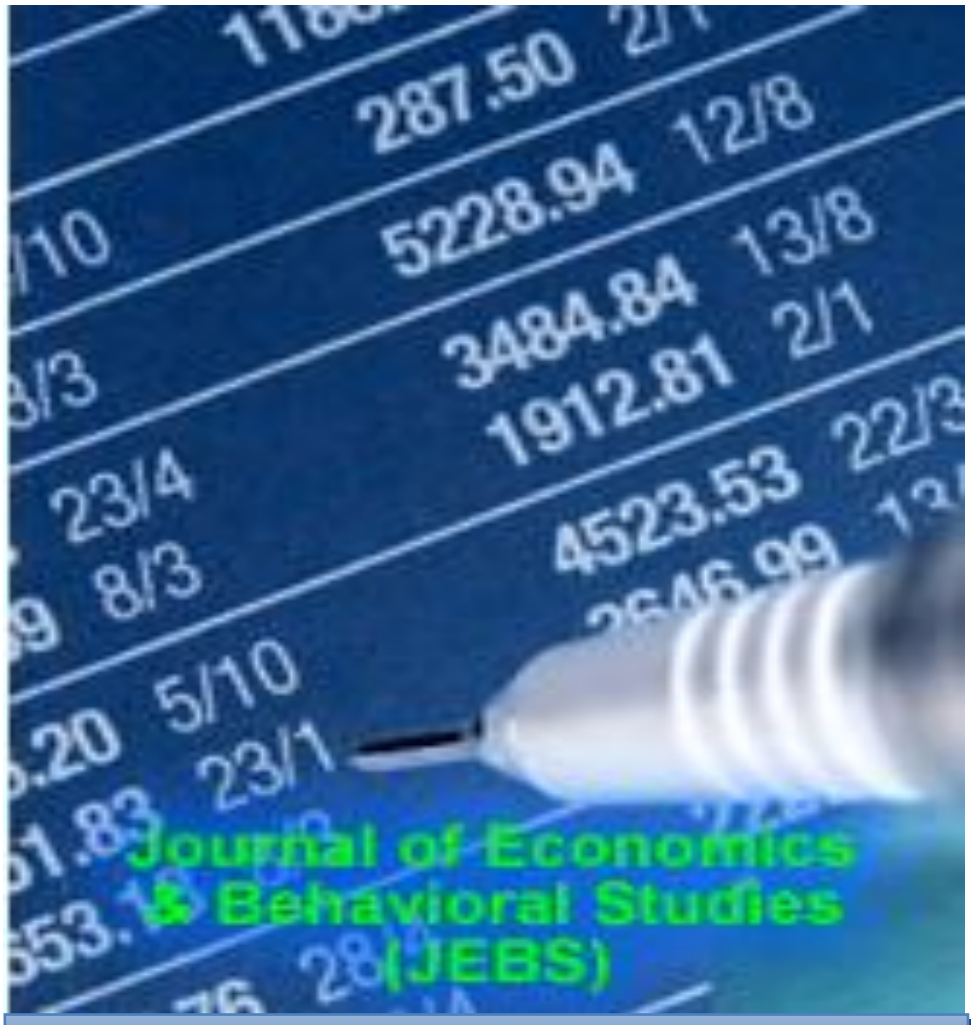


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**Editorial**

Journal of Economics and Behavioral Studies (JEBS) provides distinct avenue for quality research in the ever-changing fields of economics & behavioral studies and related disciplines. Research work submitted for publication consideration should not merely limited to conceptualization of economics and behavioral developments but comprise interdisciplinary and multi-facet approaches to economics and behavioral theories and practices as well as general transformations in the fields. Scope of the JEBS includes: subjects of managerial economics, financial economics, development economics, finance, economics, financial psychology, strategic management, organizational behavior, human behavior, marketing, human resource management and behavioral finance. Author(s) should declare that work submitted to the journal is original, not under consideration for publication by another journal and that all listed authors approve its submission to JEBS. Author (s) can submit: Research Paper, Conceptual Paper, Case Studies and Book Review. Journal received research submission related to all aspects of major themes and tracks. All submitted papers were first assessed by the editorial team for relevance and originality of the work and blindly peer-reviewed by the external reviewers depending on the subject matter of the paper. After the rigorous peer-review process, the submitted papers were selected based on originality, significance, and clarity of the purpose. The current issue of JEBS comprises papers of scholars from USA, South Africa, Saudi Arabia, Malaysia, Sierra Leone and Nigeria. The Confusing World of Cryptocurrency and Tax Compliance Issues, Business Cycles and Growth of South African Steel Manufacturing Industry, Impact of Perceived Quality of E-Health Services on Patient Behavioral Intention to Use E-Health Services, Corruption Trends and Graft Control Progress and FDI and Environmental Quality-Growth Nexus in the Nigerian Economy were some of the major practices and concepts examined in these studies. The current issue will therefore be a unique offer where scholars will be able to appreciate the latest results in their field of expertise and to acquire additional knowledge in other relevant fields.

Editor In Chief

Prof Dr Ijaz

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# The Confusing World of Cryptocurrency and Tax Compliance Issues

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**Abstract:** Subtitle A, of the Internal Revenue Code (IRC), contains regulatory provisions regarding the federal taxes imposed on the income of both individuals and corporations. The IRC guidance is intended to provide a determination of all income that must be reported on tax returns and potentially could become subject to an income tax. A new form of currency, known as cryptocurrency appeared on mainstream trading platforms beginning in 2009. Bitcoin initially was the most widely recognized digital currency but other virtual currency versions soon followed. Initially, taxpayers mistakenly believed that cryptocurrency transactions were not subject to Subtitle A of the IRC. Therefore, crypto transactions were assumed to be non-taxable and non-reportable for tax purposes. However, within a few years of the introduction of Bitcoin into the US economic system, the Internal Revenue Service (IRS) introduced tax guidance pertaining to cryptocurrency transactions. In 2014, the IRS responded with Notice 2014-21 as the popularity of Bitcoin grew exponentially. The IRC guidance stated that cryptocurrency must be treated as property for federal tax purposes. The tax implication of the IRS guidance was that cryptocurrency transactions would result in either a gain or loss for tax purposes on Schedule D. This guidance resulted in a recognition that all cryptocurrency transactions would be subject to federal income tax.

**Keywords:** *Cryptocurrency, tax evasion, analytics.*

## 1. Introduction

The IRS began targeting cryptocurrency users once the use of cryptocurrency, as an acceptable form of payment, became commonplace. Beginning in 2020, the IRS added a question to the front page of the 1040 tax form asking taxpayers, "At any time during 2020, did you receive, sell, send, exchange, or otherwise acquire any financial interest in any virtual currency" (Baker & McKinney, 2021). While technologies like crypto and non-fungible tokens (NFTs) are designed to be invisible, the mainstream use of these novel payment forms warranted an enhanced investigation by the IRS regarding the tax consequences of cryptocurrency exchanges. The IRS needed to infuse data analytic technology into the tax audit process in an attempt to identify questionable transactions that would fall within the realm of novel cryptocurrency taxable transactions (Aued, 2021). Some recent technological advances that are now embedded within IRS audit guidelines focus on providing the IRS with enhanced investigative tools. These advanced tools are designed to uncover problematic crypto transactions that had been previously hidden from the focus of the tax auditors (Gilman, 2021). With the infusion of advanced technology, like data analytics and artificial intelligence into the IRS' toolbox, these technological advances will enable the IRS in to sift through billions of transactions in the digital world and make the tax audit process more efficient for investigators (Cohn, 2021).

## 2. The Complex Definition of Cryptocurrency

Cryptocurrency has been defined as a decentralized digital form of money that utilizes the blockchain technology process (Ashford & Schmidt, 2020). Cryptocurrency is viewed as an alternative monetary system by many economists throughout the world and has the unique ability to limit the amount of substitute monetary supply (Edison, 2021). Cryptocurrency can be used for day-to-day routine household purchases or, more commonly, as an investment similar to equity purchases (Ashford & Schmidt, 2020). According to the Open Markets Institute, the most recognizable cryptocurrency, Bitcoin, (BTC) was first introduced to the world of finance in 2008. Interestingly, cryptocurrency is not managed by any oversight akin to the US Dollar or the Euro but is essentially managed via the internet by crypto users (Ashford & Schmidt, 2020). The cryptocurrency exchanges capture individual transactions via a computer program known as blockchain. All transactions are recorded essentially online in "blocks" and then are linked together in a "chain" now known familiarly as" blockchain" (Ashford & Schmidt, 2020). Now, interestingly, you cannot hold or see cryptocurrencies like Bitcoin, but the cryptocurrency is available in an investor's online crypto wallet

(Gilman, 2021). Therefore, cryptocurrency is essentially a currency driven by a market perception of value along with the virtual currency's ability to be used as a unit of exchange for commerce (Kelleher, 2021). It is difficult to "value" a cryptocurrency like bitcoin because it requires the market to predict the adoption rate of bitcoin as an international form of currency which is a subjective valuation process at best (Kelleher, 2021).

**3. Why is Cryptocurrency a Problematic Tax Issue?**

The major difficulty cryptocurrency poses to the IRS is the failure of tax regulators to conceptualize what cryptocurrency really represents as it pertains to a taxable event. In addition, the anonymity of the ownership of cryptocurrency provides ample opportunity for taxpayers to engage in unique and at times problematic transactions resulting in the IRS being unable to identify the taxpayer involved. Most often, unless the IRS is notified by a reporting third party, the questionable transaction becomes essentially an invisible event. Adding to the complexity of the cryptocurrency discussion is the failure of the IRS to provide clear guidance pertaining to the tax consequences of cryptocurrency trades and exchanges. For example, there is much confusion as to whether cryptocurrency transactions should be viewed as a form of money, or as a security. Depending on the viewpoint, some cryptocurrency transactions identified as security transactions would fall under the trading requirements of the Security and Exchange Commission (Baker & McKinney, 2021). To add an additional layer of confusion to the cryptocurrency world, some participants view cryptocurrency as a "like-kind"1031 deferred taxable event (Steverman, Ballentine & Moore, 2021). Interestingly, the IRS does not view cryptocurrency as an actual currency, but rather as a capital asset (Baker & McKinney, 2021).

Given that perspective, cryptocurrency should be reported at the acquisition cost and if at a later date, the cryptocurrency is exchanged for another asset, a potential gain or loss may result (Cohn, 2021). In 2020, the IRS included a specific question on individuals' 1040 tax forms regarding whether the taxpayer engaged in any virtual currency transactions during the year (Baker & McKinney, 2021). The IRS queried each taxpayer on whether they engaged in the buying, selling, exchanging or disposition of virtual currency during the 2020 tax year (Baker & McKinney, 2021). The IRS estimates that during the 2021 tax year, taxpayers aggregating 18-20 million will answer yes to these virtual tax questions (Baker & McKinney, 2021). The reporting problem faced by the IRS regarding these virtual transactions is their reliance on the truthfulness of the taxpayer to essentially "self-report" their virtual currency transactions. But taxpayers should be aware, that failing to respond truthfully to that question on your 1040 tax return could make the taxpayer subject to both civil and criminal tax fraud (Baker & McKinney, 2021). The lack of documentation and record-keeping available to the IRS, for audit purposes, and taxpayers, for reporting purposes, only creates more of an opportunity for inaccurate virtual transaction reporting.

**What are the Tax Implications of Virtual Currency Transactions?**

The most common way the IRS is advised of a taxable event is through the filing of required tax documents by third parties. All employers must report to the IRS, employee wages on Wage and Tax Forms (W-2) as well as financial institutions who must report all equity trades on Form 1099. The IRS is in the process of drafting tax guidance that would require all cryptocurrency brokers to report any virtual currency transactions to the IRS as well. Congress is currently debating whether any transaction exceeding $10,000 should be required to be reported to the IRS in an attempt to deter tax avoidance schemes (Steverman, Ballentine & Moore, 2021). The intent is for the IRS to be able to levy capital gains taxes resulting from all crypto trades above $10,000. These yet-to-be enacted regulatory guidelines continue to create a confusing compliance landscape for both cryptocurrency brokers and their clients (Steverman, Ballentine & Moore, 2021). To further complicate the current tax environment, the IRS is contemplating embedding unique and unusual tax consequences into these new tax proposal guidelines. For example, using cryptocurrency to purchase either a hot dog or a luxury car, like a Tesla, might result in an increase in the cryptocurrency value exceeding the initial purchase price and thus triggering a capital gain tax event (Steverman, Ballentine & Moore, 2021). Making the tax consequences even more perilous is the fact, that most cryptocurrency users are blissfully unaware of any tax implications when they engage in virtual currency transactions (Baker & McKinney, 2021). It is apparent, that Congress needs to provide clear IRS tax guidance, relating to both reporting and tax filing requirements for all cryptocurrency transactions.

**Unfortunately**, ignorance of the tax law is not a viable defense for any taxpayer attempting to explain their non-compliance with tax guidelines. However, the IRC must provide clear and specific tax reporting guidelines for all taxpayers to follow in the preparation of their tax returns. The mere inclusion of vague references by the IRS to potential taxable events will only serve to create a disgruntled and confused taxpayer. Unclear tax guidance provides incentives for opportunistic tax avoidance strategies aimed at finding ways to circumvent the intent of perceived problematic tax regulations. Interestingly, all taxpayers can engage in tax avoidance activities, it is only when the threshold advances to tax evasion does a fraudulent event occurring. **Unfortunately,** due to the confusion of the ever-evolving crypto world, some taxpayers believe that cryptocurrency transactions are unfairly being subjected to "double taxation" (Baker & McKinney, 2021). Both a vendor, who would be required to report revenue received and a buyer, who would be required to report any potential gain on asset value appreciation for the transaction, will both be required to pay taxes on the same transaction (Baker & McKinney, 2021). The perception of an unfair double taxation result will create a potential public relations nightmare for Congress and the IRS, which they will need to correct if they expect to rely on self-reporting crypto taxpayers.

**IRS Options Regarding Cryptocurrency Tax Compliance**

The IRS has a plethora of tax tools available to them as they attempt to navigate the uncharted terrain of cryptocurrency transactions. Tax amnesty opportunities have been a popular option the IRS has offered taxpayers for many years in an attempt to encourage self-reporting of foreign account disclosures (Baker & McKinney, 2021). The IRS is currently contemplating a similar tax amnesty strategy for unreported cryptocurrency transactions. Taxpayers may soon be offered an opportunity to voluntarily disclose unreported crypto accounts and transactions without fear of reprisals by the IRS (Baker & McKinney, 2021). Additionally, the IRS has to its' avail, the tax whistleblower statute. This statute provides a crypto vendor, an incentive of 30% of any tax collected if the vendor reports a crypto transaction to the IRS that they identified as a tax evasion transaction (Baker & McKinney, 2021). The Biden administration is currently reviewing proposals that would increase the IRS' tax enforcement budget aimed at requiring banks and other financial institutions to report information regarding all customer account activity including any cryptocurrency transactions (Cohn, 2021).

Additionally, the IRS is increasing its use of Artificial Intelligence (AI) and data manipulation opportunities to better identify patterns of tax evasion behavior as it relates to the world of cryptocurrency (Cohn, 2021). Interestingly, the IRS has required taxpayers, for many years, to self-report cryptocurrency transactions on their tax returns with little success. As a result of the stepped-up focus on crypto transactions, the apparent game of "hide and seek" played throughout the crypto world is coming to a close and the resulting tax consequences are beginning to loom large. Unfortunately, the IRS grasp does not extend at the moment beyond the US coastline. There is concern that many crypto investors will merely relocate to the secret world of offshore tax havens and continue to evade the tax implications of cryptocurrency. For example, if a taxpayer relocates to Puerto Rico, capital gains transactions are 100% tax-free which would include cryptocurrency transactions (Smith, 2019). Whether the crypto tax evaders will be successful in transferring massive amounts of crypto assets offshore remains uncertain. Lately, countries like Switzerland have been required to disclose to the US government the names of American clients who are banking in their financial institutions in an attempt to further restrict foreign tax evasion options (Steverman, Ballentine and Moore, 2021).

**4. Cryptocurrency Tax Basics**

The IRS applies the IRC Sec. 61 (a) (3) when addressing their authorization to oversee cryptocurrency transactions (Turrin, 2021). The IRC guidance requires taxpayers to report, as gross income, all worldwide income regardless of the source. The 2021 tax return will continue to mandate that taxpayers self-report any cryptocurrency transactions at the top of their 1040 tax form. Additionally, the IRS requires that taxpayers report any crypto transactions on form 8949. Form 8949 will provide the taxpayer with the required steps to follow in the calculation of any reportable capital gains or losses (Royal, 2021). The short-term capital gains rate is the same as ordinary income rates but, the long-term capital gains tax rates range from 0%-20% as determined by a taxpayer's ordinary tax rate. Interestingly, the IRS recently narrowed the reporting

requirement by excluding any taxpayer who purchased virtual currency with real currency from answering yes on their 1040 form. Additionally, the IRS does not exclude taxpayers from reporting transactions merely because they did not receive a 1099 form from their broker. Furthermore, the IRS has determined that any inherited cryptocurrency will be treated the same as any inherited property and will only be subject to estate taxes if the value of the estate exceeds the IRS taxable threshold of $11.7 million in 2021. Similarly, cryptocurrency gifts are subject to the same tax rules as any gift and will only be subject to a gift tax once the value of the crypto gift exceeds $15,000 in 2021. The federal tax rates for 2021 for capital gains according to the IRS are as follows:

**Table 1: Long-Term Capital Gains Rates**

| Tax Rate | Single Income | Married Filing Jointly Income | Head of Household Income |
|---|---|---|---|
| 0% | $0-$40,400 | $0-$80,800 | $0-$54,100 |
| 15% | $40,401-$445,850 | $80,801-$501,600 | $54,101-$473,750 |
| 20% | >$445,850 | >$501,600 | >$473,750 |

**Short-Term Capital Gains Rates = Ordinary Income Tax Rates**

| Tax Rate | Single Income | Married Filing Jointly Income | Head of Household Income |
|---|---|---|---|
| 10% | $0-$9,950 | $0-$19,900 | $0-$14,200 |
| 12% | $9,951-$40,525 | $19,910-$81,050 | $14,201-$54,200 |
| 22% | $40,526-$86,375 | $81,051-$172,750 | $54,201-$86,350 |
| 24% | $86,376-$164,925 | $172,751-$329,850 | $86,351-$164,900 |
| 32% | $164,926-$209,425 | $329,851-$418,850 | $164,901-$209,400 |
| 35% | $209,426-$523,600 | $418,851-$628,300 | $209,401-$523,600 |
| 37% | >$523,600 | >$628,300 | >$523,500 |

## 5. Conclusion

The IRS attempted to deal with the problematic taxation of virtual crypto transactions in Notice 2014-21, which provides that cryptocurrency be treated as property for federal tax purposes (Lerer, 2019). As a result of that guidance, taxpayers must recognize capital exchange gains or losses on the trades or barters of cryptocurrency for cash or other property (Lerer, 2019). According to the IRS, the sale or other exchange of virtual currencies, or the use of virtual currencies to pay for goods or services, or holding virtual currencies as an investment, generally has tax consequences that could result in tax liability. The current inaccurate view held by many in the world of crypto transactions, that these transactions fall outside the radar of the Internal Revenue Code is quickly being rectified by additional IRS guidance. The IRS is attempting to institute regulatory guidance that would better provide for the accurate reporting and fair taxation of any virtual crypto transaction. Unfortunately, the current IRS guidance creates a landscape of tax compliance uncertainty creating an opportunity for the unintended consequences of creative crypto tax avoidance strategies.

