- Fixed-telephone subscriptions
- Mobile-cellular subscriptions
- Active mobile-broadband subscriptions
- Fixed (wired)-broadband subscriptions
- Households with a computer
- Households with Internet access at home
- Individuals using the Internet

A survey was conducted on 15 selected Zimbabwean schools in May 2012 to evaluate the application of TAM to mobile technology and e-learning. The questionnaire used solicited data on the following areas:
- Progress on the implementation of the national e-learning programme and how the schools have responded to it
- Computing facilities and networks currently available at the school
- Internet bandwidth services, costs and management
- Perceived use of ICT and the ICT tools in use
- Progress on the diffusion and adoption of mobile technology and ICT
- Value addition of ICT to the teaching and learning process.
- The inter-linkages between technology diffusion and affordances of the interaction.

The analysis of the infodensity of various ICT development indices are shown below. Figure 11 shows the fixed (wired)-broadband subscriptions for the period 2000 to 2013 as a percentage of the population of each the African countries. Figure 12 shows the fixed telephone subscriptions for the same countries.
There has been very little investment in African countries on fixed telephony and fixed broadband for the period between 2000 and 2013, and this region has the lowest levels in the world.
However, the same African countries showed phenomenal growth in mobile density (Figure 13) and internet penetration levels (Figure 14) and these show the fastest growth rates in the world. The recommended framework for Education for Sustainable Development in Zimbabwe is shown in Figure 15 below.

**Figure 15: Education for Sustainable Development Model for Zimbabwe**

V. CONCLUSION

The research paper examined TAM using school pupils' acceptance of mobile technology and e-learning, and established that TAM was partially supported based on data collected from 15 selected Zimbabwean schools (Kabanda G., 2014). The utility of TAM for explaining acceptance of mobile technology and e-learning by learners was evaluated. Results showed that perceived usefulness is more important in determining intention to use the technology than attitude toward using. However, the costs for bandwidth per month is a major obstacle to the fast diffusion of mobile technology and e-learning in Zimbabwe.

From the Focus Group discussions, the recommended human capital development strategies for Zimbabwe are to:

- Increase the numbers and improve the retention of teachers/lecturers/administrators / technologists in schools and tertiary institutions
- Establish emphasis on exploration of innovative ways of retaining skilled manpower
- Empower indigenous people and reduce dependency on expatriates
- Embark on private-public partnerships
- Expand facilities for open and distance learning throughout the country
- Promote local manufacture and assembly of science and technology equipment, annual expositions and intellectual fairs
- Periodically review curricula to keep abreast of the developments that are responsive to national challenges

In conclusion, the key areas of focus for economic transformation and growth include the following:

- Promotion of technology development, transfer and diffusion to Zimbabwe, perhaps through centres of excellence;
- Supporting Zimbabwean efforts to develop affordable infrastructure that promote sustainable development and connectivity;
- Leadership development & planning capacity;
- Enhancing science, technology and enterprise (SMEs) development;
- Harmonisation & development of Private Public Partnerships (PPPs), and
- Utilisation of Human Capital.

In conclusion, it is indeed true that “The centrality of ICTs and technology affordances is a catalyst for economic transformation and growth in Zimbabwe”.

**REFERENCES**


