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The implication of ICT in assessing the relationship between the current account balance and the economic growth in South Africa

Abstract
For many years, continuous downgrade of the current deficit in South Africa has been a concern for a country that has an open economy and seeks for global positioning. Many authors have researched on this particular topic with an emphasis on common variables that lead to the same results. The current article seeks to highlight a predominant role played by information and communication technology in boosting the current account balance and thus enhance the economic growth in South Africa. Using a digital economic framework, this study considers time series from 2007 to 2016 (the latest full data available at the moment of research), as recent decades have been dominated by digital transformation to approach data analysis. Research findings indicated that 52.93% of GDP is explained by the dependent variables, namely foreign direct investment, ICT trade balance, computer and communications trade balance and the current account balance. This suggests that technological upgrading through digital innovation system, as well as adoption and information infrastructure, is statistically significant in affecting the current account balance and growth performance in South Africa. Data interpretation revealed that deficit on the ICT trade balance generates sustainability of the current account deficit due to a higher rate of imports compared to exports in the field of ICT in South Africa. Since ICT contributes 3.0% to the total of GDP and is a multidisciplinary field that touches all the other sectors, the South African government should restructure exiting trade policies and regulations to promote development of smart technologies. Additionally, the implementation of the sophisticated enterprise resource planning system at the level of businesses and the government should optimise productivity and profitability which are building blocks of the economic growth. However, other factors, such as policy strategies, political and currency stability are not to be neglected when moving towards long-term survival and economic growth in South Africa.
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Вплив ІКТ на оцінку взаємозв'язку між балансом поточного рахунку та економічним зростанням у Південній Африці
Анотація. Зниження рівня дефіциту в Південній Африці є одним із найважливіших завдань, що стоять перед країною, яка має відкриту економіку й прагне глобального позиціонування. Вивченню даної

проблематики було присвячено велику кількість наукових досліджень. У цій статті автори визначили домінуючу роль інформаційно-комунікаційних технологій у зміцненні балансу поточного рахунку, наслідком чого є прискорення економічного зростання в країні. У своєму дослідженні автори на основі економічної структури розглянули часові ряди в період з 2007 по 2016 роки (найновіші доступні повні дані). Результати проведеного дослідження показали, що 52,93% ВВП мають відношення до залежних змінних, а саме: прямих іноземних інвестицій, торгового балансу в сфері комп'ютерних технологій і зв'язку, а також балансу поточного рахунку. Це свідчить про те, що технологічне вдосконалення системи цифрових інновацій, впровадження й розвиток інформаційної інфраструктури статистично значимо впливає на баланс поточного рахунку й показники економічного зростання в Південній Африці. Інтерпретація даних показала, що дефіцит торгового балансу ІКТ обумовлює дефіцит балансу поточного рахунку, що пов'язано з тим, що імпорт в сфері ІКТ у Південній Африці переважає над експортом. У зв'язку з тим, що частка ІКТ у загальному обсязі ВВП країни становить 3%, а також тим, що ця галузь тісно пов'язана з усіма іншими секторами економіки, було зроблено висновок про те, що уряду країни слід реструктуризувати існуючу торгову політику з метою сприяння розвитку інтелектуальних технологій. Впровадження складної системи планування загальноорганізаційних ресурсів створить сприятливі умови для оптимізації як продуктивності, так і прибутковості, які є основою економічного зростання. Разом із тим, на думку авторів статті подальшого дослідження потребують й інші чинники економічного зростання, такі як стратегічне планування, а також політична й валютна стабільність.
Ключові слова: поточний баланс; економічне зростання; інформаційно-комунікаційні технології; Південна Африка.

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Влияние ИКТ на оценку взаимосвязи между балансом текущего счета и экономическим ростом в Южной Африке

Аннотация. Снижение уровня дефицита в Южной Африке является одной из важнейших задач, стоящих перед страной, которая имеет открытую экономику и стремится к глобальному позиционированию. Изучению данной проблематики были посвящены многие исследования. В данной статье определена доминирующая роль информационно-коммуникационных технологий в укреплении баланса текущего счета, которое ведет к ускорению экономического роста в Южной Африке. В своем исследовании авторы статьи на основе экономической структуры рассмотрели временные ряды в период с 2007 по 2016 годы (новейшие доступны полные данные). Результаты проведенного исследования показали, что 52,93% ВВП в ЮАР является результатом взаимодействия зависимых переменных, таких, например, как прямые иностранные инвестиции, торговый баланс в сфере компьютерных технологий и связи, а также баланс текущего счета. Это свидетельствует о том, что технологическое усовершенствование системы цифровых инноваций, внедрение и развитие информационной инфраструктуры статистически значимо влияет на баланс текущего счета и показатели роста в Южной Африке. Интерпретация данных показала, что дефицит торгового баланса в сфере ИКТ способствует устойчивости дефицита баланса текущего счета в связи с преобладанием импорта над экспортом в области ИКТ. В связи с тем, что доля ИКТ в общем объеме ВВП страны составляет 3%, а также принимая во внимание то, что данная отрасль тесно связана со всеми другими секторами экономики, был сделан вывод о том, что правительству страны следует реструктуризировать существующую торговую политику с целью содействия развитию интеллектуальных технологий. Внедрение сложной системы планирования общеорганизационных ресурсов создаст благоприятные условия для оптимизации как производительности, так и прибыльности, которые являются основой экономического роста. Вместе с тем, по мнению авторов статьи, внимания заслуживают и другие факторы экономического роста, такие как стратегическое планирование, а также политическая и валютная стабильность.
Ключевые слова: текущий баланс; экономический рост; информационно-коммуникационные технологии; Южная Африка.

List of abbreviations:

4IR	Fourth Industrial Revolution
ASGI-SA	Accelerated and shared growth initiative for South Africa
BEE	Black Economic Empowerment programme
CSIR	Council for Scientific and Industrial Research
DTI	Department of Trade and industry
GDP	Growth Domestic Product
IBA	Independent Broadcasting Authority
ICASA	Independent Communications Authority of South Africa
ICT	Information and Communication Technology

NACI	National Advisory Council on innovation
NIPF	National industry policy framework
OECD	Organisation for Economic Co-operation and Development
SA	South Africa
SAITIS	South African Information Technology Industry Strategy
SARB	South African Reserve Bank
SASTATS	South African Statistics
SATRA	South African Telecommunications Regulatory Authority
TISA	Trade and Investment South Africa

1. Introduction

Nowadays, businesses, as well as the government, need to get aligned to the technological change to ensure growth and long-term survival. The fourth industrial revolution (4IR) is dominated by the introduction of smart technologies and continuous system innovations. The government of South Africa has created several institutions and acts to promote acquisition and adoption of new technologies to boost the overall economy (SAITIS, 2000). Such institutions help to understand the evolution of ICT in South Africa:

- the South African Information Technology Industry Strategy (SAITIS);
- the Competitions Act and the Skills Development Act (CASD);
- the South African Telecommunications Regulatory Authority (SATRA);
- the Independent Broadcasting Authority (IBA);
- the Independent Communications Authority of South Africa (ICASA).

Besides the development of the ICT sector, the government of South Africa also seeks to improve the following, which may contribute to the performance growth of the country:

- increase in the employment rate;
- domestic and foreign direct investment;
- sustainable policies and regulations;
- human resources development;
- global competitiveness and positioning.

All economic sectors require supply of ICT products and services to achieve productivity. Industries, such as manufacturing, mining, retail, transportation, electricity and public administration and computer industries, are the building blocks to improve efficiency and profitability. Improvement on research and development allows redefining the ICT industry in South Africa through determination of key indicators relating to the sector. The DTI (2019) highlighted the positive impact of the National Research and Development Strategy (NRDS) on the South African knowledge generation capacity in positioning science-based technology to increase the quality of life and economic growth in the country. Additionally, national programmes tailor areas of telecommunications equipment and services, as well as ICT hardware and software, both in terms of professionals and non-professionals (Stats SA, 2019).

Although the ICT arena is multidisciplinary, this study looks at its general impact on improving the overall economy, both locally and internationally.