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# Business Cycles and Growth of South African Steel Manufacturing Industry

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**Abstract:** The paper studies the relationship between the South African business cycle and the performance of the steel industry. The analysis was conducted by first providing a brief bibliometric review of the definitions used for business cycles in literature. From this initial analysis, emerging themes were used to define the narrative literature review on the relationship between business cycles, economic growth, and supply-demand of the steel industry. Findings from the review, indicate a binary relationship between economic growth and steel industry output. It is recommended that future studies be done on quantitative analysis of the binary and ternary relationships between economic growth and other primary manufacturing industries in South Africa.

**Keywords**: *Steel, Economic Growth, Narrative Literature Review, South Africa.*

## 1. Introduction

The pivotal role played by primary industries in the creation of the industrialization infrastructure of any country is clearly understood. The steel industry has been just such a driver in all countries during and after the industrial revolutions in most western countries. South Africa is no exception to the basic economic growth theory, and it is unequivocal that the establishment of a viable domestic steel industry played a pivotal role in the development of a vibrant economy in the country from the 1900s onwards. Studies by Muchaonyerwa & Choga (2015), Pheng and Hou (2019), Maduku (2019) and Bonga & Kinfack (2020) link trade, industry activities and associated business cycle movements in African economies. These studies conducted found that trade and industry output performance was associated with business cycle movements. This paper aims to provide new insights into the relationship between economic growth, steel industry movements and business cycle trends in South Africa. The link between business cycles and economic growth has been central to many macroeconomic studies. Considering the existing literature, there is a need to go beyond the dichotomy and further explore the relationship between business cycles and economic industry outputs. The general objective of this paper is to identify the factors that enhanced or reduced the business cycle movements between the South African economy and its steel industry.

The paper investigates if business cycle movements were a result of decreasing level of steel manufacturing in South Africa or because of the overall decline in the manufacturing industry's contribution to the Gross Domestic Product (GDP). The objective was achieved by exploring the following:

- Defining the link between the economic activities and business cycle movements between 1960 and 2018 in South Africa.
- Analyzing the impact of steel demand and supply on the business cycles movements, and
- Examining the link between the steel price and steel demand divergence or convergence in South Africa.

The paper does not develop or apply econometric models to measure the business cycle and steel industry performance cycle between 1960 and 2018. The methodology used to analyze the paper's objectives is centered on the narrative literature review that Stanley (2001) and Brodeur et al. (2020) note that economics-related literature reviews do not contain explicit meta-analysis data and can present research that economists can use to inform academic and policy debates. Narrative literature reviews are called by Green et al. (2006) and Vicki et al. (2020) unsystematic literature reviews that synthesize previously published information. Findings from the review can be used to inform an analysis of the steel industry's economics-related gaps and areas that require further exploration by researchers.

## 2. Methodology

A narrative review of the business cycle movement and its relationship with the steel industry was conducted, informed using published empirical research. The first phase of the narrative literature was undertaken was a bibliometric analysis of the business cycle definitions in the literature. The bibliometric analysis was selected because literature is characterized by heterogeneity definitions of the business cycle. The different definitions are synthesized into themes that were used to develop linkages between business cycle movements and the South African steel industry. The second and last phase involved analysis of empirical literature including papers and steel industry publications that detail the movements in the South African economy and steel industry were imported into EndNote and data was extracted using tools developed in Microsoft Office. The approach taken is similar to that undertaken by Meagher (2013), Shiller (2017), Arruda et al. (2021) and Saz-Gil et al. (2021) by: defining the keywords that were used in the study, synthesis of emerging trends, analysis of findings from literature and making recommendations for further research.

**Organization of the Paper:** The paper is structured as follows: Section 2 summarizes the bibliometric analysis that was conducted for the study. Section 2 focuses on the theoretical literature on economic cycles and the South African steel industry. Section 3 discusses the impact of the steel manufacturing industry on economic growth from literature analysis. Section 4 focuses on the literature that describes the relationship between the elasticity of the steel sector and economic growth. Section 5 discusses the findings from the literature review on the steel industry equilibrium. Section 6 summarizes the paper, discusses implications, and suggests future research.

**Definitions:** To determine the synthesis of the review, as part of the bibliometric analysis. An overview of the most common definitions of business cycles used is articulated in Table 1, which shows the heterogeneity of definitions used in the literature.

**Table 1: Terminology and Definition in the Literature**

| Terminology | Definition |
|---|---|
| **Business Cycles** | "Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle." (Burns & Mitchell, 1946)<br>"Business cycles are defined as the fluctuations that occur in economic activities in countries where business organizations are mainly commercial or industrial." (Greenwald,1982)<br>"A business cycle is defined as a circular process of the growth and decline of a nation's economy over a period." (Bookbinder & Einleger, 2001)<br>"The business cycle is defined as a regular and oscillatory movement in economic output within a specified range of periodicities." (Cotis & Coppel, 2005)<br>" Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration, business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own."(Skare & Stjepanovic, 2015) |

An analysis of the conceptualization of the definitions of the business cycle in Table 1 discerned several recurring themes that reflect the two central elements. The first theme refers to the fluctuating or cyclic nature of the business cycles. The cyclical nature of fluctuations was explained by Cotis & Coppel (2005) in terms of expansions and contractions in the level of economic activity, typically measured by Gross Domestic Product (GDP), which are influenced by the dynamics of macroeconomic indicators (i.e., output, unemployment, consumption, investment, and prices (Zalgiryte and Giziene, 2014). The second theme refers

to the economic activity being the base of the business cycles. Gehringer & Mayer (2021) postulate that economic activity is a broad and abstract concept that looks at different industry outputs from a multidimensional perspective. In this regard, the paper focuses on economic activity related to steel production, the correlations between GDP movements over time with changes in demand and supply.

**Business Cycles and The Steel Industry:** In an attempt to properly understand the dynamics that contributed to the steel industry in South Africa over the last decade, it is important to explore the theoretical dynamics underpinning a viable and sustainable economy as a benchmark for comparison, as well as to scrutinize the changes in the operating environment in which the steel industry is required to function. This proposition is supported by both Chadha (1989), and Ra (2008), who found in their research that there is a direct causal relationship between steel consumption and economic growth in the countries they surveyed, primarily because steel is one of the basic components or building blocks of many, if not all, industries such as construction, industry, and manufacture of household machinery and equipment. In support of this proposition, Kapila and Kapila (2007), suggest that steel is one of the key sectors of the economy in terms of infrastructure development and that therefore any changes in economic performance, such as a recession, could result in volatile demand and supply of steel.

Researchers Meny, Wright and Rhodes (1987), identified a direct and positive correlation between the cyclic nature of the economies of several Western European countries in the 1970s and its impact on steel production volumes and steel prices. Similarly, Jones (2017), concludes that the steel industry is sensitive to trade-related disturbances, business cycle fluctuations and other market conditions that might result in excess capacity or deficiency. Business cycles are defined by Greenwald (1982), amongst others, as the fluctuations that occur in economic activities in countries where business organizations are mainly commercial or industrial. Bookbinder and Einleger (2001), define a business cycle as a circular process of the growth and decline of a nation's economy over a period. This description is supported by Scheiblecker (2008), who describes a business cycle as the type of fluctuation found in the aggregated economic activity of a country consisting of contractions and revivals which merge into the next economic cycle.

Arnold (2015), suggests that a business cycle consists of five phases:

- The contraction or recession phase can be described as the phase in which there is a decrease in the real gross domestic product for three consecutive quarters.
- The trough phase refers to the stage when the lowest point of a contraction phase is reached, and which lasts for a period of time before the economy turns around and grows.
- The recovery phase during which the real gross domestic product increases and becomes positive moving up from the trough and recession phases.
- The peak phase is the highest phase of the real gross domestic product, indicating a growth in the economy; and
- The expansion phase refers to the phase in which there is an increase in the real gross domestic product beyond the peak and recovery phases.

Based on these definitions of the different stages or phases of business cycles, the South African Reserve Bank identifies the different phases by means of three business cycle indicators:

- The leading indicator.
- The coincident indicator; and
- The lagging indicator.

According to Muchaonyerwa and Choga (2015), the leading business cycle indicator is identified by:

- Combining prices of all shares.
- Determining the real money supply.
- Calculating the labor productivity in the manufacturing sector.
- Examining the job vacancy advertisements in newspapers.
- Taking account of the commodity prices in US dollars for a basket of South Africa's export commodities; &
- Conducting an opinion survey of business confidence.

Moolman (2003), explains that the leading business cycle indicator provides insight and predicts the future prospects of the economy whereas the coincident indicator measures the current economic activity with the latest data. Moolman (2003), postulates that the components of the coincident indicator are:

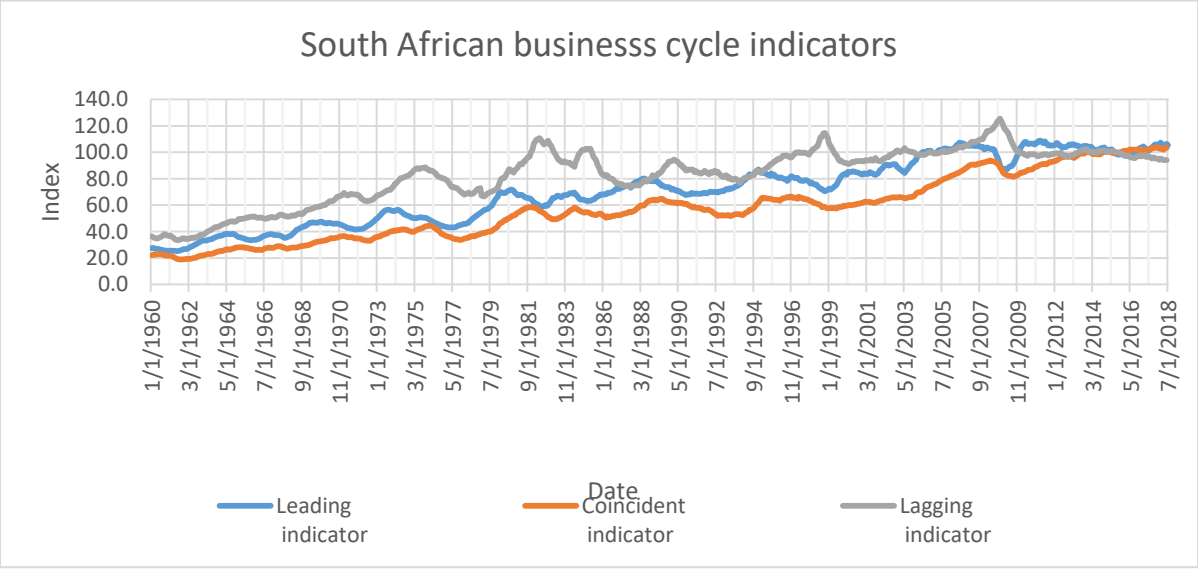
- Reported new vehicle sales.
- Reported retail sales figures.
- Reported wholesale sales figures.
- Manufacturing volume output; and
- The employment rate of the population.

The lagging business cycle indicator is a measure of the historical performance of the economy, according to Muchaonyerwa and Choga (2015), and comprises:

- The inflation rates.
- The ratio between the inventories and inventories to sales,
- The unit labor costs.
- Both short- and long-term interest rates.
- The extent and cost of commercial and industrial loans; and
- The installments on consumer installment credit.

Another economist, Venter (2005), states that the volume of manufacturing output excludes that of agriculture, fishing, and forestry. The calculation of production capacity in the manufacturing sector includes the output of both the mining and manufacturing sectors plus the amount of electricity generated and the weighted average output of each sector that contributes to the gross domestic product. Against this background, Boshoff (2020), explains that business cycle indicators can be used to analyze the historical, current and expected economic trends, while Mohr (2005), states that if the leading indicators are improving, an increase in business performance can be expected. Likewise, if the coincident indicators are declining, it can be concluded that the economic conditions are deteriorating.

**Figure 1: South African Business Cycle Indicators**




**Source:** (Reserve Bank, September 2018).

As indicated in Figure 1, there has been a steady increase in the length and duration of the leading and coincidental business cycle over the years from 1960 to 2018. The South African economy demonstrated substantial peaks and troughs with specific lengths and durations in months during the same period, but more so during the shorter periods between 1980 and 1982, and again between 1997 and 2002. During peak cycles, the economy normally grows in terms of, amongst other factors, an improved employment rate, increased industrial productivity and a reduction in the number of business insolvencies and liquidations.

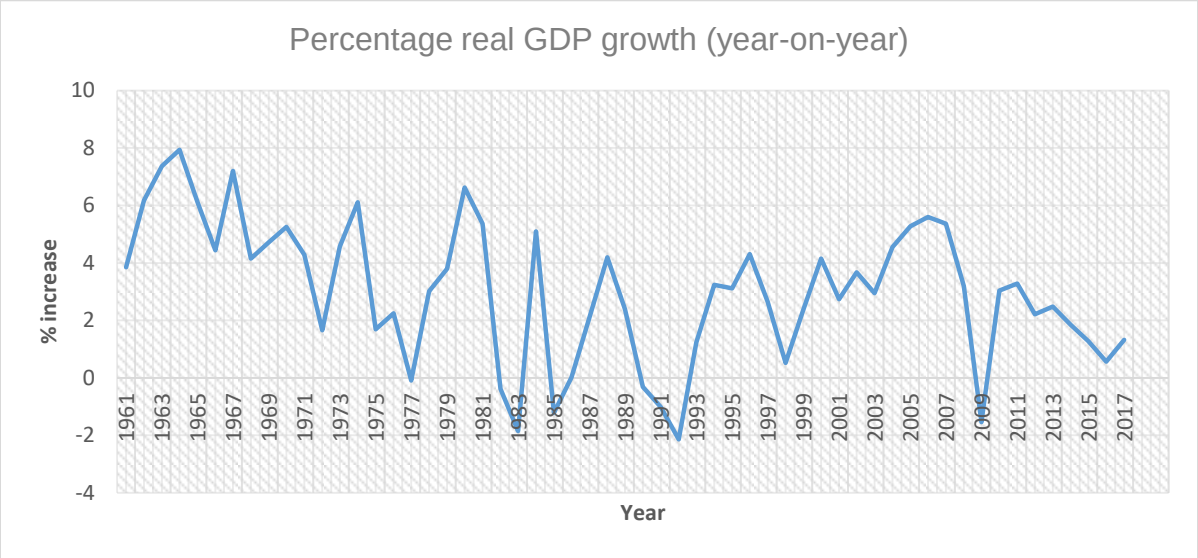
The real gross domestic product growth peak between 1960 and 1962 does not correlate with the peaks of the business cycle indices. This can be attributed to the manner in which the different indices were calculated during that period and the economic assumptions that were used in the calculation of the indices. Gidlow (1995) states that during the early 1960s the political disturbances of 1960 and 1961 required the South African Reserve Bank to implement fiscal and monetary measures to stimulate economic growth which resulted in the business cycle peaks from 1962 to 1964. The application of monetary policies to stimulate economic growth is an example of endogenous business cycle theories that were applied in the South African economy.

Boshoff (2020) states that business cycle theories can be exogenous or endogenous in nature, depending on whether the business cycle peaks and troughs are driven by internal or endogenous factors, such as a change in monetary policy, or exogenous factors such as floods and droughts. The monetary business cycle theory was developed by Friedman in the 1960s and is explained by Glasner (1997), as reliant on exogenous changes in money supply by the banks to the economy. Friedman theorized that the recovery phase of the gross domestic product starts when the cost of borrowing money falls and there is an increase in the money supply. As a result, the surplus money creates demand for goods, often leading to increases in investment and manufacturing of goods. According to Glasner (1997), and Johnson (1971), credit expansion can induce over-investment activity for a certain period of time which can come to an abrupt end and is referred to as an economic bubble. The impact of the 1960s monetary business cycle theory is evident in the growth of the manufacturing value-added index and gross domestic product that peaked at 9.9% and 6.3% respectively between 1960 and 1965, with annual growth rates of 8.6% and 5.7% respectively (Bell & Madula, 2001). The expansion of the Iscor operations in Pretoria and Newcastle in the early 1970s was an outcome of the monetary policy interventions that were applied during the 1960s business cycle.

The growth in the manufacturing value-added index slowed down between 1970 and 1981 which, according to Bell and Madula (2001), was due to the gold commodity boom in South Africa. The lower manufacturing value-added index did not impact the three business cycle indicators shown in Figure 1. The international demand for gold in the 1970s created an increase in credit borrowings and domestic investment expenditure. Gidlow (1995), states that the increase in the export of gold during the 1970s showed that South Africa could experience longer business cycle peaks before the increase in the supply of money in the economy resulted in inflation. The trade cycle experienced in the 1970s was inherent to the monetary over-investment business cycle theory. Solomou (1990), and Dwivedi (2009), state that an increase in monetary investment in the economy can result in endogenous cycle waves that are referred to as being 'Kondratieff' in nature. Solomou (1990), further elaborates that a Kondratieff business cycle can be caused by high gold and agriculture production as a result of abundant and cheap capital. As shown in Figure 1, South Africa experienced a long upswing business cycle between 1970 and 2009 over a period of 39 years.