The balance of payments that includes the current, capital and financial accounts is a statistical summary of transactions between residents and non-residents during a specific period (Connolly, 2007). The current account is the sum of the trade balance, income receipts on foreign assets and income payments on assets held by foreigners in addition to unilateral transfers (Connolly, 2007). Since 2013, the South African balance of payments has had a growing current deficit of about 5.8% of GDP. This means that there is an excess of expenditures compared to income in relation to foreign and internal trade in addition to the transfer of earnings. The current account balance has been at the origin of the deficit, as highlighted by many authors (Tsepo, 2018). The general economic situation in South Africa highlights the following as presented in Table 1.

Table 1:
Macroeconomic situation in South Africa

Macroeconomic picture	Status
The economy	Open
Foreign debt	Relatively low
Use of foreign currency denominated debt	Low
Fiscal Policy	Relatively in good condition

Source: Tsepo (2018)

Although the country's economy is open, the status of the foreign debt, as well as the share of foreign currency dominated debt, is a little bit questionable. Open economies allow open barriers and rather develop a competitive edge. South Africa is also known for its flexible exchange rate despite stability of the monetary policy and foreign reserves. Consequently, the share of the short-term debt is low compromising global economic flows. Macro-economic issues, as well as the economic growth in South Africa, have been a serious topic on the timely debate. Seeking for the equilibrium of the balance of payments that include the current account contributes and adds value to the economy in South Africa through job creation and exchange rate control. Although certain authors argue that job creation in South Africa depends on the capacity of the country to enhance gross domestic product (GPD) and attract more foreign investors (Tsepo, 2018); political stability and less corruption are to be considered as well.

The deficit of the current account causes the downgrade of the balance of payments that forces the country to become financially dependent from other countries or increase the level of foreign reserves to meet the balance (Connolly, 2007). The International Monetary Fund and the World Bank are the institutions that mange the economic situation of participating countries. These monetary institutions have realised over time that it is much more efficient to assist countries in the restructuration process of their internal economy then inject money to restore economic balance.

Institutional setting in South Africa in combination with the international development community, including the World Bank, through development programmes strongly contribute to the country's economic performance. It is necessary to distinguish between the microeconomic policy framework applicable internally in South Africa and the macroeconomic policy framework following global requirements. The aim of this article is to determine the relationship between the current account balance and the economic growth in South Africa for the period from 2007 to 2017 with an emphasis on the role played by ICT. The ICT industry is seen today as a driver of the South African economy because ICT sector is now larger than the agriculture industry (Stats SA, 2019).

2. Background

Large and continuous downgrade of the current account in South Africa has become focus of economists and researchers, as well as of those working for financial institutions. The need for managing and stopping sustainability of the current account deficit in view of the economic growth of the country has become inevitable. Since countries accumulate external liabilities as source of interest to finance their deficit from foreign credit, it is important to note that associated capital flows can derive the current account balance (Uz, 2010).

South Africa has adopted several programmes in stabilising internal and external macroeconomic balances to improve performance since 1994 (DTI, 2007):

1. Organisation for the Economic Corporation and Development (OECD).
2. Accelerated and Shared Growth Initiative for South Africa (Asgi-SA).
3. National Industry Policy Framework (NIPF).
4. Black Economic Empowerment Programme (BEE).

Nevertheless, it happens that from 2003 to 2013, as highlighted by Smit (2007), South Africa experienced continuous deficit of the current balance with 5.8% of GDP in 2013. Besides internal sources that cause the current account issues in South Africa, there are also external effects that have an impact on the current account. In 1993, the country lost almost half of its total official foreign reserves, which lead to a severe domestic recession in the domestic economy in conjunction with a low level of imports due to foreign requirements (Searl & Mana, 2010). This suggests that the balance of payments has never reached a perfect equilibrium in addition to the loss of international credibility. Consistently, a low level of reserves, continuous appreciation of the US dollar, high foreign rate of interest and political instability have been at the origin of the adverse of the current account as argued by (Stals, 1998).

South Africa progressed from inefficiency in the exchange rate policy, as well as structural and demographics change factors deriving from the current balance deficit. Although South Africa has an open economy in which a free market reflects the equilibrium or disequilibrium of the domestic economy, it happens that the country's trade policies are based on protective measures than positioning. For households, domestic saving should allow to cover domestic investments in the condition of perfect economy as well as production to cover demand of goods and services to avoid deficit. The shortfall on the net inflow of capital needs to at least balance the related outflows to limit the deficit, which is not the case in South African economy considering the continuous deficit on the

current account. In 1988, the government of South Africa put in place special protective measures to fight against incoming deficit, especially regarding import surcharges. Although economies tend to protect themselves against influences of foreign economies, the truth is that the globalisation and the digitalisation of things have removed barriers between countries. In doing so, political and economic measures should be reviewed in meeting global requirements while remaining competitive in the global market. According to Hervey and Merkel (2000), we can determine the following sources of the current account deficit:

- change in consumer spending at the expense of savings;
- short-term capital inflows from short-term investments from foreign countries;
- economic transition towards productivity associated with technology and others.

The government of South Africa had put in place various measures such as exchange controls, restrictive trade measures and export subsidies to limit the deficit of the current account balance (OECD, 2019). Such defensive actions cannot guarantee economic transparency because the complex policy framework opens doors to intransparency and distortion of resource allocation. Furthermore, change impact is out of control in a market-orientated economy where the domestic market is easily affected by foreign ones due to the globalisation of economies. Despite the difficult background of economic issues encountered in South Africa, corrective actions have been put it place to upswing the current account through the improvement of ICT. The current paper focuses on the up-to-date results and improvements of the current account and their impact on the evolution of ICT in South Africa.

3. Brief Literature Review and Methodology

3.1. Overview

Up to date, economic decrease has become a trend in South Africa due to trade imbalances, low domestic savings, low foreign direct investment in addition to poor governance, as highlighted by Osakwe and Verick (2007). Understanding indicators of the sustainable current account deficit can be a solution start in getting rid of such a negative trend. Either at the level of governmental transactions or the global level, the impact of the higher rate of technological advancement and inclusion to other sectors of the economy is to be considered as well.

3.2. Information and communication technology in South Africa

Whether in school or in companies, the evolution of ICT in South Africa has become very important as a driver of the new industrial revolution. South Africa further hosts the Research ICT Africa (RIA) as part of the ICT policy and regulation research network to inform about effective ICT governance in Africa (Gillwald, Moyo, & Stork, 2012). The statistical data for South Africa (2019) have highlighted three facts about the ICT sector:

- the ICT sector is larger than the agricultural industry;
- ICT imports supersede exports: imports of radio, television, communication equipment and office machinery exceeds exports of broadcasting, telecommunications and information supply;
- ICT subscriptions and contracts dominate household ICT budgets: households currently spent 17.4% of their total ICT budgets on telecommunications equipment (Stats SA, 2019).

3.3. Current Account

Studies on current account balances are important in a sense that it is a macroeconomic indicator that mostly tells us about economic situation in the country. The current account balance is closely related to the budget balance and the economic with implications on the exchange rate, the global competitive edge and the overall economic performance.

In South Africa, practical indicators highlight reasons of the current account deficit. According to Draper and Freytag (2008), a sudden stop in capital flows compromised the current account sustainability. Many authors, such as Draper and Freytag (2008) and Samuel (2013), argued that the imbalance of the current account in South Africa is caused by the trade balance and the investment income account. They additionally specified that the deficit is caused by the interest and dividend payments made to foreign investors.

Many organisations, especially financial institutions, have been interested by the current account balance in South Africa. The African Development Bank Group seeks to understand the reason why South African current account deficit is. They questioned the role played by

the foreign direct investment income in supporting the balance of payments in South Africa. Smit (2007), through some research at African development bank (AfDB), found out that an increase on net investment income payments made to foreign as well as other direct investors is at the origin of the current account deficit. According to Draper and Freytag (2008), the imbalance on the current account is due to the trade balance compared to Samuel (2013) who argued that the investment income account holds more deficit caused by interest and dividends payment to foreign investors. In any case, it is important to clearly identify the main cause of the current account deficit either from internal or external source. Smit (2007) emphasised the terms of payments as the main source in a sense that short term payments by means of portfolio cannot impact the current account in the same way as the long-term payments done by foreign direct investors.