Which is close to the 45-year duration of the Kondratieff business cycle that Glasner (1997), noted. The longer peaks that were experienced in the early 1980s, as shown in Figure 1, were mainly attributed to the economic growth that was experienced as a result of the gold commodity boom. Bell and Madula (2001), state that exports of manufactured goods fell during the gold commodity boom but increased from 9.1% in 1983 to 12.7% in 1990. The sectors that contributed to the growth in manufacturing exports were other manufacturing sectors such as electrical machinery and transport equipment, and not necessarily the steel manufacturing sector. The variables that contributed to this growth were endogenous in nature. This is supported by the view of Gidlow (1995), that the South African monetary policies were Keynesian in nature. Botha, Greyling and Marais (2006), state that the Keynesian business cycle of the 1980s and early 1990s was endogenous and that the cycle fluctuations were caused by multiplier and accelerator relationships between the different economic variables. The Keynesian business cycle theory indicates that government must intervene in the economy by applying monetary and fiscal policies that will positively impact the gross domestic product.

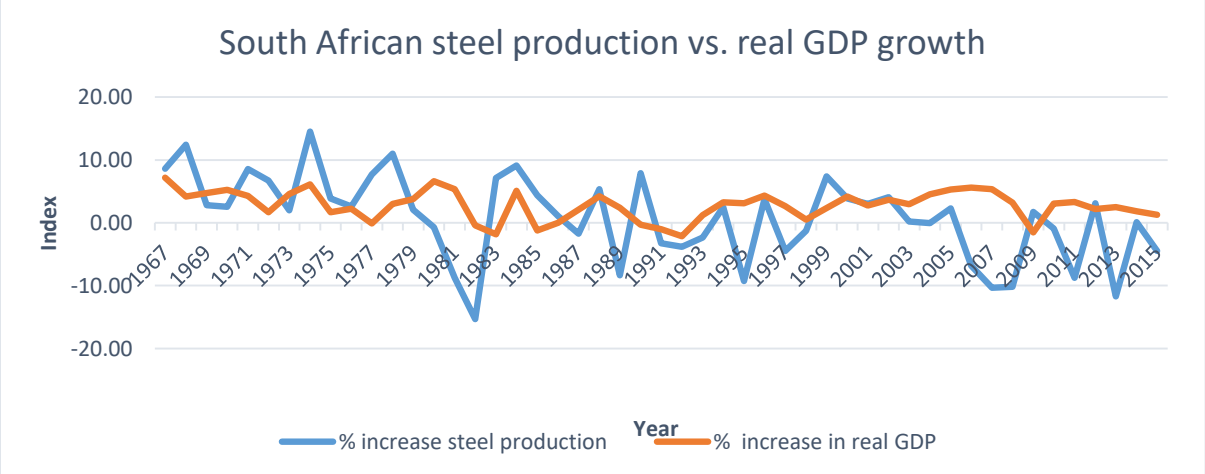
**Figure 2: Annual Percentage Increase of Real Gross Domestic Product from 1961–2017**




**Source:** (Statistics South Africa).

The economic researchers Fulop and Gyomai (2012), suggest that in some countries there is a direct, linear relationship between the economic business cycle indicators such as the gross domestic product and the manufacturing value-add production index. They are also of the opinion that industrial development in these countries plays a pivotal role in promoting the economic development of that country. This proposition is strongly supported by Wan and Thorbecke (1999), Szirman (2011), and Schwarzer (2013), who all agree that industrial development plays a central role in the economic development of countries as stated by Fulop and Gyomai (2012), especially in sectors that are the base of infrastructure development in the country, such as the steel sector. A comparison of the steel production volume output versus the real gross domestic product growth over five decades between 1960 and 2014, as shown in Figure 3, clearly supports the theory of the Kondratieff and Keynesian business cycles that were discussed.

**Figure 3: Comparison of the Rate of South African Steel Production versus Gross Domestic Product Growth**




**Source:** (World Steel Yearbook 1967–2016 and Statistics South Africa).

Figure 3 represents the operational performance of the steel industry and shows substantially greater fluctuation trends than the gross domestic product, which is of some concern as steel production and productivity are unequivocally key drivers of the sustainability of economic growth. In support of this proposition Yu (2015) states that steel is a key feature in economic growth and Hogan (1999), is of the view

that its role can be seen in public and private infrastructure investment, including in the average disposable incomes of households. The critically important role of the steel production industry is clearly demonstrated by the patterns of the per capita public and private infrastructural investment during the past five decades, compared with the economic growth data shown in Table 1 below, which shows a direct relationship between these two variables. The years between 1961 and 1978 also show a positive correlation between gross domestic product growth and infrastructure investment. This corresponds with the percentage increase per annum of domestic steel production during the same period, as shown in Table 1.

**Table 1: South African Real Gross Domestic Product and Public Sector Economic Infrastructure Investment Per Capita**

| Period | GDP per Capita, % Increase per Annum | Economic Infrastructure Investment per Capita, % Increase per Annum | Domestic Steel Production, % Increase per Annum |
|---|---|---|---|
| 1961 – 1976 | 2.2 | 6.0 | 6.5 |
| 1977 – 1978 | -1.0 | -15.7 | 9.3 |
| 1979 – 1982 | 1.5 | 4.0 | -5.7 |
| 1983 – 1993 | -1.4 | -8.1 | 1.4 |
| 1994 – 2002 | 0.9 | 0.3 | 1.1 |
| 2003 – 2008 | 3.2 | 19.3 | -4.1 |
| 2009 | -2.7 | 19.5 | 1.8 |

**Source:** (Perkins, 2011).

The decline in economic growth between 1977 and 1978 had an immense impact on economic infrastructure investment which declined by 15.7% during the period. The impact of this negative economic growth and public infrastructure investment on steel production had a delayed effect as the impact was not immediately visible. The data shown in Table 1 indicates that during the subsequent periods and decades, the steel production had a delayed reaction to the government public sector infrastructure investments. A study conducted by Accenture (2017), and research conducted by Huh (2011), found that international steel consumption measured as a per capita index is generally found to increase in a direct, linear relationship with overall economic growth. More specifically, these studies found that economic growth is related directly to the demand for steel and steel-based products, amongst others, because it is a basic or raw material for sectors such as construction and other industries that are the cornerstone of economic growth. Hogan (1999), supports this argument by stating that economies that have a high demand for steel as an input to the key sectors contributing to economic growth, such as construction and public infrastructure development, tend to increase their steel usage.

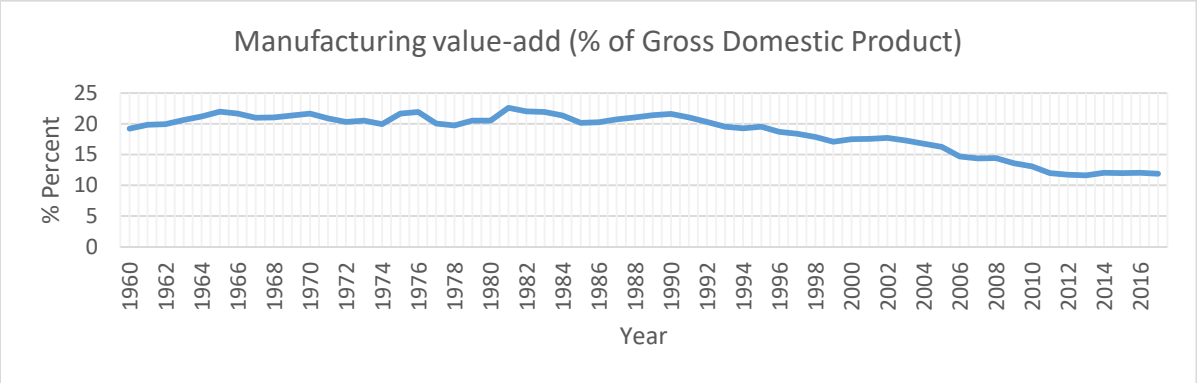
This supposition is expanded upon by Perkins (2011), who points out that in most countries the state or government is the largest investor in infrastructure development and that the government should have a vested interest in securing the sustainability and the viability of the steel production sector. This perspective of Perkins (2011) is confirmed by Aron, Kahn and Kingdon (2009) who state that it was mainly the South African government that, at the time, built, owned and operated steel-intensive sectors such as electricity, road and rail transport, ports, water systems entities, and other social infrastructure that were, and still are, largely operated as state-owned companies. South African state-owned companies such as Transnet, the various water boards and Sanral contributed largely to the companies in the steel sector. However, it would be presumptuous to conclude that public infrastructure investment is the only cause of fluctuation in domestic steel production. The direct relationship between steel sector productivity and economic business cycles has been well documented in the publications of the South African Reserve Bank and the South African Department of Trade and Industry. Public infrastructure spending has clearly been a critically important driver of the economic growth and sustainability of the steel industry over the past five decades.

### 3. Steel Manufacturing Against Economic Growth

Whereas it is abundantly clear from the discussion in the previous section of this paper that economic theorists agree that steel is accepted to be a critical driver and differentiator of economic viability, sustainability, and growth, it is also accepted that there is a delicate reciprocal and interdependent

relationship between the various other differentiators as well as between the various sectors of the economy. It is consequently also accepted that steel is not the only driver or differentiator of economic sustainability or growth. This supposition is demonstrated by the knowledge that even though steel production declined between 1979 and 1983, the contribution to the gross domestic product and the manufacturing sector during the same period, remained in excess of 20%, during this period. Data shown in Figure 4 indicates that the manufacturing sector contributed between 20% and 25% of the gross domestic product between 1960 and 1980. The generally held view and that of Bell and Madula (2001), is that other manufacturing sectors such as the mineral beneficiation and related industries sustained the economy during that period.

**Figure 4: Manufacturing Sector Contribution to Gross Domestic Product from 1960–2007**




*Source: (World Bank data, 2018).*

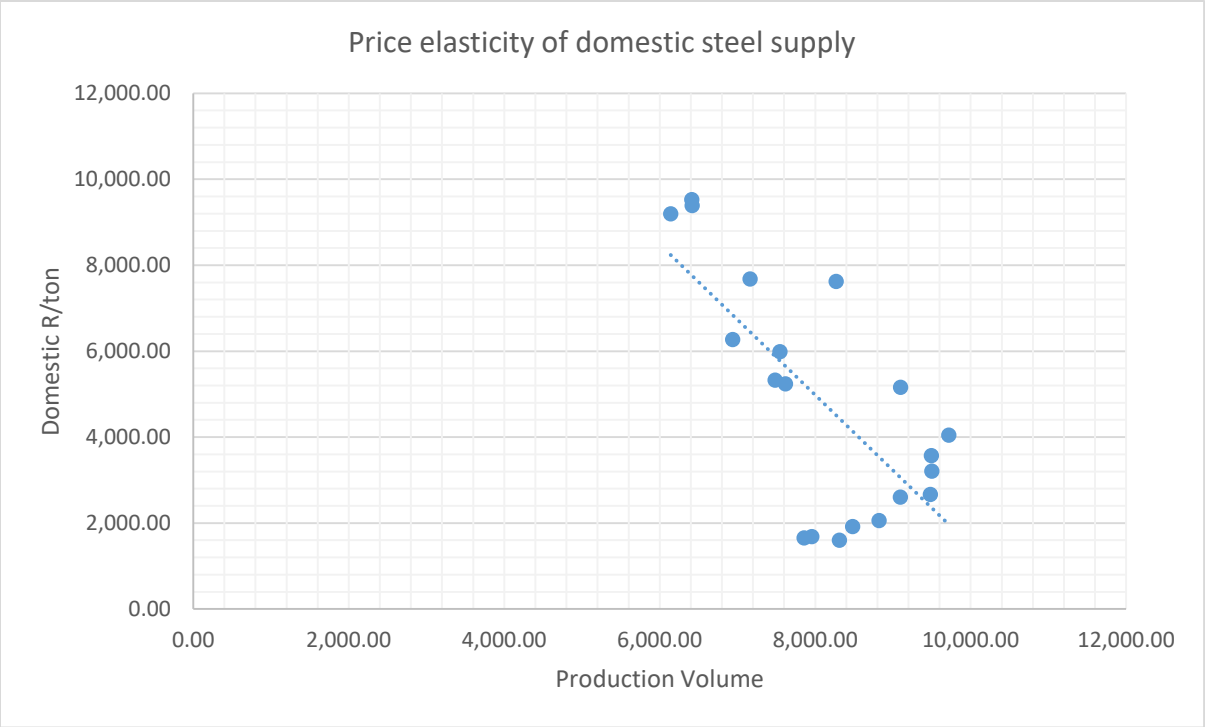
The importance of steel in assuring economic sustainability and growth is borne out by the fact that the marginal growth of an average of 1% per annum of steel production between 1983 and 2003, correlates closely with the decline, expressed as a percentage of the overall economy, of the manufacturing sector during that period. The information provided in Table 1 also indicates that public infrastructure investment during the same period declined by 8% due to high government debt arising from foreign loans. In the context of this information, Bond (2019), explains that the majority of capital-intensive projects in the 1960s, 1970s and the early 1980s, were financed by means of foreign loans. Between 1976 and 1983, the International Monetary Fund approved loans for South Africa of nearly $2 billion. Similarly, Camdessus (2000) records that between 1976 and 1983 the International Monetary Fund provided South Africa with continuous, so-called 'standby' funding agreements and loan drawdowns which allowed the government to access funds with ease. Other private international banks, including the World Bank, provided South Africa with similar funding agreements resulting in the national debt crisis of 1985. According to Bradlow (2017), South Africa's debt was $16.9 billion in 1980, which was 20% of gross domestic product, and increased to $24.3 billion in 1984, which was nearly 46% of the gross domestic product.

Adding to this bleak picture of economic decline, Hirsh (1989), records that South Africa's foreign debt was $18 889 million and its short-term foreign debt was $10 573 million in 1981. By 1986 the long-term foreign debt had increased to $ 22 593 million and its short-term foreign debt to $35 816 million. The short-term foreign debt was therefore 72% of the total foreign debt by 1985, with the total national debt reaching 50% of gross domestic product. Although public infrastructure investment declined substantially during the 1980s due, among other reasons, to the escalation of the public debt, economic sanctions and political turmoil, the liberalization of trade in the early 1990s resulted in a boom in the mining industry as well as in in the general economy between 2000 and 2008. The increased mining activity, specifically the mining of iron ore, had a positive impact on economic growth and public infrastructure investment, as shown in Table 1. This growth is generally attributed to the export of mineral ores such as coal, iron and manganese. Despite this positive impact, the steel production and manufacturing sectors did not reflect an equal or even similar growth. While it is clear from the previous discussion that steel manufacturing is in an interdependent, reciprocal relationship with most other sectors of the economy, its output, however, stimulates more economic activity related to infrastructure development than any other sector, hence the use of the uncommon term, the 'elasticity' of steel production & implications in the context of economic growth.

**4. Economic Growth and The Elasticity of The Steel Sector**

As discussed previously, there is clear evidence of a reciprocal and interdependent relationship between the domestic steel production industry, public sector investment, the manufacturing sector, and the overall performance of the economy. This reciprocal and interdependent relationship is impacted by what is referred to as the elasticity and fluctuations in the production of steel. The construct of elasticity, according to Colander (1998), and Guo and N'Diaye (2009), is based on the understanding that the effectiveness and efficiency of the steel industry and other sectors are influenced by various factors, including the price of raw materials such as iron ore, the quality of the steel produced, and changes in the volume of demand for steel and steel products in the global markets. Another description of elasticity, according to Mostert, Oosthuizen, Smit and Van der Vyver (2002), and Weaver (2010), amongst other authors, is that it refers to the measure of the reaction of consumers and producers to the changing economic dynamics that each commodity is exposed to. Mostert et al. (2002) suggest that the elasticity of the steel production industry is best explained in terms of the change in the price of the final product to the changes in demand in volumes of the same products and the ability of the industry to ensure that the supply or availability of the products satisfies the demand. Lipsey and Harbury (1992), describe the elasticity of the supply of steel as the relative change in quantities of the products supplied to the change in their price.

**Figure 5: Price Elasticity of the South African Steel Supply and Production 1997–2016**




**Source:** (World Bank data, 2018).

Figure 5 shows the relationship between price versus demand which describes the elasticity of the supply of domestic steel between 1997 and 2016. From the data, it is clear that the domestic production of steel is elastic in terms of price and therefore the supply of steel and steel-related products is also elastic. According to Siddiqui (2011), the price elasticity of a product will depend on the marginal cost of production and the volume of production. This is related to what is referred to as the contingency costs of production which are the costs that are not directly involved in the production of the commodity, but those indirectly incurred prior to production in the preparation for production. The following example from the building industry illustrates this in practical terms. The cost of bricks, mortar, wood for roof trusses, labor-related costs, and various other related costs are included in the normal building costs. The cost of bringing heavy earth moving equipment to prepare the ground before the start of the actual building activity as well as the cost of leasing

this equipment is considered to be the indirect or contingency costs of the building. From this proposition, Fuerstenau and Han (2003), conclude that if the marginal or contingency costs of steel production increase, the producers are likely to decrease production, even if the overall steel price increases.