The current account is a sum of the trade balance, income receipts on foreign assets and income payments on assets held by foreigners in addition to unilateral transfers (Connolly, 2007). While ignoring the transfer component at a point in time, Hervey and Merkel (2000) investigated the equation that summaries international investment position of a specific country.

$$(X_t, M_t) + (1 + r_t) A_t = A_t + 1 , \quad (1)$$

where:
X - exports,
M - imports,
r - rate of return,
t - period by dividing equation (1) by GDP (Y) and allowing an S prefix to share of GDP and a g as the growth rate. In a long run steady state, equation can be written as follows:

$$(SX, SM) = (g, r) SA . \quad (2)$$

As defined on equation (2), they found out that trade balance depends on the growth rate and the interest rate of return between imports and exports for a specific period. Somehow, the rate of return can be critical and relevant for countries that are strongly involved in imports and exports of goods and services compared to countries with closed economy. In his research, Tsepo (2018) studied the relationship between foreign direct investment and economic growth in South Africa using a vector error correction analysis. He found out that economic growth has a significant and positive relationship with both FDIs and the real effective exchange rate, while sharing a negative long-run relationship with government expenditure. High exchange rate negatively affects foreign investment in terms of the cost of labour besides corruption and insecurity in the country. According to Sakyi & Opoku (2016), the twin divergence hypothesis showed that fiscal deficit also causes deficit of the current account in developing countries such as Ghana. «Theoretical understanding of the relationship between fiscal and current account deficit derive their foundation from the national income identity (NII). For an open economy, NII equation is written as follows:

$$Y = C + I + G + (X - M) , \quad (3)$$

where:
Y is gross domestic product (GDP),
CC is household consumption expenditure,
I is investment expenditure,
GG is government expenditure,
X is total exports of goods and services,
M is total imports of goods and services» (Sakyi & Opoku, 2016).

They further argued that the current account is built by the difference between imports and exports in addition to the net factor income from abroad and the impact of fiscal deficit, as emphasised by Bannaga (2004).

Regarding the fact that economic development also relies on the stability of the current account, adjustment strategies and policies of the current account balance can improve the economic situation of the country. Bannaga (2004) emphasised that government reforms are more efficient than the policies enforced by the IMF or the World Bank in managing the current account in Sudan.

From the short-run to the long-run results, he found out that adjustment policies have a positive and significant impact on the equilibrium of the current account besides the factors such as foreign direct investment, external debt and foreign aid. Common knowledge showed that South African economy depends on imports compared to exports due to unlimited number of foreign brands in the South African market. The financial ratio such as the deficit-to-GDP external, debt-to-GDP and foreign currency are used to measure sustainability of the current account as well as the indicative of the country's ability to finance its imports (Wickens & Uctum, 1993).

In Indonesia, the current account balance is affected by the movement of explanatory variables such as oil prices, commodity prices, trade openness, credit to the private sector, energy subsidies besides government expenditures, real effective exchange rate and foreign direct investment relative GDP growth (Varela et al., 2015). However, all listed dependencies are impacted by global uncertainties not always predictable or measurable. From the equation of internal and external balances within an open economy, Uz (2010) inserted the real variables to the Turkey's model and ended up with a current account balance equation that depends on the exchange rate, private savings and government saving. In Zimbabwe, the annual economic growth is determined by the stability of the current account, foreign direct investment, external debt and foreign aid (Musisinyani, Nyoni, & Munyaradzi, 2017), as defined in the equation (3) below. The deficit of the current account therefore affects the overall economic performance:

$$«GDP = \beta_0 + \beta_1 CAB + \beta_2 FDI + \beta_3 ED + \beta_4 AID + \mu\ . \quad (4)$$

Using the following equation in determining net foreign asset position (NFA), Searle and Mama (2010) found that South African has a sustainable current account deficit over time:

$$NFA_t = FDIA_t + EQA_t + DEBTA_t + FX_t - FDIL_t - EQL_t - DEBTL_t, \quad (5)$$

where:
$FDIA(L)$, $EQA(L)$ and $DEBTA(L)$ are the stocks of direct investment, portfolio equity and debt» (Musisinyani, Nyoni, & Munyaradzi, 2017).

The net reflects the difference between assets and liabilities for the same indicator at the particular period of time. Tshepo (2018) further assessed the relationship between foreign direct investment as a variable of the current account and economic growth using the following equation:

$$«GDP_t = \theta_0 + \theta_1 FDI_t + \theta_2 GEX_t + \theta_3 REER_t + \theta_4 TGDP_t + \varepsilon_t, \quad (6)$$

where:
GDP_t - the rate of South Africa's real GDP growth,
FDI_t - the ratio of FDI inflows to South Africa's GDP,
GEX_t - the ratio of government expenditure to South Africa's GDP,
$REER_t$ - the real effective exchange rate,
$TGDP_t$ - the ratio of total trade (exports + imports) to real GDP».

This equation only considers inflows and not outflows, whereas the net balance between FDI inflows and outflows is more relevant in measuring the balance of the current account.

3.4. Foreign Direct Investment

As part of the globalisation effect, technology shock affects the rest of the world through improvement of investment in foreign countries and, consequently, adjustment of the current account. It is true that for a country, in order not to be overwhelmed by foreign investment, the local government need to continuously increase maturity of foreign liabilities to improve the situation with capital outflow. Smit (2007) emphasised that the increase of net-investment income payments related to external direct investors that was 37% between 2004 and 2013 in keeping deficit status of the current balance, compared to other investors that represented only 14.5%. To promote foreign direct investment in South Africa, governmental institutions, namely DTI and TISA, have put in place specific programmes, such as the foreign investment grant that was created in September 2000 as a cash prominence scheme to foreign investors who invest in the manufacturing area, as well as incentives for firms to create new plant sites (DTI, 2007). The strategic investment programme was introduced in November 2001 to improve

competitiveness, development and growth of specific industrial sectors, such as ICT and mining (Opoku-Afari, 2007). Additionally, South Africa has signed bilateral agreements and bilateral investment treaties with other countries to promote in-and-out investments. In 1996, South Africa developed a strategic industrial project incentive scheme that aims at supplementing lower savings and investment rates mostly for private investors, as opposed to the government participation (DTI, 2007). Figure 1 depicts that a decrease of the net investment income payments based on FDI and non-FDI net income payments was observed from 1994 to 2013, triggering downfall of the current account (SARB, 2019). Less assets or high liabilities can cause net deficit. Hence, deficit controls in both sides of the account, both from direct investment liabilities and/or direct investment assets side of the foreign direct account. The negative value of the current account can be due to the shortfall of the investment income receipts from assets abroad. In 1999, an increase of foreign direct income, as well as the GDP, was observed when South African companies were re-listing at the London stock exchange abroad. South Africa holds a considerable amount of direct investment assets in Africa, as well as in China, compared to other countries (SARB, 2019).