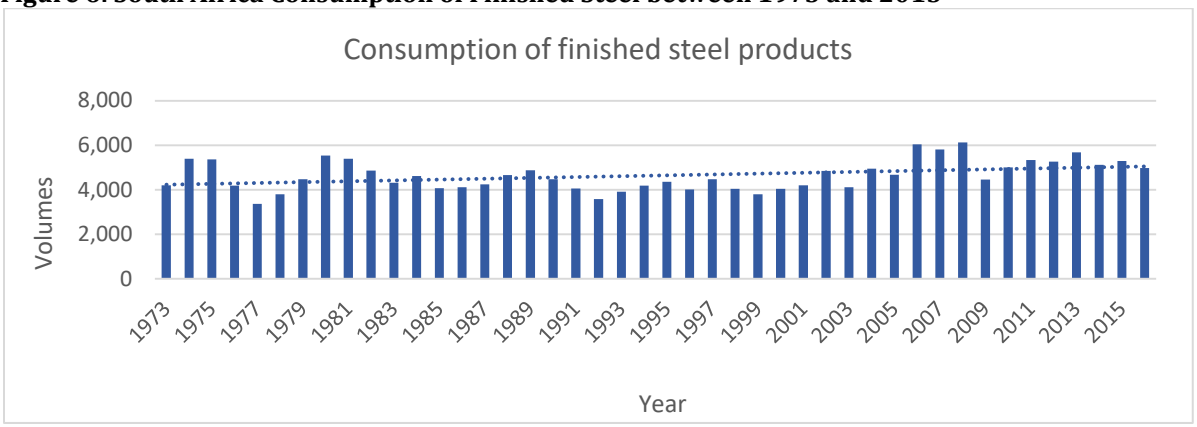
In support of this statement, Mostert et al. (2002), state that the factors that influence steel supply elasticity are:

- The number of raw materials available enables steel producers to increase production when needed. These raw materials include iron ore, scrap steel, electricity, and coking coal.
- The capacity of steel producers to increase production if and when the steel price increases. The question of whether a steel mill's utilization capacity in terms of efficiency and effectiveness is important as is whether the steel production plant is flexible enough to increase production for the market. The high utilization capacity of a steel mill means that the production of steel is assured, regardless of changes in price or market demand.
- The availability of appropriately qualified and experienced skilled labor as well as the availability of the necessary production equipment will enable steel mills to increase production without delay. A situation in which there is a need to procure new or additional equipment or to train additional labor will cause a delay in the production of products; and
- In a capital- and raw material-intensive industry such as steel production, the availability of commodities such as raw materials or capital is a critical determinant of the capacity to increase production without delays.

According to Adams (2006), when steel producers experience a price increase, they are faced with the problem of deciding whether the price increase represents a change that will increase the company's revenue or is the increased price inflation-related. Considering the determinants stated by Mostert et al. (2002), of optimizing steel production while assuring the continued viability, sustainability and competitiveness of the steel industry in a changing business environment, the steel industry is responsible for the decision of when the price of steel should increase. The issue of whether the steel price increase represents a real opportunity to increase the company's revenue or assure its viability and sustainability should be disregarded from a practical business management perspective. Monetary policy adjustments by the South African Reserve Bank usually result in short-term changes in the economy in terms of the duration of the effect of a change in the price of general products. Mohr and Fourie (2002), describe monetary policy adjustment as the measures taken by the monetary authorities to influence the quantity of money available in the economy or the rate of interest, referred to as the 'repo rate'. This impacts the rate of repayment of loans from banks and other sources of financing.

To achieve stable prices, improve the employment rate, and promote economic growth. The Reserve Bank's monetary policy committee meets on a quarterly basis to consider any possible adjustments to the repo rate, which is the interest rate at which the Reserve Bank lends money to commercial banks. Amongst other measures, the South African Reserve Bank uses the repo rate as an instrument to control inflation rate fluctuations within defined limits. A change in commodity prices, whether negative or positive, in relation to steel production, can also contribute to the changes in the demand for steel emanating from the downstream and value-adding steel-consuming sectors such as the construction or automotive sector. Research has shown that the consumption of steel is not sensitive to price but is sensitive to consumer demand and the ability of steel companies to meet the consumer volumes. The volume of consumption of finished steel products, as shown in Figure 6, is not limited to basic steel, but includes different carbon steel products such as hot-rolled coil sheets, structural bars and railway track material. Over the past decades, the consumption of finished steel products has clearly shown a regular cyclical pattern, as is depicted in Figure 6.

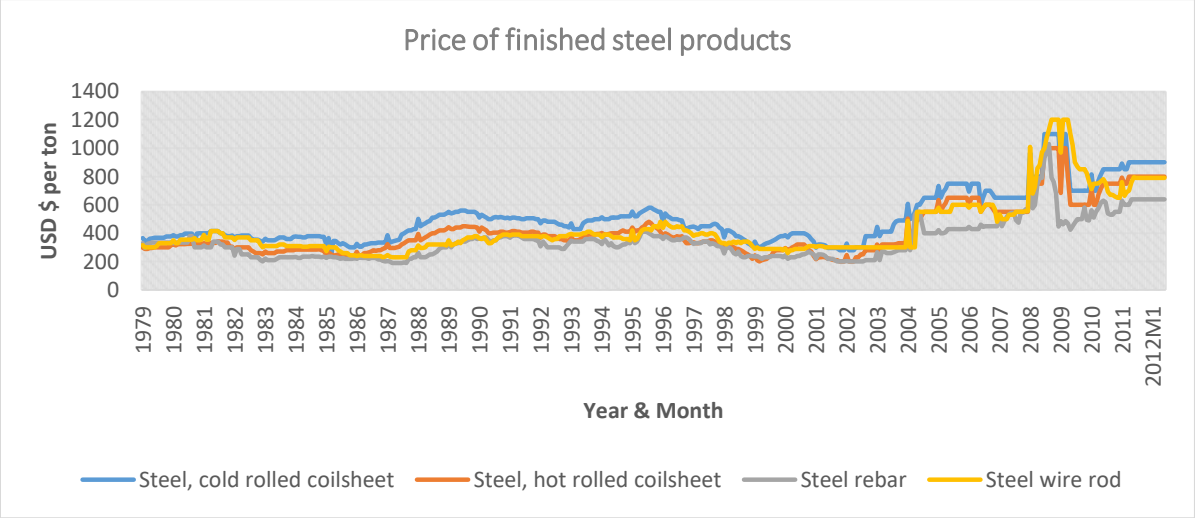
**Figure 6: South Africa Consumption of Finished Steel between 1973 and 2015**




**Source:** (World Steel Organisation data, 2018).

The demand for and consumption of finished steel products declined in the late 1980s and early 1990s in line with the decline in the global price of steel products, such as steel rebar, during this period. It is clearly understood that the downstream demand for and consumption of manufactured steel is sensitive to consumer market sectors such as the car manufacturing and industrial equipment manufacturing industries. The global price of most steel products, as shown in Figure 7, increased rapidly from 2008 due to the construction sector globally and the measures taken by various countries to limit volumes of steel imports from China.

**Figure 7: Global Price of Finished Steel Products between 1979 and 2012**




**Source:** (World Bank Pink Sheet, 2018).

In their research Hazlitt (1971), Colander (1998), and Fernando (2006), found that the degree to which consumers of raw steel consumers respond to changes in the price of steel and steel-based products, is determined largely by the following factors:

- The perception of consumers of whether steel is regarded as a necessity or a luxury item. Steel is considered to be a basic material required by most manufacturing and construction industries globally, therefore, the demand and supply of steel products should not be price sensitive nor should it be considered a luxury item.
- Metal oxides such as ferroalloys, stainless steel, or other derivatives manufactured from base metals such as aluminium and silver, can be used as substitutes for steel in some areas of construction and manufacturing. The demand for certain grades of steel is elastic because consumers can easily switch

between different oxides, depending on the final product specifications and the demand of consumers in sectors such as petrochemical and food manufacturing.

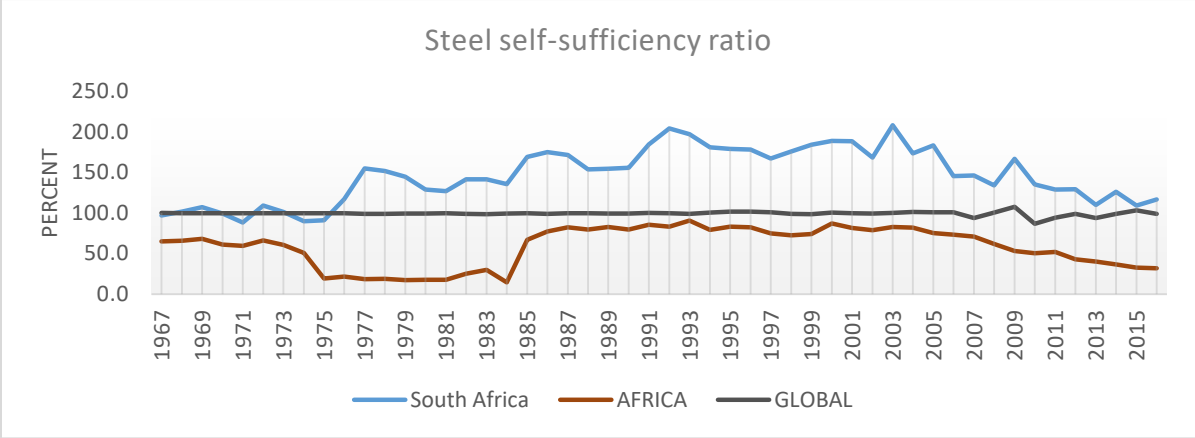
- Unlike other consumer goods such as alcohol and cigarettes, steel is not a habit-forming product. Therefore, it is elastic in the sense that it is sensitive to changes in price and consumers can live without steel products such as electricity towers or motor vehicles. This allows for the supposition that the consumption of steel for these purposes is understood not to be price sensitive.
- The cross elasticity of raw materials as inputs to the manufacture of certain products, such as iron ore, scrap metal, and coking coal, can change the demand for steel and its selling price. If the cross elasticity of iron ore and coking coal is negative, it can be explained that the increase in the price of one product leads to an increased demand for another product.

Rapid fluctuations in steel prices can often lead to pressure from consumers for the government to intervene in the reduction of inflation by means of intervention from the South African Reserve Bank. In South Africa, however, the price of steel is not only affected by normal price inflation on consumer products, but also by the changes in the global demand for and supply of steel products. Research has shown that the consumption of steel is not sensitive to price but is sensitive to consumer demand and the ability of steel companies to meet the consumer volumes.

**The Steel Market Equilibrium:** It is accepted amongst academics and economists that to determine the market equilibrium of steel and steel-based products, the total capacity of the steel market must be fully understood in context. According to Colander (1998), and Mostert et al. (2002), the definition of the construct of market equilibrium is dependent on the understanding of the concept of total market utility which includes the sum of the consumption of all related products and services within a given period of time. For the purposes of this paper, the total utility of the domestic steel industry was characterized as the self-sufficiency ratio. In this context, the self-sufficiency ratio (SSR) of the steel sector is defined by Omoweh (2005), as the measure of the country's total production capacity against the domestic demand for steel and steel-based products, and for which the following formula was proposed:

SSR = domestic production
Total steel demand (consumption).

**Figure 8: Steel Self-Sufficiency Ratio in South Africa, Africa and Globally**

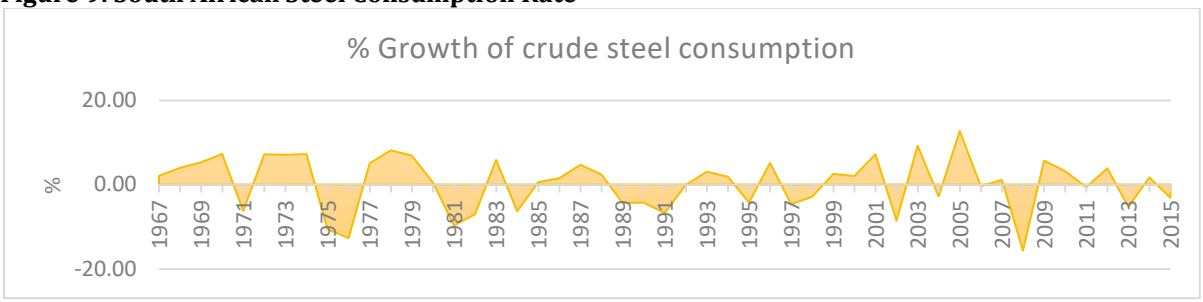



*Source: (World Steel Organisation, 1967–2016).*

From the graphs of the self-sufficiency ratio of the steel industry, as shown in Figure 8, it is clear that South Africa remained self-sufficient in terms of steel production and consumption from 1967 to 2015. A self-sufficiency ratio of 100 and above suggests a constant or optimum level of steel production measured against the consumption of steel. This is usually accepted as an indication of an optimum level of development in stable and sustainable steel industry. Between 1967 and 2015, South Africa had an average self-sufficiency ratio of 146, which means that the country was able to produce steel volumes sufficient to meet the domestic demand and to have a sufficient excess of produced steel for export. In contrast, the African continent as a whole showed an average self-sufficiency ratio of only 59, compared with the threshold of 100 mentioned

previously and South Africa's ratio of approximately 150, which indicates that most African countries were required to import crude steel from countries with export capacity because their domestic steel production was below their domestic consumption. The data provided by Statistics South Africa confirmed that South Africa was exporting excess crude steel to other African countries between 1975 and 2015, which supports the abovementioned supposition and also shows that South Africa dominated the African steel sector during that period. Although South Africa was exporting excess crude steel to other African countries, the consumption of crude steel in South Africa was erratic from 1967 to 2015, as shown in Figure 9 below. This erratic consumption was a result of economic business cycle fluctuations that impacted the usage of steel in the South African economy.

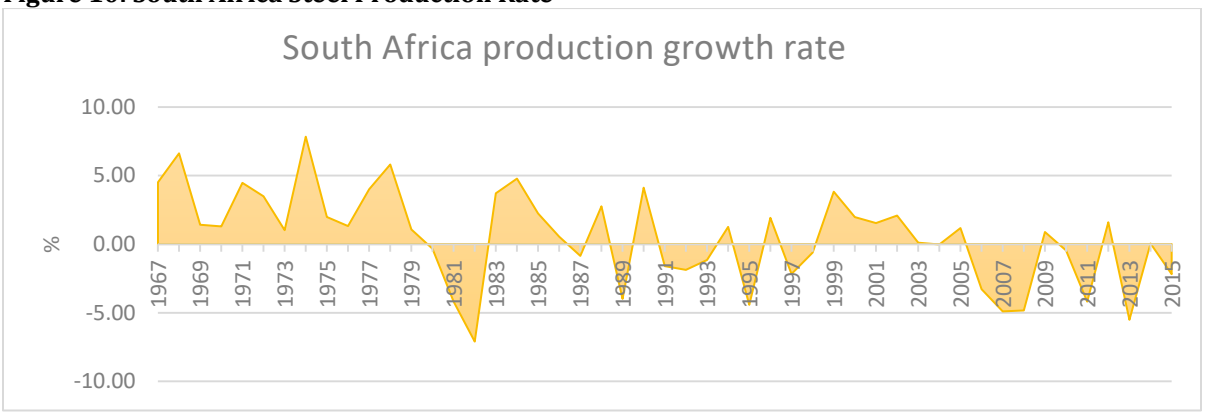
**Figure 9: South African Steel Consumption Rate**




*Source: (World Steel Association reports, 1964–2016).*

The economic growth in the early 2000s had a positive impact on the demand for and consumption of steel in South Africa. Conversely, the rapid decline in the consumption of domestic steel in 2007 and thereafter can be attributed to various factors such as the new steel pricing structure that was adopted at the time and the increase in foreign steel imports. As can be seen in Figure 10, the domestic steel sector had a similar erratic growth rate in the consumption of steel in terms of production volumes between 1964 and 1980. Domestic steel production gradually declined after 1991, but showed a marginal growth between 1999 and 2003, ostensibly due to economic growth in South Africa. While the South African steel sector has seen challenging times in the past, it has continued to remain self-sufficient throughout the years.

**Figure 10: South Africa Steel Production Rate**




**Source:** (World Steel Association annual reports, 1964–2016).

The self-sufficiency ratio cannot be used in isolation to determine the overall level of development and performance of any industrial sector in any country. This also holds true for the South African steel sector. The per capita steel consumption can also be used as an indicator of the volume of steel consumed by the economy as a whole. According to Jenkins, Barton, Bartzokas, Hesselberg and Knutsen (2002), and Dohrn and Kratschell (2013), there are two factors that can be used for the calculation of per capita steel consumption. These are:

- The income of the population and its demand for steel-related products such as motor vehicles; and

- The structure of the steel sector in the economy in terms of where raw materials are procured, the technology type, and the location of the steel production plants.

Ezekiel and Wylie (1941), argue that the consumption of steel determines the volume of production which, in turn, determines the production costs of steel at the steel mills. In support of this argument, Moya (2016), states that the costs that steel mills incur in the production process will depend on a variety of production inputs and factors which can be either fixed or variable. Adding to the discussion of the assurance of a balanced operational system in the manufacture of steel, Mostert et al. (2002), promote the differentiation of fixed and variable costs in a commodity production business. It is necessary to identify the production costs that are flexible and those that are inherent to the production process. The financial implications of using specific factors of production such as machinery and equipment cannot be changed in the short term and in business, these are the fixed costs. Conversely, production costs that can be altered at relatively short notice, such as skilled labor that can be dismissed, can be described as variable costs.

In attempting to clarify this proposition, Svatos and Gargulak (1983) elaborate by explaining that the maximization of steel production output requires the optimal usage of production input factors such as labor, raw materials, and machinery, and these can either be fixed or variable costs, depending on production requirements. This differentiation between fixed and variable costs in the management of any business is well understood and has been an integral part of the financial management of business organizations from the earliest days of industrialization. The achievement of high levels of self-sufficiency in the South African steel sector can only be realized by the capacity of the industry to consistently contain its fixed and variable costs to affordable and manageable levels. Keeping costs down whilst operating in globally competitive sectors such as steel production requires the local steel sector to drive down production costs while increasing innovation in all departments of the business.

## 5. Conclusion and Recommendations

There is a rich profusion of research on linkages between business cycles, the steel industry and economic growth, with a range of theoretical analogies. The literature has been reviewed under three main categories: mapping linkages between business cycles – steel industry performance – GDP performance; steel elasticity against economic performance; and balancing between self-sustainability in steel in South Africa and supplying other African countries. The paper made a critical contribution to studies on African economies' business cycle relationship with the steel industry. During the investigation, it was found that there is a scarcity of literature investigating the binary relationship between steel industry performance and South African economic growth. There is a need for future binary and ternary relationship studies on economic growth, manufacturing industry performance and business cycle movements, especially from an African perspective. In South Africa, employment growth is elastic to growth in the manufacturing industry (Mkhize, 2019). With an unemployment rate of 34.9% in December 2021 (Statistics South Africa, Dec 2021), an increase in manufacturing industry output, specifically the steel industry can reduce levels of unemployment in South Africa. It was found in the literature that an increase in economic infrastructure investments correlated with an increase in steel production and GDP growth in South Africa between 1961 and 2009. Furthermore, there is a need for future modelling of the relationship between South African steel prices against monetary policy decisions, on the impact of the industry's short-and-long-term liquidity sustainability.

Such research should explore the relationships between industry sustainability practices and monetary policy with a special focus on the steel industry's leading rates. Studies by Gertley and Gilchrist (1994), Cooley and Quadrini (2004) and Yang et al. (2021) have analyzed the impact of monetary policy uncertainty and decision on decisions made by manufacturing companies in developed economies. These researchers concluded that short-term monetary policy uncertainty has a weakening effect on manufacturing industry investment levels. For manufacturing industries such as steel that are reliant on primary input commodities such as electricity and coal that are elastic to global political and economic changes, it is important to measure the net steel industry collateralization effect triggered by monetary policy decisions. In terms of steel production and exports, the study found that Africa lags far behind the rest of the world, and South Africa is the shining beacon on the continent. There is significant room for growth in African steel

manufacturing within the continent. Signe (2018) and Fofak and Mold (2021) note that Intra-African trade in manufactured goods has increased from 10% in 2000 to 16% in 2014. An increase in intra trade of manufactured steel goods between African countries will result in countries being able to control the quality and prices of steel goods which will ultimately result in more self-sufficient and globally competitive manufacturing sectors. Given the capabilities of the steel industry to support economic growth, policymakers and researchers should support the generation of industry data that promotes investment and strengthens the intracontinental trade of South African steel products.

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# Impact of Perceived Quality of E-Health Services on Patient Behavioral Intention to Use E-Health Services: A Moderating Role of Knowledge of E-Health Management

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**Abstract:** The objective of this study is to investigate the impact of perceived quality of e-health and the perceived usefulness of behavioral intention to use e-health services with moderating role of knowledge on e-health. A quantitative research approach was applied to examine the proposed relationships between variables of the model. A cross-sectional method was used to gather the data from Saudi patients with the help of a self-administrative survey questionnaire. Findings illustrated that IQ, system quality, and perceived usefulness have a significant and positive impact on the behavioral intention to use e-health services of Saudi patients. Moreover, results show that knowledge of e-health significantly moderates the relationship between perceived quality of e-health and perceived usefulness with the patients' intention to use e-health services. This study enriches the body of knowledge regarding e-health usage, patient intention to use services of e-health, and literacy regarding e-health. The findings of the present study improve the understanding of health care executives regarding the use of e-health services intention and how this intention can be improved.

**Keywords**: *Perceived quality, perceived usefulness, intention to use e-health services, e-health management knowledge.*

## 1. Introduction

In the healthcare sector, technology application concerning the various stakeholders is considered much important (Dogra, Bakshi, & Gupta, 2022). The Healthcare industry is considered a large and complicated industry that sometimes contains interactions among stakeholders which results in contradictory purposes and data issues (Dahleez, Bader, & Aboramadan, 2020). Various countries around the world are motivated toward the transformation of the health industry by implementing innovative technology and advanced practices (Dahleez et al., 2020). Accordingly, this study in the field states that the appropriate application of information systems (IS) significantly impacts numerous outcomes concerning individuals and organizations (Gu et al., 2021). A piece of well-timed and precise information is provided by IS to the different users at various levels of management (Hossain, Yokota, Sultana, & Ahmed, 2019; Marinho, Costa Filho, Moreira, & Machado, 2020) to achieve efficiency, better planning and to take decisions more appropriately (Paparova & Aanestad, 2020; Radhakrishnan et al., 2016). Over the last years, the contribution of the internet in the health industry is constantly increasing. This increasing trend can be attributed to the increasing demand for e-healthcare services (e-health) among many other factors. In addition, Bruhn and Batt (2015) stated that the "Internet has enabled consumers to become more proactive in managing their health."

Exploring health-related or medical information is among the most common online activities undertaken by consumers of healthcare services (Zolait, Radhi, Alhowaishi, Sundram, & Aldoseri, 2019). Pew Internet & American Life Project conducted surveys and concluded that about 75 to 80 internet users out of 100 in America have used the internet to search for health-related information, particularly by 55 percent of the household users who have broadband internet access (D. Kumar & Bansal, 2015). Furthermore, easy and appropriate availability of information searching also plays a vital role because some researchers concluded that patients prefer the secrecy of their information instead of providing personal information to the doctors (Andersen et al., 2019; Win, Hassan, Bonney, & Iverson, 2015). Another factor that motivates consumers to search online information is that the medical field is inherently treated as a "credence quality" (Spinelli & Benevolo, 2016) that is relevant to the reservations of diagnosis, care, etc. Thus, a lack of trust among doctors and customers takes place where consumers question the competency of the doctor, feel embarrassed while discussing their problems with the doctor, or face frustration with fruitless treatment (Serenko, Dohan, & Tan, 2017). Saving healthcare costs is also involved because patients who obtain benefits from e-health services save their traveling costs to visit their doctor or pharmacy (Trivedi & Saxena, 2015).

Researchers and specialists paid wider attention to the healthcare sector because of the significant and invaluable advantages of using technology and IS. In response to the increasing globalization and rapid advancements in the use of medical technology, researchers paid attention to the field. In the contemporary dynamic settings, the healthcare industry witnessed ISs with higher intensity to improve the efficiency and effectiveness of the sector (Ben-Assuli, Shabtai, & Leshno, 2015; Bitaraf et al., 2021). Currently, the application of IS in the health sector is not merely associated with the financial measures but with the more progressive and complex paradigm (Chauhan & Jaiswal, 2017). In the context of health establishments, it is called health information system (HIS) or e-health and it has become the preference for consumers because of swift and wide-ranging expansions in the medical industry and increasing expectations of patients (Shahbazi, Bagherian, Sattari, & Saghaeiannejad-Isfahani, 2021). IS helps in the collection, storage, and application of the data regarding patients (Fiza, Lizawati, Zuraini, & Narayana, 2016). Researchers believe that IS has significant potential of improving the quality of healthcare services, ensuring patient safety, improving the performance of staff and clinic, minimizing administrative mistakes, enhance access to the data of patients, improve medical choices and considerably diminish cost of service delivery (Chauhan & Jaiswal, 2017; Hoque, Bao, & Sorwar, 2017; Ibrahim, Gulihana, & Susanto, 2022; Kirkman, Hawes, & Dadds, 2016; Mishra, Mishra, Mishra, & Choudhury, 2017; Peng, Yuan, & Holtz, 2016).

Although IS has an insightful effect on the efficiency of an organization, researchers in the current literature also state that the application and maintenance of IS and enterprise resource planning (ERP) methods are usually expensive, complex, and may provide adverse outcomes (Hamdan, Ayyash, & Almajali, 2020). Although, there are many examples where e-health systems remain very fruitful and produced prosperity and welfare in the organizational outcomes (Ross, Stevenson, Lau, & Murray, 2015). On the other hand, many failure cases are also there when systems remained to fail in attaining their goals which results in the declined performance of the health unit (Shah & Peikari, 2016; Stephanie & Sharma, 2016). Despite heavy investments made by firms for the procurement and installation of customized e-health systems (Devlin, Bouamrane, McGee-Lennon, O'Donnell, & Mair, 2015), researchers found no significant evidence to confirm the success and productivity of its outcome (Bhyat, 2019). Hence, investigations are crucially required for the organization to address that IS sufficiently satisfying their operational requirements and enhance health performance and service (GÜRSEL, Yazar, & KURU, 2016). This research aims to investigate an integrative single framework by incorporating D&M (Yusif, Hafeez-Baig, Soar, & Teik, 2020), TAM (L. E. Davis et al., 2019), and IS user satisfaction reflected in medical performance, patient care and patient-doctor relation in the settings of healthcare. Integrating various frameworks of IS helps in the better contextualization of the technology impact (Pakarbudi, 2018; Radhakrishnan et al., 2016) specifically in the complex environmental context (Serrano, Garcia-Guzman, Xydopoulos, & Tarhini, 2020).

Such kind of integration is generally recognized as a better practice that improves our vision and empathetic regarding recognition, acceptance, practice, and achievement of IS (Adejo, Ewuzie, Usoro, & Connolly, 2018; Riana, Hidayanto, Hadianti, & Napitupulu, 2021; Yadegaridehkordi, Iahad, & Asadi, 2015). Moreover, this research aims to investigate the close and distant predictors of system application and IS users' satisfaction reflected in medical performance, patient care, and patient-doctor relationships. Radhakrishnan et al. (2016) emphasized the essential of further appreciation of the elements that affect recognition or opposition and user satisfaction. Similarly, Asoodar, Vaezi, and Izanloo (2016) mentioned that more studies are required to evaluate the variables that elucidate the deviations in the fulfillment of IS users. Yuan, Ma, Kanthawala, and Peng (2015) concluded that their research consisted of mixed findings regarding the relation between e-health systems and medical outcomes. In addition, they found that their study is applied in the Middle East because the region lacks research on the topic of IS and its practices (Dahleez et al., 2020; Yaseen, Dajani, & Hasan, 2016). Most of the studies on the topic are conducted in the developed world (Serrano et al., 2020; Soualmi, Alti, & Laouamer, 2021). Therefore, there is a dire need of conducting more studies to evaluate the validity of IS frameworks in developing economies (Alqatan, Noor, Man, & Mohemad, 2017; Yunusa et al.,). The objective of this study is to examine how perceived quality and perceived usefulness influence the intention to adopt e-health services and how knowledge of e-health moderates the relationship between perceived quality and perceived usefulness influence the intention to adopt e-health services.

## 2. Literature Review

**E-Health Services:** Ross, Stevenson, Lau, and Murray (2016) state that e-health (EH) is a new and rapidly progressing area of research and numerous ideas, terms, and applications are still under discussion. Moreover, no agreed-upon definition of e-health prevailed so far. In some settings, this term only refers to telemedicine. In contrast, telemedicine is also termed one of the numerous applications of e-health (Erard, 2021). In addition, Radder et al. (2016) explained that e-health is the sector made possible by the internet in the health industry. Further, Kreps described this term as the application of developing information and communication technology (ICT), particularly the internet, to enhance healthcare services. Accordingly, Ross et al. (2016) concluded an inclusive definition of e-health by focusing on the research of Eysenbach (2001) and stated that "an emerging field of medical informatics, referring to the organization and delivery of health services and information using the internet and related technologies". Besides, Gill regarding e-healthcare describes the collective application of electronic ICT in the health industry with the purpose of medical, educational, research, and managerial growth. In literature, some researchers also included interactive computer-based communication among patients and service providers likewise e-mail, chat, and other discussion platforms (Tebeje & Klein, 2021; Wilson, Heinsch, Betts, Booth, & Kay-Lambkin, 2021).

**Theoretical Background:** A health information system is explained as a socio-technical setup that incorporates all subsystems prevailing in the healthcare setup and combines all human resources in their assigned roles of information handling (Atallah, 2017) with the help of technology and coordination among each other (Loute, 2021). E-health comprises many different forms that are not only HIS but include "electronic health record (EHR)", "computerized physician order entry (CPOE)", "electronic prescribing (e-prescribing)", "clinical decision support systems (CDSS)", and "bar-coded medication administration (BCMA)"(Salahuddin et al., 2020). Despite the development of theories and methodologies, the application of IS is facing numerous long-term challenges in general and particularly in the healthcare system (Al-Fadhli, Othman, Ali, & Al-Jamrh, 2017). Moreover, the installation of IS in healthcare systems requires huge investment and heavy costs (Ben-Assuli et al., 2015). For this reason, managers and investors in the field are more concerned about the outcomes that whether this investment will result in the improved performance of the business or not (Mou, Shin, & Cohen, 2017).

Understanding of various dimensions leading toward IS success is needed for the organizations to safeguard the benefits of investment with improved efficiency, performance, and effectiveness (Hoque et al., 2017). In the presence of various IS stakeholder groups with different stakes, the criteria for success are different for each of the groups. Therefore, there must be a comprehensive model incorporating all the essential dimensions of success (Bitaraf et al., 2021). For system developers as well as for organizations, it is very important to understand in what ways people using ISrecognize and develop user acceptance, and satisfaction. By understanding this, organizations can achieve the appropriate application of their investments in e-technology (Radhakrishnan et al., 2016). One of the most commonly used IS models is the "Technology Acceptance Model (TAM)" which explains the procedure of technology adoption, acceptance, and implementation by the people (Alqatan et al., 2017; Kumar & Shenbagaraman, 2017; Mortenson & Vidgen, 2016). Accordingly, TAM is the most recognized model in the context of the healthcare system because of its applicability and strength that is used to study the acceptance and application of e-health systems (Geng et al., 2020; Shachak, Kuziemsky, & Petersen, 2019; Singh, Singh, Jaiswal, & Chauhan, 2017).

Davis (1985) established TAM which provides strong theoretical support to the scholars (Al-Jabri & Roztocki, 2015) because of its wider application for more than 30 years in various domains and disciplines of studies by a large number of scholars (Alqatan et al., 2017). Two major elements of the model that are "Perceived Usefulness" and "Perceived Ease of Use" influence acceptance of IT, the satisfaction of users, and determine the actual application of this system (Chauhan & Jaiswal, 2017; MAAMUOM, 2016). However, external social, political, and cultural variables impact these constructs (Surendran, 2012). In contrast, TAM is criticized by critics because of its simplicity (Dovrat, Meron, Shachak, Golodets, & Osem, 2019), its emphasis on system usage, and features with less recognition of accomplished tasks (Wu & Chen, 2017). This model is easy to combine with other competing models (Radhakrishnan et al., 2016). In return, many amendments are witnessed in the original model and researchers combined it with other models to meet the requirements of the studies (Amarenco et al., 2018; Guan, Chen, Fang, & Qiu, 2020). Accordingly, D&M (Urbach & Müller,

2012) model significantly plays a role. Researchers reviewed the present definitions of IS success and recommended that it is measured by using various interacting elements including quality of service, reliability of the information, method of information application in the system, satisfaction level of system users, and overall influence of systems on organization and users (Zaman, Hossain, Ahammed, & Ahmed, 2017).

**Healthcare Industry and Service Quality**: In the services industry, the healthcare sector is one of the fastest-rising sectors (Horodnic, Apetrei, Luca, & Ciobanu, 2018). In the US, health expenditure is forecasted to average increase by about seven percent (Bae, Lage, Mo, Nelson, & Hoogwerf, 2016). For attaining a competitive edge, increased support, sustained profitability, and quality of service have significantly become important concerning the business strategy of various organizations in the health sector (Horodnic et al., 2018). In general, objective measures were used to assess the quality of services such as death rate or disease rates. However, researchers in the last two decades focused on the role of patients in describing quality in the health sector (Moore et al., 2015; Razmak & Bélanger, 2017). Though researchers conducted a great number of studies to address the quality of services and their evaluation (Ackerman et al., 2021; Agarwal et al., 2019; Campos, Negromonte Filho, & Castro, 2017; Lin, Wei, & Gan, 2019; Salminen et al., 2018) some of the researchers have the opinion that most of these studies emphasized on the establishment of service quality frameworks that are generic (e.g. Asubonteng, McCleary, and Swan (1996) developed SERVQUAL scale).

However, there are only a few research works that emphasized the establishment of service quality frameworks that are "context-specific" (Bruhn & Batt, 2015). In addition, it was highlighted that largely applied research used the SERVQUAL scale (Gram & Rönkkö, 2018)concerning the health care settings resulted in the mixed results consisting of an original five-factor structure (Lim et al., 2018) ranging from six and seven dimensions (Cengiz & Fidan, 2017) or even 12 dimensions (Schena et al., 2021). By studying the extensive literature on healthcare, numerous models were used to assess healthcare quality (Machida, Sutton, Williams, Wellman, & Sanford, 2019; Zineldin & Vasicheva, 2017). Razmak and Bélanger (2017) highlighted that by comparing identified dimensions of healthcare literature, it is found that their findings are significant in line with the findings of marketing literature. Accordingly, Razmak and Bélanger (2017) developed a new measure to evaluate the service quality of healthcare. They recommended that four key dimensions control the perception of customers concerning service quality. These dimensions include interpersonal, technical, environmental, and administrative quality.

**Hypotheses Development**

**Information Quality (IQ):** IQ is defined by Yakubu and Dasuki (2018) as a desirable feature of an IS output and its productivity for the customers. Some important characteristics of information discussed in the literature are timeliness, uniqueness, scope, format, accessibility, correctness, precision, uniformity, applicability, understandability, conciseness, practicality, consistency, relevance, and adequacy. Similarly, Häyrinen, Mattila, Berghäll, and Toppinen (2015) researched IQ to evaluate the input and output of the IS and found that completeness and accuracy are the most widely applied dimensions among the numerous dimensions of measuring IQ. In addition, Cohen and Welling (2016) concluded IQ is an important predictor of productivity results and satisfaction of end-users. They defined it as the content and format of outputs of this system to confirm its usability, appropriate detail, meaningfulness, easy understanding, and readability that leads towards the decision making and task accomplishment. Information gathered from patients as a result of interaction between patients and service providers must be supportive for management decisions as well as for doctors. Information is recognized as valuable when it has characteristics of accuracy, relevance, organization and is displayed in useable form comfortably. Accurate and updated information is significant not only for the provision of quality clinical services but also for ongoing health services, the appropriate level of healthcare maintenance, research regarding medical and health, and preparation and administration of health services (Ault-Brutus & Alegria, 2018). Therefore, the following hypothesis based on the above-debated literature is proposed.
**Hypothesis 1:** IQ has a significant influence on the behavioral intention to use e-health services.