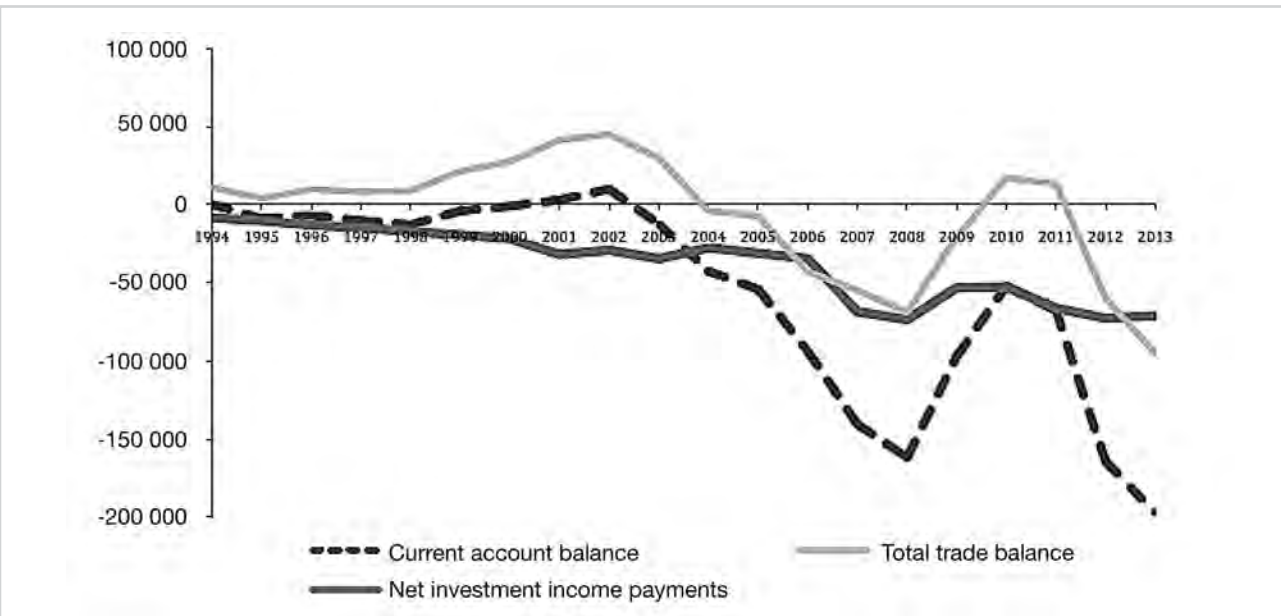

Figure 1:
Net investment income payments from 1994-2013 (in Millions R)
Source: Data from SARB (2019)

3.5. Contribution of the study

Compared to previous studies that only focuses on investigating existing variables that trigger the current account deficit, the current article focuses on the key role played by the digitalisation process in improving the current account balance. Besides common factors, such as the exchange rate, governmental expenditures, high external debts, ICT evolution and adoption of the computer and communications service, there are current boosters of any country's economic growth. The ongoing and critical role played by the FDI reveals a technical capacity of the country in keeping pace to the technological update in order to remain competitive both internally and globally. This study provides an exhaustive linkage between the current account balance and the improvement on technological innovation that improve economic performance in South Africa

4. Model Specification

This model specification focuses on the creation and adoption of smart technologies to local conditions to improve the domestic and the overall economic growth. The model uses a digital economy framework in alignment with the following economic dimensions to statistically analyse the relationship between economic growth and the current account balance.

Digital performance indicator: Gross domestic product (GDP) is a relevant economic indicator that helps to efficiently measure economic performance growth (Stats SA, 2019). In South Africa,

Table 2:
Digital economy framework in South Africa

Dimensions	Variables	Symbols
Digital performance indicator	Average annual GDP growth (%)	GDP
Digital economic aggregate	Current account balance	CAB
Digital innovation system	FDI as percentage of GDP	FDI
Digital adoption	ICT goods exports, % of total exports	ICTGE
	ICT goods imports, % of total imports	ICTGI
Digital Information infrastructure	Communications, computers, etc., % of service exports, BoP	COMPE
	Communications, computers, etc., % of service imports, BoP	COMPI

Source: Compiled by the authors

the average annual GDP growth data published by the South African statistics are used to measure the sustainability of long-term economic growth.

Digital economic aggregate: In South Africa, constituents of the current account are the merchandise balance of exports versus imports, the services balance of exports versus imports, income on the investment balance of exports versus imports and net unilateral aid transfers, as published by the SARB (2019). The current account is evaluated as a percentage of the average annual GDP growth.

Digital innovation systems: Foreign direct investment is measured as a percentage of the GDP growth annual average for the selected period from 2006 to 2017. It comprises net flows between FDI inflows and FDI outflows.

Digital adoption: Imbalances between imports (ICTGI) and exports (ICTGE), as well as the exchange controls measures, have been affecting the balance of payment situation. Deficiencies in the domestic economy structure and restrictive trade measures have limited the economy of South Africa to be market-orientated. The total trade balance equals the sum of the merchandise trade balance, the services trade balance and the gold trade balance.

Digital information infrastructure: The difference between communications and computer exports (COMPE) and imports (COMPI) constitutes the trade balance that tells us about the level of ICT inclusion in South Africa. This study uses communications and the computer trade balance (COMTB) to measure the impact of technological change on the economic growth in South Africa. Table 3 below summarises independent and dependent variables for the study:

Table 3:
Digital economic model Variables

Independent Variable	Description	Dependent Variables	Description
GDP	Gross domestic product	FDI	Foreign direct investment
		ICTTB	ICT trade balance
		COMTB	Computer trade balance
		CAB	Current account balance

Source: Compiled by the authors

The following linear equation is based on the economic variables considered in this study:

$$GDP = \beta_0 + \beta_1 FDI + \beta_2 ICTTB + \beta_3 COMTB + \beta_4 CAB + £ , \quad (7)$$

where:
GDP - Gross domestic product;
FDI - foreign direct investment;
$ICTTB$ - the ICT trade balance;
$COMTB$ - the computer trade balance;
CAB - the current account balance with £ as the error term,
β_1, β_2, β_3, β_4 - the estimation parameters,
β_0 - the constant term.

The data used in this research where collected from secondary sources such as the World Bank, the Organisation for Economic Cooperation and Development (OECD), the South African Reserve Bank (SARB) and Statistics South Africa (SA STATS). The study considered the period from 2007 to 2016 to investigate on up-to-date data that tell us about the current performance development.

A theoretical analysis is done using descriptive statistics and correlation analysis to determine the relationship between growth performance in South Africa and the current account balance indicators.

5. Results

5.1. Statistical Analysis

Descriptive statistics

Table 4 displays descriptive statistics that describes and summarises data of the research variables. The annual average of GDP is 2.173 and has an FDI average of 1.63, 10 for ICTTB, 10.6 for COMTB and a CAB of 3.1. The standard error shows how close the sample mean is from the population mean. The standard deviation indicates how close the data are to the mean.

Table 4:
Descriptive statistics

	GDP	FDI	ICTTB	COMTB	CAB
Mean	2.172777339	1.631085803	10	10.6	-3.1
Standard Error	0.582549095	0.694661063	0.49441323	0.4760952	0.555578
Median	2.349277654	0.950429017	9.5	10.5	-2.6
Standard Deviation	1.842181989	2.196711161	1.56347192	1.5055453	1.756891
Kurtosis	1.410092624	0.625643547	-0.0292208	-0.3651755	-0.37718
Skewness	-0.45540741	1.22184142	0.87218475	-0.1172137	-0.86807
Minimum	-1.53808933	-0.67	8	8	-6.4
Maximum	5.360475891	6	13	13	-1
Sum	21.72777339	16.31085803	100	106	-31
Count	10	10	10	10	10

Source: Compiled by the author

Correlation Matrix

Table 5 shows the correlation coefficient between economic variables. Considering the higher rate of the correlation coefficient, this correlation matrix shows that there is a strong relationship between GDP and the dependent variables such as FDI, ICTTB, COMTB and CAB.

Table 5:
Correlation matrix

	GDP	FDI	ICTTB	COMTB	CAB
GDP	1	0.550746194	-0.6782256	-0.6313781	-0.5727
FDI	0.550746194	1	-0.6391304	-0.6478498	-0.78027
ICT TB	-0.67822561	-0.639130436	1	0.7080515	0.558215
COM TB	-0.63137806	-0.647849817	0.70805148	1	0.667907
CAB	-0.57270444	-0.780268934	0.55821516	0.6679069	1

Source: Compiled by the authors

Summary Outputs

Table 6 displays summary outputs of how significant the results are. The multiple R coefficient equals 0.72775. It shows a positive and significant correlation between growth performance and the dependent variables. The coefficient of determination R Square equals 52.93% and indicates goodness of fit between the variables. This also means that 52.93% of GDP is explained by the dependent variables, namely FDI, ICTTB and ICTCOM as well as Current Account Balance.

The significance F value, which is 0.0353246, is less than 0.05 (5%) significance level. This means that the regression model is reliable. This result further shows that there is a significant relationship between the growth performance and the dependent variables.