**System Quality (SQ):** Umaroh and Barmawi (2021) defined SQ as a desirable feature of an IS that deals with the usability characteristic and performance metrics. Important characteristics of SQ include availability,

efficiency, sophistication, suitability, customization, data correctness, ease of understanding and application, flexibility, incorporation, interactivity, turnaround time, consistency, response time, system correctness, and system structures. Additionally, Airaksinen et al. (2020) determined SQ as a success factor of IS that measures the system processing information and its characteristics are included easy usability, ease of understanding, and effectiveness of the system. In contrast, Cohen and Welling (2016) defined it from a non-traditional viewpoint as the experience of the system user from a technical, operational, and design perspective. While evaluating system attributes by users, this experience is significant likewise consistency, response time, and ease of application. Furthermore, Alazzam, Al Khatib, Mohammad, and Alassery (2021) while measuring SQ, emphasized consistency, accuracy, response time, and incorporation and found that a higher degree of SQ may deliver suitability, privacy, and early responses to the users. Hence, responsiveness and easy-to-learn attributes were found more relevant to the satisfaction of users among all the above-discussed attributes (Cohen & Welling, 2016). Therefore, the following hypothesis is proposed based on the above literature.
**Hypothesis 2:** SQ has a significant influence on the behavioral intention to use e-health services.

**Perceived Usefulness (PU):** PU is concerned with the features of IS that are fitted with the needs and expectations of users' jobs (Gürsel et al.,). Thus, PU is defined as the subjective beliefs of the users associated with the numerous benefits of HIS use to achieve the goals of the job in clinical practice (Ibrahim et al., 2022). This indicates that people recognize or reject the use of IS according to their own belief that to what extent it will help them in performing their jobs or will enhance the performance of their job (Hennemann, Beutel, & Zwerenz, 2017). PU influences the intention of the users (Dahleez et al., 2020). Moreover, Arkorful, Shuliang, Muhideen, Basiru, and Hammond (2020) while studying the perceptions of doctors and EHR recognition concluded that PU strongly and positively influences the attitudes of doctors towards EHR. Similarly, Sansone and Gagnon (2015) concluded that a large part of behavioral intentions towards using EHE is explained by PU and claimed that these findings are in line with the large number of previous studies.Therefore, following hypothesisis proposed based on the above literature.
**Hypothesis 3:** PU has a significant influence on the behavioral intention to use e-health services.

**Knowledge of E-Health Management:** E-health knowledge is associated with the combination of abilities and knowledge that enable productive sharing of technological-based health devices, including the capability of information recovery tactics and appropriate sharing of health ideas (Bautista, 2015; Longhurst et al., 2019). Potential issues that may create hurdles in the way of effective application of e-healthcare important to be highlighted. Medical and health associated websites are used by people to increase their health information, practice their disease-management abilities, reduce their nervousness regarding treatment and save time and money that is required to visit a doctor (Frempong, Chai, Ampaw, Amofah, & Ansong, 2020; Liebschner et al., 2019). Knowledge is considered an integral element of health literacy among people. It is an idea, ability, practice, and insight that create the framework for generating, assessing, and applying that information. Health literacy gained wider attention in recent years because of its impact on improving psychological health information, reducing stigma, and enhancing help-seeking attitudes (Chesser, Burke, Reyes, & Rohrberg, 2016; Hosseinzadeh et al., 2020). Baumeister, Kraft, Baumel, Pryss, and Messner (2019) explained basic health knowledge as the combination of basic terminologies that describe the primary systems and functions associated with health. Further, Lane and Aldoory (2019) elucidated conceptual knowledge as technical information.

The abilities required to “behave in a health-promoting way, ”which is frequently experimental, situation-based, and concerned with routine practices. 72% of internet users obtain health-related information from an online source in the USA (Glicksberg et al., 2018). In contrast, information about biomedical organizations, and how they are associated with each, is important for several reasons including vigilance and decision-taking (Us, Pimonenko, Tambovceva, & Segers, 2020). Knowledge is also a vital component of the innovation-decision process because it clarifies the doubts about the advantages and disadvantages of innovation (Hosseinzadeh et al., 2020). In addition, knowledge discovery is recognized as a growing domain in computer science that ranges from the catalogs to images and “natural language processing (NLP)” (Alshahrani, Stewart, & MacLure, 2019). Scholars and health practitioners are attracted by the new expansions of text-computing approaches in health to comprehend the data in various dimensions instead of just reading it to establish a new database of knowledge (Piad-Morffis, Gutiérrez, & Muñoz, 2019). Accordingly, e-health

administration is facing the key issue of information and knowledge sharing (KS) because there is active coordination among different health-related stakeholders (Van Den Heuvel et al., 2018).

Hence, it is essential to manage information, knowledge, information apparatuses, and technology in contemporary healthcare organizations to attain competitiveness, decision-making support, managing patients, financial management, resource allocation, resource planning, strategic management, and modifying institutional practices. Health-care organizations operate in an active environment which is why they are required to have capabilities of information gathering likewise medical data based on the evidence or the ideal required rules of practice, sharing of information internally and externally, integrating innovative knowledge, and working out information for supporting managers in decision making (Cummings, Shin, Mather, & Hovenga, 2016). So, Sengan et al. (2022) designated that KS behavior of medical practitioners may be referred to as a compassion signal of their helpful nature and motivations toward the patients. Zheng et al. (2017) concluded that knowledge of medical practitioners may enhance economic benefits for them. Therefore, the following hypothesis based on the above-debated literature is proposed.

**Hypothesis 4:** Knowledge of e-health management has a significant moderating role in the relationship of IQ to the use of e-health services.

**Hypothesis 5:** Knowledge of e-health management has a significant moderating role in the relationship of SQ with the intention to use e-health services.

**Hypothesis 6:** Knowledge of e-health management has a significant moderating role in the relationship of PU with the intention to use e-health services.

## 3. Methodology

The purpose of the current study was to investigate the impact of perceived quality of e-health services on patient behavioral intention to use e-health services. The current study also investigated the moderating role of knowledge on e-health on the relationship of perceived quality of e-health services with patient behavioral intention to use e-health services. This study was cross-sectional and the data were gathered from the Saudi patients. The study was conducted on Saudi patients. The unit of analysis was the individual in the current research. A questionnaire of self-administered nature was applied for the collection of data from the respondents of the study. This data collection technique is one of the suitable techniques to be applied to gather the primary data due to cost and time efficiency and effectiveness (Sekaran & Bougie, 2016). The convenience sampling method was employed to gather the data from the patients. Furthermore, the G*Power software version 3 was also applied to check the adequacy of the sample size (Faul, Erdfelder, Lang, & Buchner, 2007). This study got a sample size of 140 at a statistical power of 0.95 at the 5% level of significance. The 280 survey questionnaires were disseminated which was twice to sample size to cater to the complications of the low response rate. Out of 280 disseminated survey questionnaires, 198responses were received and able to use in the analysis. The questionnaire includes a cover letter and questions related to the variables. The cover letter elucidates the purpose of the study and the privacy of the collected data. The scale items to measure the variables were adapted from the existing studies.

## 4. Analysis and Discussion

The present study analyzed the collected data by using 2nd generation software, represented to “Partial Least Squares Structural Equation Modeling” (PLS-SEM). The Smart-PLS statistical software was employed to examine the projected association among the variable of the current study (Henseler et al., 2014).

**Assessing the Outer (Measurement) Model:** The outer model (Measurement model) is used to investigate the configuration of the model on the bases of some particular quality principles (Henseler et al., 2014). The outer model was investigated in three stages, composite reliability (CR) was investigated in the first stage and then convergent validity and discriminant validity were estimated. CR was evaluated by loading values, the value of alpha whereas, the values of VAE were used to examine the convergent validity of the variables, and Fornell and Lacker (1981) criteria and the value of HTMT were applied to test the discriminant validity and. The value of loadings must be higher than 0.50, the value of alpha ($\alpha$) must be greater than 0.6 and CR must be above 0.7 to fulfill the composite reliability standards (George & Mallery, 2003). AVE’s value must be

above 0.5 to achieve convergent validity. Results of the measurement model are illustrated in Figure 1 and Table 1, Table 2, and Table 3.

**Figure 1: Inner Model Assessment**

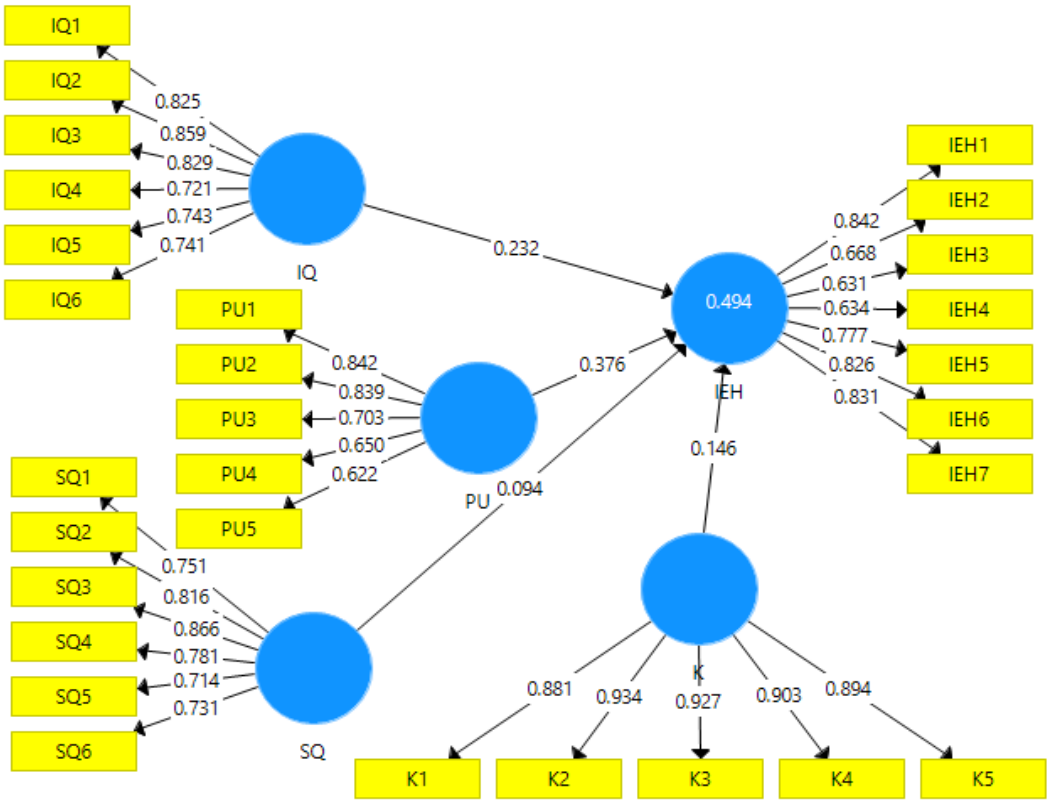


**Table 1: Reliability and Validity**

| Construct | Indicators | Loadings | Cronbach's alpha | Composite Reliability | AVE |
|---|---|---|---|---|---|
| Behaviour Intention to use E-health (IEH) | IEH1 | 0.842 | 0.866 | 0.898 | 0.562 |
| | IEH2 | 0.668 | | | |
| | IEH3 | 0.631 | | | |
| | IEH4 | 0.634 | | | |
| | IEH5 | 0.777 | | | |
| | IEH6 | 0.826 | | | |
| | IEH7 | 0.831 | | | |
| Information Quality (IQ) | IQ1 | 0.825 | 0.877 | 0.907 | 0.621 |
| | IQ2 | 0.859 | | | |
| | IQ3 | 0.829 | | | |
| | IQ4 | 0.721 | | | |

| | | | | | |
|---|---|---|---|---|---|
| | IQ5 | 0.743 | | | |
| | IQ6 | 0.741 | | | |
| System Quality (SL) | SQ1 | 0.751 | 0.869 | 0.902 | 0.606 |
| | SQ2 | 0.816 | | | |
| | SQ3 | 0.866 | | | |
| | SQ4 | 0.781 | | | |
| | SQ5 | 0.714 | | | |
| | SQ6 | 0.731 | | | |
| Perceived Usefulness (PL) | PU1 | 0.842 | 0785 | 0.854 | 0.543 |
| | PU1 | 0.839 | | | |
| | PU3 | 0.703 | | | |
| | PU4 | 0.650 | | | |
| | PU5 | 0.622 | | | |
| Knowledge on E-health (K) | K1 | 0.881 | 0.947 | 0.959 | 0.824 |
| | K2 | 0.934 | | | |
| | K3 | 0.927 | | | |
| | K4 | 0.903 | | | |
| | K5 | 0.894 | | | |

Table 1 indicated that the loading values for all items are higher than 0.5 and alpha (α) values of all constructs are more than 0.7, this shows that the study attains reliability. CR values are greater than 0.7 and the AVE values are more than 0.5 that endorsing the convergent validity.

**Table 2: Fornell-Larcker Criterion**

| | **IEH** | **IQ** | **K** | **PU** | **SQ** |
|---|---|---|---|---|---|
| **IEH** | 0.749 | | | | |
| **IQ** | 0.520 | 0.788 | | | |
| **K** | 0.541 | 0.405 | 0.908 | | |
| **PU** | 0.645 | 0.489 | 0.643 | 0.737 | |
| **SQ** | 0.542 | 0.469 | 0.631 | 0.657 | 0.778 |

Table 2 indicated the outcomes of Fornell and Lacker (1981). Findings indicated that the current study attains the discriminant validity because the AVE's square root of every construct is higher than the correlation with other constructs of the model.

**Table 3: Heterotrait-Monotrait Ratio (HTMT)**

| | IEH | IQ | K | PU | SQ |
|---|---|---|---|---|---|
| **IEH** | | | | | |
| **IQ** | 0.585 | | | | |
| **K** | 0.602 | 0.449 | | | |
| **PU** | 0.772 | 0.576 | 0.753 | | |
| **SQ** | 0.620 | 0.531 | 0.681 | 0.771 | |

Table 3 shows the value HTMT ratios that are below 0.85 which approves the discriminant validity (Kline, 2011).

**Structural Model Assessment:** After the endorsement of the reliability and validity of the measurement model, researchers can examine the projected relations within the variables of the model. The inspection of the structure model comprises the assessment of the relationship between the construct of the model. The structure model was assessed by using the PLS-SEM algorithm and bootstrapping procedure (Chin, Marcolin, & Newsted, 2003; Kousar, Zafar, Sabir, & Sajjad). The output of the structure model valuation is presented in Figure 2 and Table 4.

**Figure 2: Structural Model Assessment**

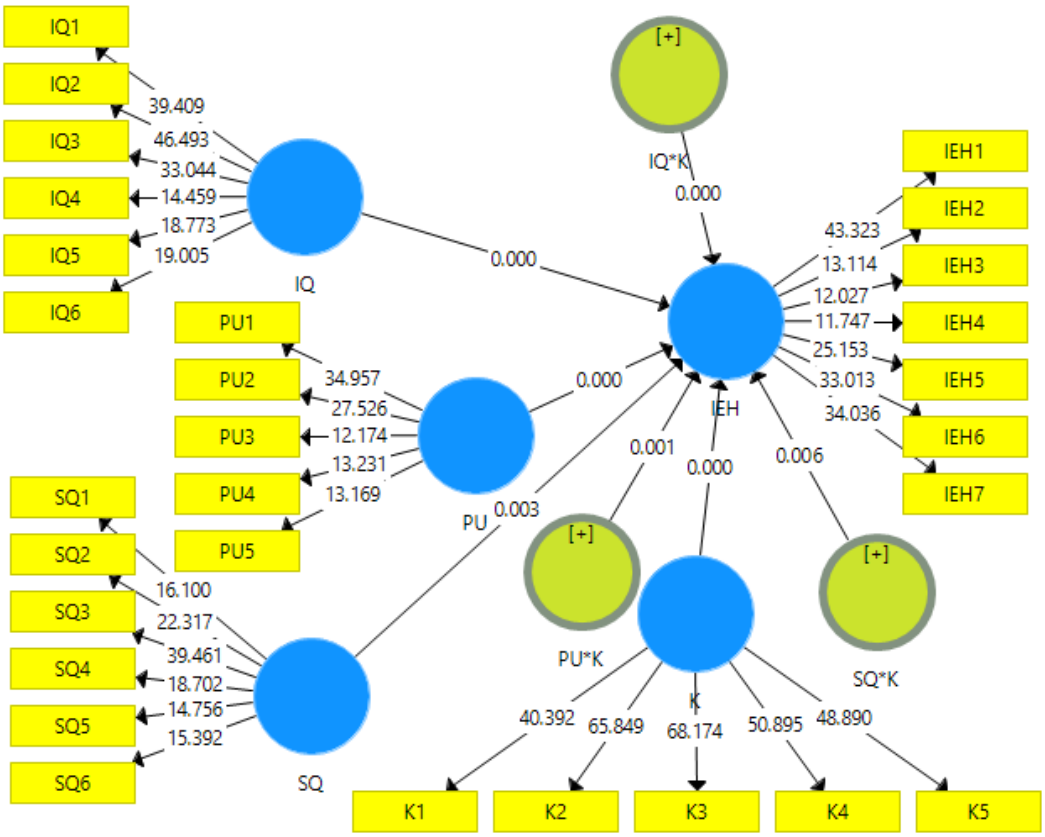

**Table 4: Structural Model Assessment**

| Hypotheses | Relationship | Beta | STD | T Value | P Values |
|---|---|---|---|---|---|
| **$H_1$** | IQ ->IEH | 0.240 | 0.062 | 3.901 | 0.000 |
| **$H_2$** | SQ ->IEH | 0.490 | 0.059 | 8.305 | 0.003 |
| **$H_3$** | PU ->IEH | 0.389 | 0.087 | 4.491 | 0.000 |
| **$H_4$** | IQ*K ->IEH | 0.171 | 0.058 | 2.948 | 0.000 |
| **$H_5$** | SQ*K ->IEH | 0.178 | 0.083 | 2.145 | 0.006 |
| **$H_6$** | PU*K ->IEH | 0.203 | 0.075 | 0.271 | 0.001 |

Table 4 illustrated the output of the structural model. The findings indicated that IQ has a significant relationship with the intention to use E-health services (β= 0.240, P= 0.000). So, $H_1$ was supported on statistical grounds. Furthermore, SQ also significantly affects the IEH services (β= 0.490, P= 0.003), and perceived usefulness also has a significant influence on the IEH services (β= 0.389, P= 0.000), therefore $H_2$ and $H_3$ were also supported on statistical grounds. Furthermore, knowledge of e-health has a significant moderation effect on the relationship between IQ and IEH services (β= 0.171, P= 0.000). Findings revealed that the knowledge of e-health significantly moderates the relationship of SQ with IEH services (β= 0.178, P= 0.006), thus $H_5$ was supported. Lastly, this study also found that the knowledge of e-health significantly moderates the relationship of perceived usefulness with IEH services (β= 0.203, P= 0.001).