Regression Model

Following the summary outputs, the regression model appears as follows.

The p -value, calculated at a significance level of 95%, gives a coefficient less than 0.05 (5%). This suggests that FDI, ICTTB, COMTB and CAB are statistically significant in affecting the growth

Table 6:
Summary outputs

Multiple R	0.727484768
R Square	0.529234088
Adjusted R Square	0.152621358
Standard Error	1.695786949
F	1.405247476
Significance F	0.0353246333

Source: Compiled by the authors

Table 7:
Regression model

	Coefficients	Standard Error	*t*-statistic	*p*-value
Intercept	9.144641	6.947813	1.316190	0.245217
FDI	-0.029582	0.460282	-0.064269	0.029512
ICTTB	-0.515451	0.545733	-0.944511	0.038828
COMTB	-0.236553	0.603773	-0.391792	0.017114
CAB	-0.238181	0.551062	-0.432222	0.036836

Source: Compiled by the authors

performance in South Africa. Based on statistical data from the regression model, the economic growth performance equation can be updated as follows:

$$GDP = \beta_0 + \beta_1 FDI + \beta_2 ICTTB + \beta_3 COMTB + \beta_4 CAB + £ . \quad (8)$$

The regression model becomes:

$$GDP = 9.144641 - 0.02956 FDI - 0.5154 ICTTB - 0.2365 ICTCOM - 0.2365 COMTB - 0.2381 CAB + £ . \quad (9)$$

5.2. Interpretation and Discussion

5.2.1. Performance Indicators

In South Africa, the GDP indicator has been decreasing since 2011 with a value from 3.28 to 0.57 in 2016. Figure 2 shows that it fell down to the negative value of 1.54 in 2009. SA Stats (2019) recently published its latest GDP data showing that South Africa's economy increased to 0.8 in 2018. Although, the GDP growth can be impacted by many other sectors in South Africa, such as mining and manufacturing as well as construction, the study considers the fact that ICT currently drives all the sectors of the economy. Despite the negative impact of the so-called economic recession in South Africa and the upcoming political change in 2019, observations show that the forecasted levelling down didn't happen as predicted (Businesstech, 2019).

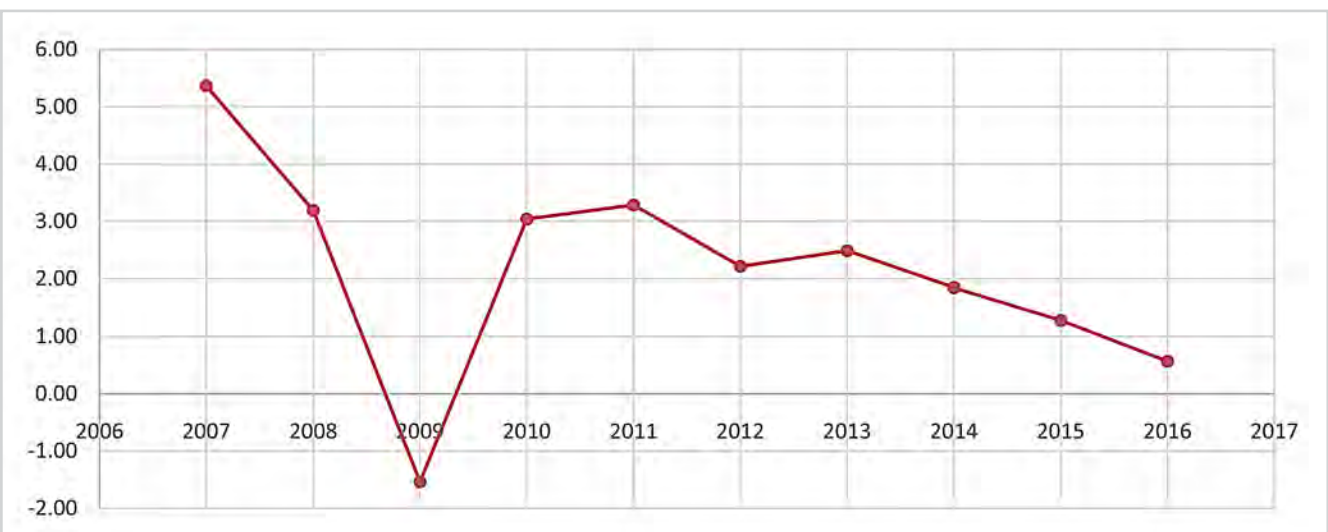

Figure 2:
GDP growth in the period of 2007-2016, annual %
Source: SA Stats (2019)

5.2.2. Foreign direct investment

It is often asserted that foreign direct investment generates economic growth in the host economy. Although outflows of FDI can enhance inflows in between the same or different countries, it is predominantly the receivers' countries that benefit from income generation, increasing employment rate and import of technology. Such an economic transfer require local educated workforce and developed financial markets in addition to relevant trade policies. Figure 3 shows that

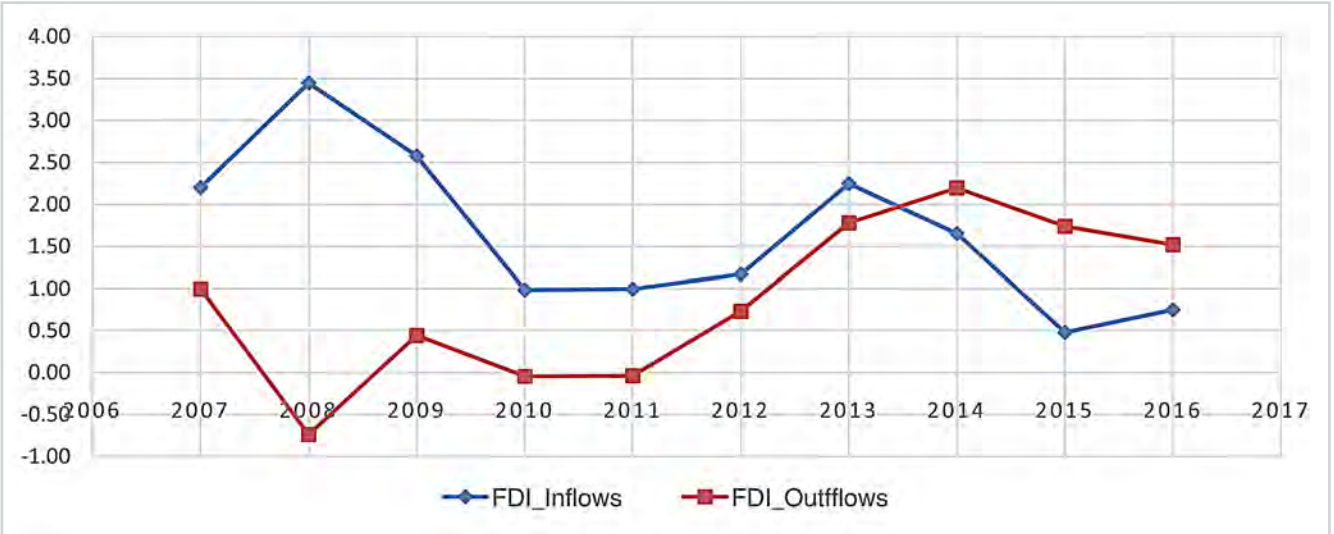

Figure 3:
FDI inflows Vs outflows in South Africa
Source: SA Stats (2019)

from 2007 to 2013, the FDI inflows were higher than the FDI outflows. Since 2014, the volume of FDI inflows has considerably decreased, bringing a decrease in GDP per capita. Political instability and a higher exchange rate contributed to chasing away foreign investors in the country. That was the beginning of the economic recession in South Africa.

Controlling the volume of capital inflows from foreign investors is crucial in controlling international trade deficit (Hervey & Merkel, 2000). They argue that borrowing abroad to finance local deficit is not the way because the problem must be resolved from the root of adjustment of the domestic economy to better results. Figure 4 displays a decrease in the net FDI flows for the period from 2007 to 2016, as published by the World Bank (2019). The diminution is due by many factors such as lack of machinery to fight corruption among others (Tsepo, 2018).

The FDI fall is aligned to the flow of the real effective exchange rate based on the customer price index as displayed in Figure 5. The monthly average of the REER index equalling 100 has not been achieved in South Africa since 2010. This suggests an increase in the competitiveness of the economy of South Africa. Consequently, the misalignment behaviour of the REER of the rand undermines the equilibrium of inflows versus outflows or imports versus exports transactions.

Bannaga (2004) stated that «Ghana opted for the nationalisation and substantial low-productivity investment financed by foreign borrowing». With regard to the above statement, South Africa

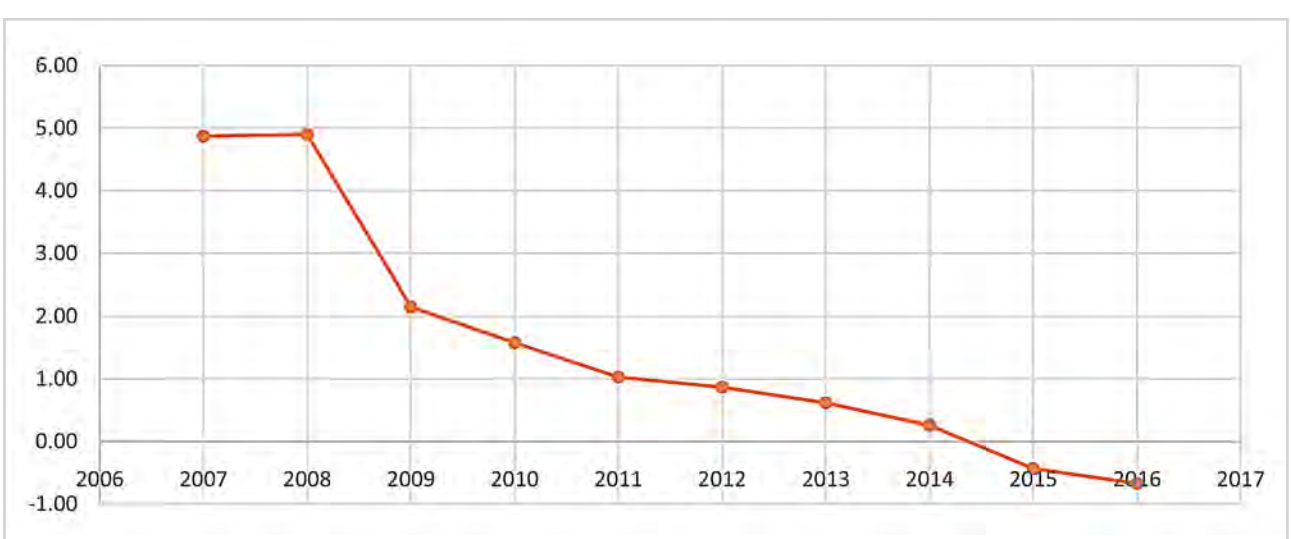

Figure 4:
Foreign direct investment, net inflows (% of GDP), 2007-2016
Source: Wold Bank (2019)

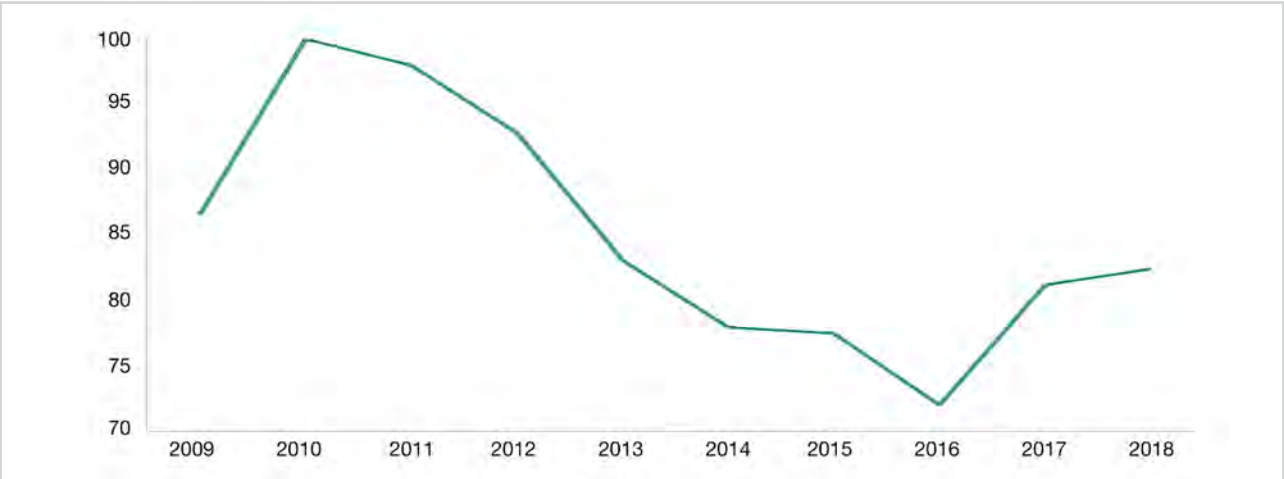

Figure 5:
Real effective exchange rate, 2009-2018
Source: World Bank data (2019)

has favourable economic conditions compared to the Sudan. Despite the heavy impact of the foreign direct investment in contributing to the deficit of the current account, Smit (2007) argues that it remains an opportunity for South Africa to alleviate his external imbalances. Above all, policy makers have the last say in making this opportunity comes true. As part of the global market strategies, South Africa should be able to compete internationally while protecting its balance of payment accounts.

5.2.3. Digital Adoption

The level of exports of ICT services versus imports reveals the capacity of the country in creating and adopting new technologies. An increase in technological innovation forces a country to seek for new open markets for digital competitive edge and global positioning. Figure 6 represents the percentage of ICT goods exports compared to the total goods exports and the percentage of ICT goods imports of the total goods imports from 2007 to 2016.

There is a relatively high rate of ICT imports compared to ICT exports from 2007 to 2016. This implies a trade deficit in ICT goods and services in South Africa. Additionally, the huge gap between imports and exports highlights the dependence on other countries to provide ICT needs whether tangible or not. Evidence shows that ICT equipment, such as smartphones, tablets and technological devices, are mostly made in foreign countries. The largest ICT exports are covered by broadcasting, telecommunications and information supply services (Stats SA, 2019).

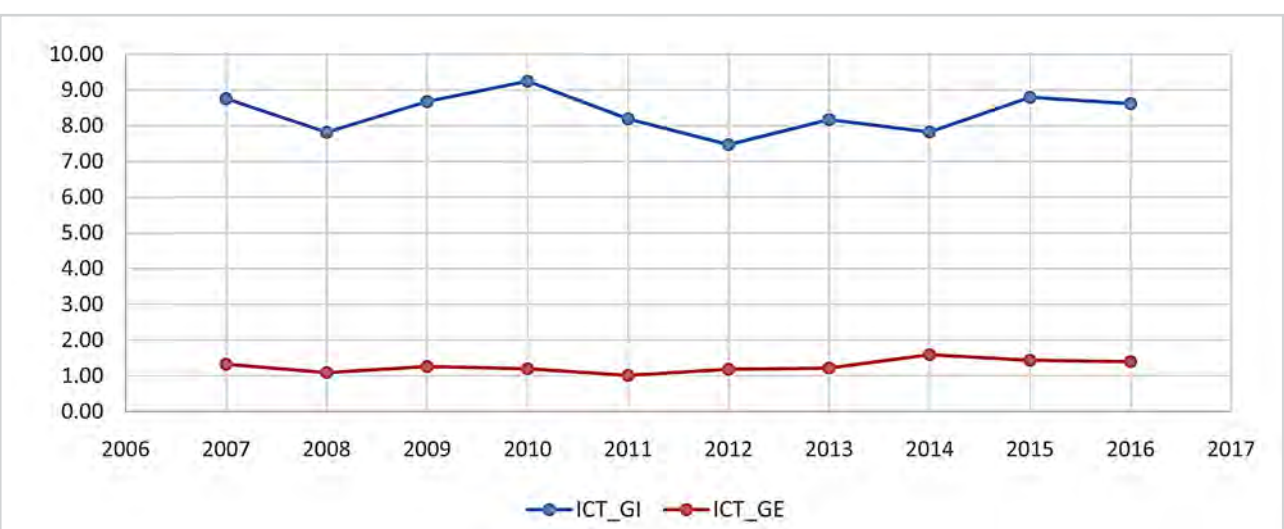

Figure 6:
ICT exports Vs imports, 2007-2016
Source: World Bank Data (2019)