## 5. Conclusion and Recommendations

The aim of the current study is to investigate the impact of perceived quality of e-health services on patient behavioral intention to use e-health services. The current study also investigated the moderating role of knowledge on e-health on the relationship of perceived quality of e-health services with patient behavioral intention to use e-health services. The results of the current study elucidated that IQ and SQ have a positive impact on the behavioral intention to use e-health services among Saudi patients. The results of current research are in line with the study of Dahleez et al. (2020) and Razmak and Bélanger (2018), who argued that quality does matter and impacts to intention to use. Furthermore, the findings of the current study show that knowledge of e-health significantly moderates the association of IQ, SQ, and PU with IEH services among Saudi patients. According to Hosseinzadeh et al. (2020), Knowledge of e-health management services is an important element that affects the use of services. This study offers substantial implications for health care executives, policymakers, and project directors to efficiently set their processes and make them sustainable, avert unexpected difficulties and improve their allocated resources. Moreover, health care organizations may advance their quality of e-health services and improve their overall performance. Health care executives may improve the knowledge of patients on e-health services to add value in the adoption of e-health services. This study focused only on the Saudi patients, where this can be investigated in a population other than Saudi Arabia.

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# Corruption Trends and Graft Control Progress in Sierra Leone: Study of Causes and Remedies

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**Abstract**: Corruption continues to affect the vast majority of Sierra Leoneans and is regarded as the greatest culprit of poverty, inequality and social cohesion. This publication shed light on corruption trends, control measures, causes, development implications and remedies for combating corruption in Sierra Leone. The data for this article was sourced from secondary/desk review. The secondary data sources were mainly from published articles, government reports, Acts, policies, workshops and conference proceedings, newspaper commentary, Transparency International Annual Reports, Truth and Reconciliation Commission Reports, and NGOs among others. Key words like corruption in Sierra Leone, causes of corruption, negative effects of corruption and bribery, and control measures of corruption were used to search for relevant information. Specifically, the study revealed that corruption was more prevalent from 2003 to 2018 but declined from 2018 to 2021. Most corruption cases in Sierra Leone arise from the abuse of public offices for private gains. Furthermore, systemic analysis of literature showed that corruption arises as a result of low salary wages, political ambition and other sociological factors. From 2019 to 2021, Sierra Leone has made remarkable progress and is been rated below Africa's corruption average. This might be attributed to the various reforms and the pre-conviction corrupt asset recovery strategy adopted and the massive public outreach and awareness-raising drive adopted by the commission. It is recommended that the Anti-Corruption Commission of Sierra Leone be adequately empowered to go after any individual engaged in corrupt practices regardless of social status, ethnicity, political connection and wealth. It further recommended that the Anti-Corruption Commissioner appointment should not be political but by integrity and sound track record of citizens.

**Keywords:** *Corruption; Sierra Leone, Government, Civil Servant, Corruption Perception Index, Graft Control.*

## 1. Introduction

Although there is no universally agreed definition of corruption globally, some schools of thought have, however, defined corruption as the improper and unlawful behavior of public individuals (civil servants & politicians) while holding public offices. It could also be defined as an abuse of power for a selfish gain against the public interest (Atuobi, 2007). Corruption in developing countries has been the major reason why those countries are taking the back seat in economic development, infrastructure, technology, employment and human capacity development. Across Africa and Sierra Leone, in particular, corruption is threatening the social, economic development and the peaceful co-existence of citizens (Duri, 2021). A school of thought, argues that corruption in Africa has the mechanism to negatively influence smooth government activities and functions (Andvig, 2008) while Hope (2017) stated that corruption tends to negatively affect the health and other vital government sectors in Africa. According to Javed (2020), corruption has affected over 25 million children across Africa alone. In Sierra Leone, corruption has led to gross inequality, unequal wealth distribution, unfair service provision and a major barrier to the economic development of the nation since its independence in 1961 (Javed, 2020).

Critics argue that Sierra Leone's sustainable development and advancement have been plunged by Colonialism, Civil war, Ebola outbreak, Covid-19 Pandemic and rampant corruption. As such, corruption has stolen the future of youth and potential leaders of tomorrow in Sierra Leone. The attempt to combat corruption in Sierra Leone is proving difficult due to the fact that corruption has made many individuals more powerful and famous; hence having the power to attract more people into politics and by extension increasing their political party's numbers. As such, those who resist any form of corrupt practices in the public sphere are faced with constant threats and intimidation and in some cases summary unlawful dismissal. Apparently, corruption issues and discussions are a sacred topic among politicians and civil servants in Sierra Leone. The mentality of most civil servants in Sierra Leone is that "state" properties are not theirs; hence embezzling and or looting these properties or resources so that they could be converted into their private properties or resources is now the motive of the most civil servant in the 21st century (Adjiboloso, 2005). Most corruption reports over the years have been left to swallow dust on shelves.

But that is changing now with the current new Anti-Corruption Commission leadership. Although "The Anti–Corruption Commission" (ACC) was established in 2000, however, the country has not been graft-free over this period and the commission was considered a little more than a paper tiger. As a result, corruption was/is rampant and endemically rooted in Sierra Leone due to weak institutions, inadequate fines, political power and the mindset of public servants. Despite the millions of dollars of international technical assistance and aid poured into Sierra Leone over the past decades meant to improve the standard of living of average Sierra Leoneans, the country had been languishing at the bottommost section of the international corruption rankings body globally especially from 2001 to 2017 (Roberts, 2020). Corruption is the major driving force behind the abysmal performance of Sierra Leone's economy since independence. Before the civil war in 1992, Sierra Leone was operating on a free-fall status in terms of corruption and autocracy (Kpundeh, 1994). Over this period, corruption among government officials and politicians became a religion where everybody practice it in favor of personal gains. The rampant scale of corruption in Sierra Leone is intrinsically linked with the deplorable state of development condition the country is stocked in and the low wages of public servants. For instance, the poor condition of service in critical sectors of the nation is a recipe for bribery and grand corruption (Samura, 2016). Over the past two decades, most government mega projects in Sierra Leone were considered white elephants and national loan disbursement was diverted to the personal bank account of the rich influential politicians at the expense of national development.

In turn, ordinary citizens are feeling the wreck of sub-standard quality of service being provided by municipalities, contractors, engineers and medical practitioners due mainly to heavy kickbacks demanded by government officials. Before 2018, the fight against corruption was seen as an impossible fight as the act flourished and persisted with grand corruption among public officials. According to the 1991 Constitution of Sierra Leone, Section 13 paragraph C Act No. 6, the ACC is mandated to "protect and preserve public property and prevent the misappropriation and squandering of funds belonging to the Government, local authorities or public corporations" The commission is empowered to investigate corrupt practices and subsequently punish corrupt culprit in the move to suppress and permanently eradicate corruption in Sierra Leone. This paper seeks to assess the dynamic trend of corruption, driving forces, development implication and graft control measures and remedies instituted in curbing corruption in Sierra Leone. This article seeks to answer the following research questions: 1) what is the status of corruption in Sierra Leone: 2) what are the driving forces behind corruption in Sierra Leone: 3) what are the implication of rampant corruption in Sierra Leone: 4) has there been any progress made in the fight against corruption in Sierra Leone: 5) what are the remedies instituted in eradicating corruption out of Sierra Leone. The answer to these questions will address the knowledge gap on corruption-related matters in Sierra Leone. The rationale of this publication can offer good insight into corruption and its driving forces in Sierra Leone and beyond.

## 2. Review of Relevant Literature

Many scholars have published articles and newsletters about corruption and its role in shaping the development landscape of Sierra Leone. For instance, Potter and Bankole (1998) discussed and identified corruption predisposing factors in Sierra Leone. The authors further analyzed and discussed reform policies geared towards improving corruption in Sierra Leone. Chene (2010) conducted an overview of corruption in Sierra Leone and concluded among others that, corruption infiltrates almost all sectors of the country. Kpundeh (2000) assessed the effort puts in place to control corruption in Sierra Leone in the near future. The author concluded that; politicians, military junta regimes and civil servants are the key culprits engaged in the exploitation of government revenue via emptying the coffer meant for both social and economic development (Kpundeh, 2000). Similarly, corruption and reforms in contemporary Sierra Leone were investigated by (Kpundeh, 1993). The author systematically assessed the various effort employed by the military regime in the mid-90s to tackle corruption in Sierra Leone. Kpundeh (1994) further investigated the prospect that can limit administrative corruption across Sierra Leone and proffer solutions to end administrative corruption in Sierra Leone.

Reno (1995) comprehensively reviewed state politics and corruption in Sierra Leone and revealed the driving forces in state politics. The book highlights how some politicians and powerful business individuals demonstrate absolute authority in controlling mineral resources in Sierra Leone. According to Kpundeh (1993) nations like Sierra Leone have over the years endured an array of in-depth and rampant corruption.

Over the past decades, corruption was regarded as the way of life (Hors, 2000) and the easiest way to make wealth in Sierra Leone. This mentality is, however, common among politicians and civil servants. This mindset has paved the way for persistent corruption hence holding Sierra Leone at the bottom of the international corruption ranking index to languish for decades (Roberts, 2020). Based on academic research and policy perspectives, it is a consensus that corruption is very high and costly in low-income countries (Olken, 2012) like Sierra Leone. Wei, (2003), estimated that moving from a relatively clean" government like that of Singapore to one as corrupt as Mexico's would have the same effect on foreign direct investment as an increase in the marginal corporate tax rate of 50%. Corruption has held nations with huge mineral deposits captive by transforming these minerals into a 'resource curse'. According to this literature, low wages in the civil service encourage petty corruption, and the imbalance between the supply of, and demand for, public services likewise create opportunities for corruption in Sierra Leone.

Also, individuals tend to invest in a career in the public service, given the shortage of opportunities in the private sector, thus increasing the likelihood of their involvement in corrupt practices. Society has learned to live with it, even considering it, fatalistically as an integral part of their culture. Not only are public or official decisions affecting individuals but the clandestine award of government contracts and the often little or no access to public service or the exercise of a right of citizens in obtaining civil documents are mostly abused. Civil servants who refuse to toe the line are removed from office; similarly, business individuals who oppose it are penalized vis-à-vis their competitors get contracts while they are ignored (Hors, 2000). In recent times, greater attention is being given to the problem of corruption, especially in developing countries like Sierra Leone than it was in the past (Wei, 2003); and this era has seen a remarkable expansion in economists' ability to quantify corruption (Olken, 2012). Corruption has not only affected the standard of living of citizens in developing countries but has caused political instability, civil conflicts, massive demonstration as seen in Haiti and Cameroun and Equatorial Guinea among others.

Most developing countries like Venezuela, Mexico, Haiti, Sierra Leone, Zimbabwe, Nigeria, Angola and many more are struggling with corruption scandals, and political instability amidst a declining economy due to rampant corruption. Robinson (1998) asserted that corruption is regarded as a sensitive political and economic agenda across the world. Sierra Leone has endured a systemic pattern of corruption traced back to 1962 just after independence (Kpundeh, 2000). According to the Truth and Reconciliation Commission (TRC) report in Sierra Leone, corruption was the major reason for the outbreak of the 11 years of civil war that kills thousands and lefts hundreds amputated. Although many scholars have undertaken research on various graft-related issues in Sierra Leone, however, most scholars downplayed the negative development implication of corruption, driving forces, progress made and the suitable mitigation option require to eradicate corruption in Sierra Leone. This article is poised to bridge this gap and provide adequate information about the current trend of corruption and the various graft control measures being instituted to reduce graft activities across Sierra Leone. This article will contribute to knowledge on the aspect of corruption and its related consequences in developing countries.

## 3. Research Methodology

Sierra Leone is a small low-income West African nation with a population of approximately 7.8 million people (World Bank, 2009). Sierra Leone is rich in mineral resources such as Diamonds, Gold, Rutile, Bauxite, Iron ore, Chrome and many more and is endowed with substantial natural resources such as croplands, forests, rangelands, freshwater, wetlands (swamps), biodiversity, wildlife, extensive fisheries (Blinker, 2006). Additionally, Sierra Leone faces multi-dimensional challenges: (1) economic challenge of stagnation, volatility and unemployment; (2) social challenge of corruption, poverty, inequality and precarity; (3) democratic challenge of polarization, patronage and institutional inefficiencies; (4) environmental challenge of biodiversity loss, land degradation and climate breakdown. Sierra Leone is characterized by high youth unemployment, illiteracy, poverty and corruption (World Bank, 2020). The country has been previously named among the most corrupt nations on earth but that is now changing since 2018.

**Study Metrics:** The methodology adopted for this article was desk review. Documents of interest were: published articles, newspaper commentary, Transparency International Annual Reports, Government documents including Acts, Policies, and Truth and Reconciliation Commission Reports, NGO corruption

reports, and workshop proceeds conferences among others. Ex-Government Corruption Transition Report from 2007 to 2018 was also analyzed.

**Data Collection:** The data for this article was sourced from secondary sources. Key words like corruption, bribery, negative effects of corruption, and corruption in Sierra Leone were used to search for relevant information.

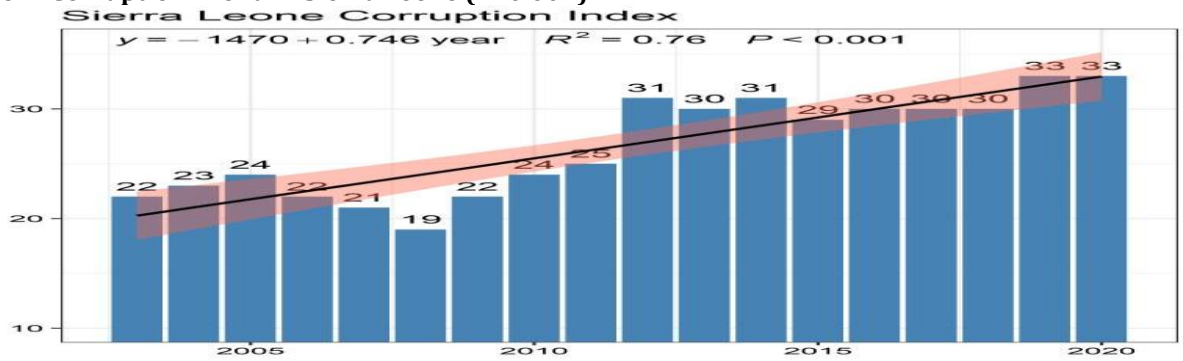
**Data Analysis:** Data collected from the document analysis was sorted to extract relevant information that formed the results and discussion aspect of the article. The Descriptive Statistical Analysis was done using the R software version 4 to predict the trend of corruption ranking in Sierra Leone. The results are presented in simple frequency tables and figures.

**Organization of the Article:** The article is organized as follows: Introduction; Review of literature, Materials and Method; Study metrics; Data collection; Data analysis; Trend of corruption in Sierra Leone; Corruption in state institutions; Effects of corruption on the economy; Corruption in the education sector; politicians and corruption in Sierra Leone; Causes of corruption; Corruption and its role in igniting the eleven-year civil war in Sierra Leone. Ex-Government Corruption Transition Report from 2007 to 2018; Progress in the fight against corruption and the way forward for Sierra Leone in eradicating grand corruption.

## 4. Trend of Corruption in Sierra Leone from 2002 to 2020

Over the past two decades, corruption in Sierra Leone has been an internecine activity resulting in abject poverty of the masses. The impact of corruption in Sierra Leone is shaping the ever-changing trend in poverty, social injustice, inequality and the sustainable economic development of the country (Samura, 2016). Rampant petty corruption activities in Sierra Leone are particularly popular among traffic police officials, finance and procurement officials. Procurement officials, for instance, overprice needed office equipment and award hefty procurement contracts/binding to close relatives, friends and political party loyalists and allies. The Sierra Leone Anti-Corruption Act was established on the 3rd February 2000 and later renamed the Ant-Corruption Commission on the 1st of January, 2001, nonetheless, it was considered by many as a tiger paper prior to 2018 (Roberts, 2020) From 2002, the fight against corruption was viewed derisory by the masses and the corruption index rating was wavering between 22 to 19 corruption indices; the lowest in the world (Fig 1). However, from 2010, the index rating slowly increased especially from 2018 to 2020, but the country has a long way to go in the fight against corruption. The fight against corruption is not yet over in Sierra Leone, nonetheless, the current rigorous trend of fighting corruption is remarkable and assuring as seen in (Fig 1).

**Figure 1: Corruption Trend in Sierra Leone (P<0.001)**




**Corruption and State Institutions in Sierra Leone:** In Sierra Leone, corruption is widespread and a way of life (Hors, 2000) especially for those in authority to an extent that most individuals are more powerful than some state institutions altogether. Corruption has served as an economic barrier undermining the country's potential in delivering inclusive economic growth needed to foster sustainable development. Critics argue that state institutions like the Supreme Court and other powerful organs like the Anti-Corruption Commission

are not totally free from corruption in some cases. Kawusu, (2012) stated that political corruption in Sierra Leone involves the manipulation of political institutions for personal gain and the deviation from the rational-legal values of the modern state. Together with weak and arbitrary governance, weak protection of civil liberties and inadequate regulatory and legal framework to guarantee property rights, political corruption deprives Sierra Leone of needed productive investment and growth (Kawusu, 2012).

The Anti-Corruption Commission of Sierra Leone was established in 2000 by an Act of Parliament to mainly investigate rampant corruption and to prevent the re-occurrence of the civil war that was due mainly to corruption. However, critics believed that the institution itself is corrupt citing the salary of the past and current commissioners capable of paying 50 or more civil servants. Critics believed that the institution has not lived to its full expectation and has been politicized to an extent that it only arrests ordinary citizens who commit minor crimes while allowing influential politicians to get away with corrupt practices worth millions of dollars. For example, the former Mayor of Freetown city council was involved in serious embezzlement amounting to billions of Leones (Millions of US Dollars) but was only charged 120 million Leones ($12,000) which was not even 1% of what the mayor embezzled simply because the Major was from the ruling party as at that time. Also, Valentine Collier, a former ACC head was sacked in November 2005 for alleged involvement in corrupt practices. In October 2007, the chairman of the Anti-Corruption Commission was removed from office for doing very little in fighting corruption. The inability of government institutions to fight corruption at a local, regional and national level has earned Sierra Leone the status of Least Develops Countries title.