5.2.4. Digital information infrastructure

A surprising increase in GDP to 0.8% in 2018 showed that the economy was boosted by the communication industries through the use of land transport and communication devices (Businesstech, 2019). A little gap between communications and computer exports versus imports can justify such results. But, there is still a trade deficit because the volume of imports exceeds the volume of exports. Computers and servers whether in premises or in cloud are mostly implemented and managed by foreign countries. Software and sophisticated applications are owned by foreign countries leading to continuous license renewal fees associated with such services. Reliance on external providers increases gross expenditure of the country compared to empowering local research and development in the computer field through both ICT professionals and non-professionals. Figure 7 depicts percentage of communications, computer, etc. on the total service exports compared to the percentage of communications, computer, etc. of the total service imports from 2007 to 2016. There was a relatively high rate of the COMP imports compared to the COMP exports from 2007 to 2016. This implies a trade deficit in computer, communications and related services in South Africa. Furthermore, a huge gap between imports and exports highlights the dependence on other countries to provide computers and laptops requirements.

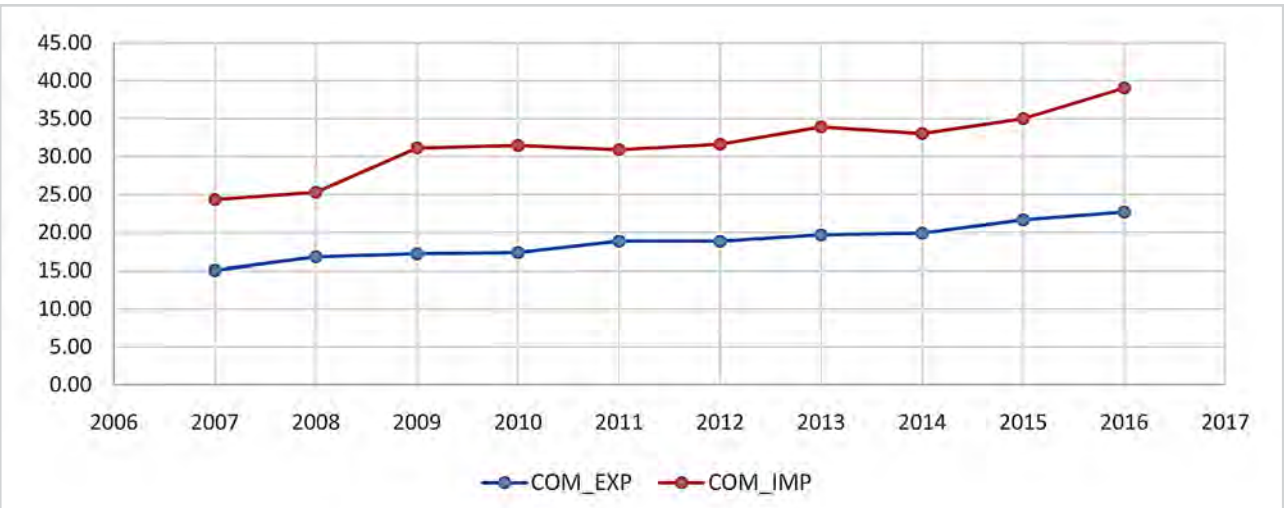

Figure 7:
ICTCOM exports Vs imports in South Africa, 2007-2016
Source: World Bank Data (2019)

5.2.5. Current Account in South Africa

From 2007 to 2016, the current account was negative, as displayed in Figure 8. Despite the shortfall from 2010 to 2013, the current account balance was slowly adjusted and reached the threshold of -1.5 in 2016.

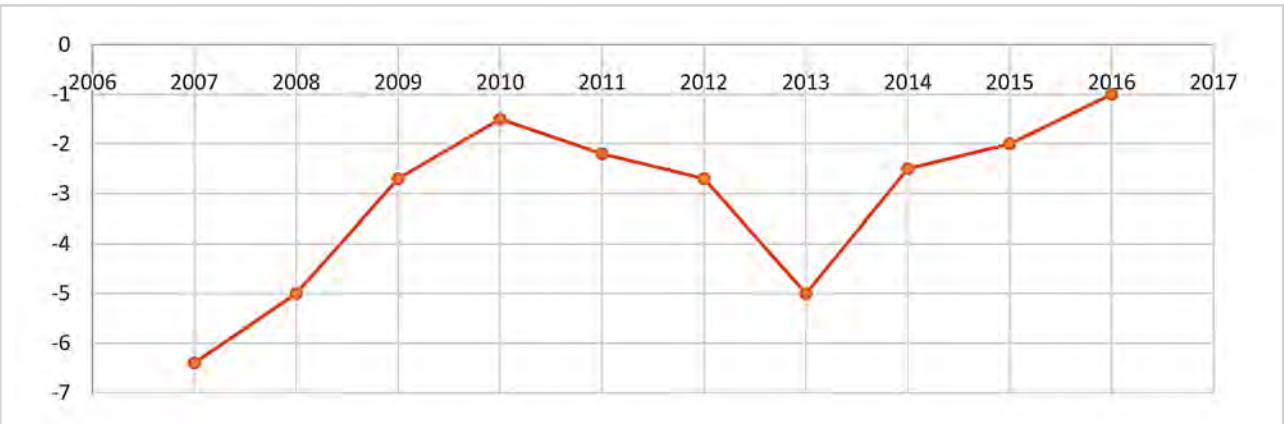

Figure 8:
Current account balance 2007-2016
Source: World Bank Data (2019)

The increase in the current account as a percentage of GDP from 2013 upward is aligned to the increase in the ICT trade balance since 2013, which is shown in Figure 9. This alignment reflects the impact of the ICT trade balance that significantly affects the current account balance. The South African Statistics reveals that ICT contributes 3.0% to the total GDP (Stats SA, 2019)

Percentage of Computer and communications trade balance between exports and imports against CAB as a percentage of GDP displays as follow. Figure 10 below shows that COM trade balance significantly affects the current account balance.

Compared to previous research, the current study emphasises the role of technological transformation in affecting the sustainability deficit of the current account in South Africa. However, the government of South Africa should be able to determine specific variables that cause deficit of the current balance at any point of time in order to manage them efficiently. Since the deficit of the current account in South Africa is mostly related to FDI and the trade balance, the current study suggests an increase in the ICT and computer exports compared to imports as solution for the current account balance equilibrium at the domestic level. At the global level, international institutions, such as the World Bank and the IMF can still assist South Africa in the case of foreign exchange challenges.

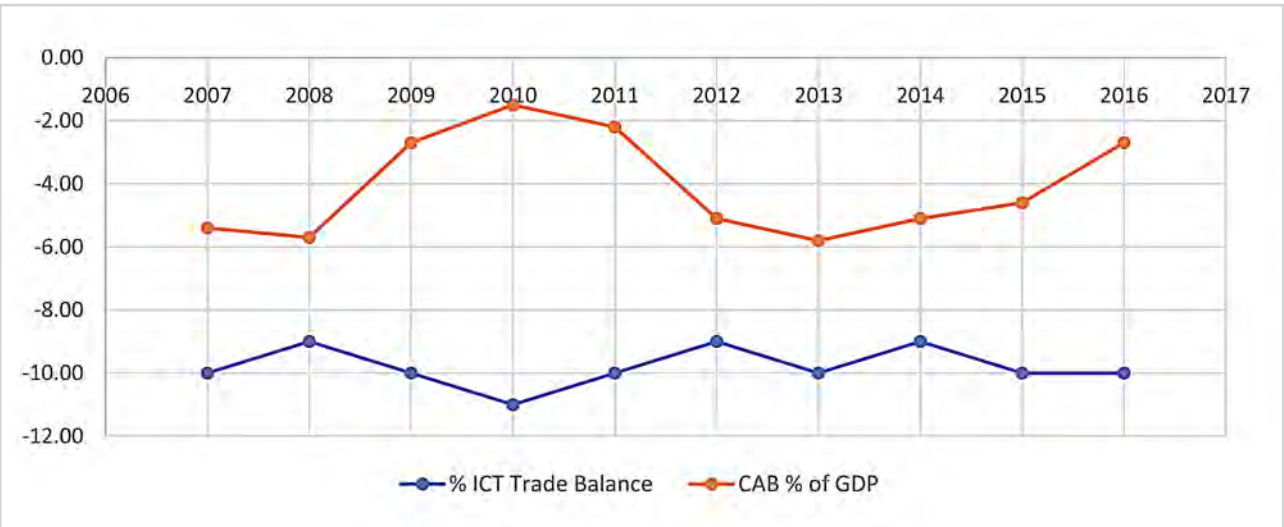

Figure 9:
ICT trade Balance Vs CAB, 2007-2016
Source: World Bank Data (2019)

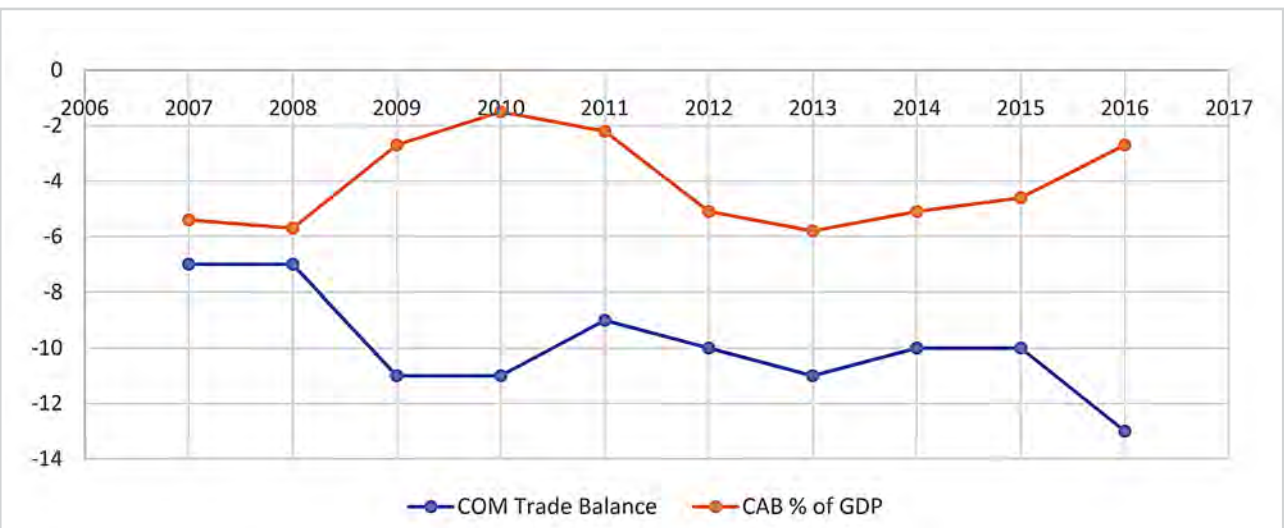

Figure 10:
COM trade balance Vs CAB, 2007-2016
Source: World Bank Data (2019)

6. Other factors impacting economic growth in South Africa

6.1. Policy strategies

The research of ICT Africa institution primarily seeks for building an African knowledge development based on a sound ICT policy and regulatory design aligned with efficient monitoring and implementation of processes (Gillwald, Moyo, & Stork, 2012). Improvement of the trading policies in South Africa will continuously enhance and help to manage both short-term and long-term investments to limit capital expenditures. Monetary policies, as defined by the South African Reserves Bank (SARB), builds up financial stability. Additionally, trading policies need to be well-structured to rather attract new investors and foster the competition instead of promoting trade barriers. Update of fiscal policies is also required to alleviate the tax burden either in terms of local or international transactions. Trading policies should promote a market-orientated system and reduce exchange controls as well as restrictive trade measures that compromise the equilibrium of the balance of payments. Since 1994, the following four programmes have been innovated to improve the employment rate, structural change and growth in South Africa as highlighted by Freytag (2008):

- the Reconstruction and Development Programme (RDP);
- the Growth, Employment and Redistribution Strategy (GEAR);
- the Accelerated and Shared Growth Initiative for South Africa (AsgiSA);
- the National Industrial Policy Framework (NIPF).

Although these are all national policy frameworks, some programmes, such as the NIPF, are directed to support targeted industries that promote internal growth, including the automotive industry, the metal processing industry and the textile industry among others. Draper and Alves (2007) argue that the DTI plan is not detailed enough to show the reason for choosing specific industries among many in South Africa. The question is how these industries are selected. This approach might easily lead to economic risks and corruption in a sense that supported industries may become dependent on the support from the government and thus limit their market penetration and performance (Freytag, 2008). Empirical evidence further showed that the more the government supports targeted industry the more the structural change is repressed overtime (Sally, 2008).

6.2. Political and currency stability

As the world is going through digital disruption through technological innovation and advancement, the ability of the USA to impact world interest rates is a highly disruptive factor in the economic sector of South Africa. The Rand's value is controlled by the Dollar's value. Currency stability towards the US Dollar is, of course, significant in protecting the balance of the current account. Although it is difficult to define the real effective exchange rate because of diverse constituents such as an increase in real commodity prices and net foreign wealth or improvement of the fiscal balance among others, the South African Reserve Bank can define policy measures that can adjust the exchange market. This will allow market forces to set a free exchange rate to attract foreign investors and not the decision makers to enforce rates and continuous adjustments. Freedom House (2008) also considered indicators such as civil liberties and political rights in improving growth. The level of corruption in the country is somehow linked to the degree of lobbying and is critical in promoting the country's image around the world (Coates, Heckelman, & Wilson, 2011).

6.3. Sophisticated IT system deployment

Known as the best disruptor in the current world, technological shift created by the digitalisation also affects the equilibrium of the economic growth. Using effective system deployment at the level of industries and the government makes it possible to achieve the following results to leverage productivity and profitability in South Africa:

- optimisation and stabilisation of the existing import and export tariff structure using efficient valuation method;
- minimisation of cost and maximisation of profit;
- management of foreign direct investment in South Africa;
- detecting of inadequacies in smart technology systems trade;
- stabilisation of the exchange rate through management and rationalisation of market forces;

- implementation of pilot systems per province with their possible integration and consolidation at the country level;
- computerisation of administrative and trading processes in order to achieve better results;
- automatic generation of performance reports for analysis and early adjustment where required.

7. Conclusions

Development and technological changes lead to dynamic economic thinking that governs the need to get aligned with the global change. Every economic sector is now using smart technologies and invests on technology innovation to improve efficiency and profitability. At present, the ICT sector in South Africa is larger than the agricultural industry, as published by the SA Stats (2019). This article has highlighted the role of the current account in increasing the economic growth of South Africa through technological development. The research findings show that 52.93% of GDP is explained by dependent variables, namely FDI, ICTTB and COMTB as well as the current account balance. Data interpretation leads to a conclusion that the deficit of the sustainability of the ICT trade balance of the current account deficit has been mostly due to a higher rate of imports compared to exports.

Increasing exports and imports control as well as developing financial systems in addition to relevant trading policies and banking regulations are the key elements to boost the economic performance in South Africa. The government of South Africa should implement strong strategies and policies to sustain the equilibrium of the overall balance of payment and thus to eliminate the current account deficit. Deficiencies in the domestic economy, as well as exchange controls, need to be restructured to attract foreign investors and solve the problem of the trade deficit in the long run. South Africa still has an opportunity to maintain economic growth through restructuring of the existing reforms and programmes. However, adjustment of economic programmes also requires digital change through implementation of a sophisticated enterprise resource planning system to optimise economic performance.

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