One of the most corrupt nations on earth. Most government institution workers operate AA a syndicate to exploit the very poor they are supposed to serve. Thus, corruption and other aspects of poor governance and weak institutions have substantially hindered the economic growth of Sierra Leone. Kawusu (2012) warned that institutionalized political corruption has become a necessary economic backbone for the state elite. The author further opined that ‘‘political corruption is negatively or inversely related to good governance. Critics argue that the very institution designed to fight corruption has been struggling to live up to expectations and that shows how deep corruption is engulfed, Sierra Leone. Since independence, government institutions have been considered the most corrupt sectors in Sierra Leone. The 2020 audit service report of Sierra Leone alleged that the office of the president was involved in some clandestine corrupt activities. The police force of Sierra Leone has always been in the spotlight in connection with corrupt practices. Similarly, government ministers, permanent secretaries, directors, Mayors, city chairpersons and local chiefs have all been alleged to be engaged in corrupt practices and abuse of offices since independence.

**Corruption in the Educational Sector:** Sierra Leone was once considered the epitome of educational civilization and fulfillment in West Africa in the 18$^{th}$ century. The nation was acclaimed as the “Anthem of Africa” educationally. Sierra Leone was, ranked the best among competing universities as a result of the rich curriculum especially in Greek and Latin (Jackson, 2015; Paracka, 2002). During this period, the tertiary education system in Sierra Leone outperformed other higher learning institutes across West Africa before and after independence. However, that glory has long faded away and was replaced by poor academic performance and examination malpractice among students. These might be attributed to corruption, underdevelopment in the educational sector, civil war, poverty catastrophic events like Ebola, and the Covid-19 pandemic among others. Corruption and abysmal performance in public and local examinations in Sierra Leone are intertwined. According to Thomas (2017), most students in Sierra Leone are brained washed those grades and admission to higher education institutions can be bought.

Academic corruption in the form of cheating in the examination across major higher learning institutions and school leaving examinations (West Africa Senior Secondary Examination (WASSCE) is the order of the day in Sierra Leone and other West African countries. The corrupt staff of some of these institutions connives with students to leak examination information in exchange for monies and other demands. In most cases, learning materials supposed to be supplied freely to schools are instead being sold to local vendors on the street (Campaign for Human Rights and Development International (CHRDI), 2017). Over the past few years, examination questions (WASSCE) have been sold to students by teachers prior to the commencement of the examination date. In some cases, rich students pay an intelligent student to take the examination on their behalf while other students are taken to secret locations and allowed to write their examinations using an open book in exchange for a hefty sum of monies. The implication of these actions is felt in the high school

dropout rate, the poor performance of university students, a weak educational labor force, a high illiteracy rate, and an increase in crime, violence and ill-educated future leaders.

**Effects of Corruption on the Economy and Standard of Living of Average Sierra Leonean:** In the 1970s, Sierra Leone, Singapore, Malaysia, Ghana and other nations had more or less the same economic status and GDP. At this time, these nations especially Singapore is far ahead of Sierra Leone in terms of development and economic strength. Corruption held Sierra Leone static for almost three decades without progressing economically and socially. Within this period, however, few individuals acquired huge wealth while the masses standard of living deteriorated exponentially. In Freetown, the capital city today, the increase in the cost of education, health services, food and other basic commodities has given an advantage to a few elites and high-income earners in the city but to the detriment of the majority of the citizens earning low income (Kawusu, 2005). According to the recent UNDP Human Development Index ranking, Sierra Leone is placed 182 out of 189 and categorized among the 10 least developed nations on earth and below the average of Sub-Saharan Africa (UNDP, 2020). About 60% of the population of Sierra Leone lives on a mere US$ 1.25 a day due to widespread poverty in the country as a result of corruption (UNDP, 2020).

Also, the Human Capital Index (HCI) ranks Sierra Leone 151 out of 157 nations in 2019 (HCI, 2019). The country's population is characterized as young—with around 45.8 percent of the population below the age of 15 and 74.8 percent below the age of 25 (World Bank, 2020). The 2021 life expectancy for Sierra Leone stands at (55.18 years) a slight increase from 2020 54.18 years (https://www.macrotrends.net/countries/SLE/sierra-leone/life-expectancy). Sierra Leone has the fifth-lowest life expectancy rate in the world (51 Years). Sierra Leone's poverty rate stands at 56.8 % but remains high (78.5%) in rural areas (World Bank, 2020; Trosclair, 2017). Kpundeh (1997) cautioned that corruption in Sierra Leone is manifested in all categories of government-appointed positions of responsibility. Bitong, (2005) stated that in Sierra Leone, corruption is illegal but no one is willing to give it up yet. Rampant corruption activities across various public and private sectors have denied Sierra Leone the opportunity to experience economic development and advancement other nations like Rwanda are enjoying.

**Politicians and Corruption in Sierra Leone:** On the global stage in recent times, we have seen influential and powerful politicians such as Jacob Zuma, former South African President, former South Korean president Park Geun, Brazil's former President Luiz Inaciao Lula de Silva, Nawaz Sharif (Former Pakistan Prime Minister) found guilty and jailed for corruption. British politicians Jonathan Aitkin and Jeffery Archer were also both in prison for corruption. On the contrary, politicians who looted stated resources are instead celebrated in Sierra Leone. Any attempt by the ACC to arrest such individuals in Sierra Leone usually meets protest and stiff resistance from the political party's loyalists and tribal men. Hence, it is believed that the easiest way to make illegal money in Sierra Leone is by being a politician or closely connected to a powerful politician. Most politicians believed that they are above the laws of the land because they can never be prosecuted and if they do their charges are nothing to worry about. This mentality over the years has made politics an attractive career, especially for the younger generation whose parents acquired illegal wealth through politics.

For instance, the former Chief of Staff of the Sierra Leone government, former Vice President and former Mayor of Freetown City Council were all accused of corruption on issues with explicit evidence that qualify for imprisonment but they are all walking free and living luxurious lives with their looted wealth. ''*Corruption has become a culturally accepted phenomenon; though we may not say corruption is the sole domain of Sierra Leoneans. But let us admit it, we are corrupt*'' (Mansaray, 2018; Kpundeh, 1997). For instance, the invitation of the former president of Sierra Leone for questioning by the ACC in connection with some corrupt practices stimulated a strong protest by his clan's men and party loyalists. Corruption has been the main reason why Sierra Leone is among the poorest nations on earth even though the country is endowed with plenty of minerals with a low population. ''*Judging by the reactions of people on social and mainstream media, it is irrefutable that corruption has gone from a mere act of bribery to a complete state of mind and way of life. It seems to have become so acceptable that, any hint to tackle it is seen as a treasonable offense*'' (Mansaray, 2018). However, Sam (2018) cautioned that ''*Corruption is a complex and multidimensional problem that requires total commitment if it is to be defeated*''.

**Causes of Corruption in Sierra Leone:** The causes of corruption within the political arena of Sierra Leone range from sheer greed to low wages of public officials and sociological factors. But irrespective of the causes, a common characteristic of this obnoxious activity is politicians acquiring wealth and prestige through a system of predatory accumulation (Kawusu, 2012). The establishment of a one-party state system of governance in 1978 was the start of deep-rooted corruption maneuvers in Sierra Leone (Thompson, 1997). During the fourteen years of rule of one-party system governance, corruption reached its peak level and was said to be widespread among politicians and civil servants (Thompson, 1997). Over-expenditure and tribalism are among the other factors contributing to rampant corruption in Sierra Leone over the past decades. According to Chene (2010), the root cause of the eleven-year civil war was a result of corruption. Other root causes of corruption in Sierra Leone have been weak institutions, meager fines, low salaries and a civil servant mindset on bribery, bureaucratic regulations and political affiliation (Chene, 2010).

**Corruption and its Role in Igniting the Eleven-Year Civil War in Sierra Leone:** Six years after Sierra Leone's independence in 1967, a functioning democracy met its premature end with the election of an opposition party. From 1978, the country degenerated further into a one-party state with high-level corruption that the nation has ever seen due to the discovery of Diamonds. Since then, the economic decline continued unchecked with few individuals becoming very wealthy and powerful. Consequently, the skyrocketed rate of corruption and injustice led to the outbreak of the civil war that finally wrecked the already weak economy while at the same time destroying colonial infrastructures. *So endemic was corruption that the government was simply expected by all sides to use state resources to advance the interests of its supporters* (Truth and Reconciliation Commission report, 2003). According to the Truth and Reconciliation Commission (TRC) report (2004), the main reason for the outbreak of the civil war was corruption, injustice, and political oppression among others. From 1968 to 1992 Sierra Leone was ruled by a one-party system and this system was alleged to have looted immerse unaccounted wealth. Because of the corrupt practices of powerful politicians in those days, the economy of Sierra Leone crumbles and has since not recovered. The high level of unequal benefit distribution resulting from diamond sales angered and frustrated ordinary Sierra Leonean under President Steven's Government. Proceedings or revenue from the Diamond sales through National Diamond Mining Corporation that was jointly steered.

DeBeers' ventures were solely used for the personal enrichment of the president and his government allies and the few elites close to him (Federico, 2007). Minerals such as Diamonds are abundant in Sierra Leone and their mining started way back in the 1930s, but because of corruption, there is nothing much the country can boost having that those other nations with Diamonds do not have. Corruption of those in positions of responsibility within the diamond industry is also obvious (Rodgers, 2006). The country lags behind today in all aspects simply because of corrupt individuals and institutions who were supposed to uphold the values and welfare of the country and its people. During the British rule, Sierra Leone had a functioning train connecting strategic parts of the country but soon after independence that train seized operation because of corruption and mismanagement by its management staff. The rampant misappropriation of government funds, unemployment, inequality and unequal distribution of wealth and economic deterioration left the youth population with no choice but to join the civil war and fought the government as rebels. The Revolutionary United Front (RUF) rebels enjoy most of their support from citizens' dissatisfaction with the corrupt governments that were in place since Sierra Leone gained independence from Britain in 1961 (Hirsch, 2001). In addition, Rodgers (2006) ascertains that during the eleven-year civil war, RUF was supported by mostly corrupt and incompetent systems in Sierra Leone.

**Ex-Government Corruption Transition Report from 2007 to 2018:** The March 2018 elections saw a peaceful transit of power to the incumbent government of Sierra Leone. The major reason for their ousting was alleged to be closely linked to corruption and unequal distribution of wealth, especially from the country's mineral resources among other reasons. According to the government transition report (GTR, 2018) ''*Reckless spending, facilitated by the unrestrained use of the Government's overdraft privileges at the Bank of Sierra Leone, was the norm, leaving the economy substantially burdened by debt*'' The use of tax payer's money on personal development was the order of the day for most civil servants in Sierra Leone during this period. The government transition report further discloses millions of Leones taken as loans by top government officials who in turn refuse to pay. Such loans and credits were canceled as bad debts by the same government officials. The reports also found a good number of financial transactions appeared to be

marred by corruption as well as conflict of interest in connection with former top government officials (GTR, 2018). Furthermore, the report unearths many fraudulent contracts that were given to incompetent people who failed to deliver. Moreover, these failed contract individuals were, however, given other enviable positions in the Government while others were merely dismissed from their positions and allowed to walk freely with the millions they stole or misappropriated. For example, in 2013, a $15 million arms deal was awarded to the best friend of the then Minister of Defense for the supply of military vehicles to the army but the Audit Service Sierra Leone report 2014 found that the said contract was over the price at $6.1 million (ASSL, 2014).

**Progress in the Fight against Corruption Since 2018:** In Sierra Leone, the fight against corruption has been complex due to political, tribal, cultural, mindset and weak institutions. However, recent strides in making corruption unfashionable are gradually paying off in Sierra Leone. The country has taken bold steps in tackling corruption through the development of legal frameworks that enable the commission to prosecute corrupt crimes. Since the establishment of the Anti-Corruption Act, Sierra Leone has only been rated below Africa's corruption average in 2021, 2020 and 2019 respectively (Table 1). For instance, Sierra Leone was ranked 3rd among 35 African Countries surveyed in 2019. This rank placed the country ahead of all West African nations (Sandi, 2019). The Corruption Perception Index (CPI) ranked Sierra Leone 129 in 2018; 119 in 2019 and 117 in 2020 respectively. Similarly, the Afro Barometer Corruption Perception Survey shows that the fight against corruption in 2019 has climbed to 66% as compared to 40% in 2015. In addition, the National Corruption Perception Survey conducted in 2019 shows that 92% of Sierra Leoneans are convinced that Anti-Corruption Commission is serious & dedicated to reducing corruption in the country (Jalloh, 2022).

Similarly, the citizen's perception of corruption prevalence declined to 40% in 2020 as compared to 70% in 2015. In 2020, Sierra Leone Millennium Challenge Corporation (MCC) scorecard recorded 81% on the "Control of Corruption" (Sandi, 2019). Table 1 present the yearly corruption ranking of Sierra Leone from 2003 to 2021. The country's ranking is far above the global and African corruption average rankings. However, the country has been ranked below Africa's corruption average since 2019. Nonetheless, the country is still far from reaching the global average in the fight against corruption. A pre-conviction corrupt asset recovery strategy adopted by the Anti-Corruption Commission in Sierra Leone is serving as the best model for recovering looted monies from corrupt politicians and civil servants (Kaifala, 2021). Furthermore, the embarking of the commission officials on public outreach country-wide and awareness-raising is positively shifting the paradigm of government and non-government officials' perception of corruption. Government officials are educated on what constitutes corruption through various outreaches being conducted country-wide by the commission. Recently, the ACC has introduced a compensation scheme for reporting corrupt practices across the country.

**Table 1: Development of the Corruption Index in Sierra Leone 2003 – 2021**

| Year | Sierra Leone Corruption Ranking | Africa's Average | Global Average |
|---|---|---|---|
| 2021 | 66 | 67.9 | 56.8 |
| 2020 | 67 | 67.5 | 56.7 |
| 2019 | 67 | 67.6 | 56.8 |
| 2018 | 70 | 67.5 | 56.9 |
| 2017 | 70 | 67.9 | 56.9 |
| 2016 | 70 | 68.5 | 57.1 |
| 2015 | 71 | 67.7 | 57.5 |
| 2014 | 69 | 67.4 | 56.8 |
| 2013 | 70 | 67.9 | 57.4 |
| 2012 | 69 | 66.7 | 56.8 |
| 2011 | 75 | 70.7 | 59.7 |
| 2010 | 76 | 71.1 | 59.9 |
| 2009 | 78 | 71.3 | 59.7 |
| 2008 | 81 | 71.4 | 59.8 |
| 2007 | 79 | 71.5 | 60.1 |
| 2006 | 78 | 71.5 | 59.1 |
| 2005 | 76 | 71.4 | 59.1 |

| | | | |
|---|---|---|---|
| 2004 | 77 | 70.8 | 58.3 |
| 2003 | 78 | 71.3 | 57.6 |

**Source:** (https://www.worlddata.info/africa/sierra-leone/corruption.php).

## 5. The Way Forward for Sierra Leone in Eradicating Grand Corruption

Sierra Leone is among the 48 least developed countries in the world that largely depend on international aid but corruption remains a cross-cutting issue that affects service delivery and standard of living. The article revealed that the corruption trend in Sierra Leone is on the decline as compared to early 2000. The majority of corruption activities across the country emanate from gross abuse of public offices for private gains. The driving forces behind corrupt practices in Sierra Leone are closely linked to low salary wages, political ambition, the mindset of civil servants, greed and other sociological factors. Great Nations like the US, China, the UK and Canada, etc. have taken bold steps in fighting corruption and today their footprints are noticed everywhere around the globe. The model used to fight corruption in these countries should be borrowed and implemented in Sierra Leone. The extradition of criminal culprits should be enacted and their monies and properties confiscated after being found guilty. If corruption is not tackled now, the future generation of leaders will be worst and the country will plunge into permanent ruin. For a corrupt-free society, the anti-corruption commissioner's appointment should not be political. The commission should be empowered in terms of finance and human capacity to act independently. The government should put punitive measures in place to deal with any public servant and Minister found or engaged in corrupt practices. Allocating contracts based on friendship, relationship and party connection should be discouraged and those engaged in such practices should be prosecuted.

The Anti-Corruption Commission of Sierra Leone should be adequately empowered to go after any individual found wanting regardless of his/her position or connection in the Government; the culprit should be brought to justice. The commission should improve on its public outreach engagement, and develop the pre-conviction corrupt asset recovery strategy already in place. The commission should sign more memorandum of understanding with important sectors and undertake more reforms to strengthen the institution's capability in handling corrupt cases. Massive corruption awareness campaigns should be undertaken regularly alongside Civil Society Organizations (CSO) and NGOs to sensitize the general public about the negative impacts and dangers of corruption to the nation, citizens' welfare, economy and standard of living. As such, regulations, norms, policy framework and transparent procedures, prosecution protocols and crimes committed should be made public. Lastly, the fight against corruption should be collective in a way that everybody should put their hands on deck to report, resist, and stop the "Dutch disease" that has held the country backward since independence. This study will serve as a baseline for future research on corruption and its consequences in developing countries and inform policymakers on the direct and indirect causes of corruption in Sierra Leone.

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# FDI and Environmental Quality-Growth Nexus in the Nigerian Economy: New Evidences from System GMM

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**Abstract:** This paper examines the effect of foreign direct investment through economic activities on the environmental quality of the Nigerian economy by using annual data from 1981 to 2020. Our estimation of the simultaneous equation model was done through system GMM where we estimate the scale, technique and composition effects of foreign direct investment. Our results reveal that foreign direct investment improves economic activities through the scale effect and damages the environmental quality through technique and composition effects. The contribution of physical and human capital investment becomes more prominent in attracting direct investment inflow in the country. This however suggests that our institution should be strengthened to ensure the adoption of technology that poses little harm to the environment in the production process by the investors. Also, more investment should be made in physical and human capital in the country to attract more overseas investment.

**Keywords:** *FDI, Environmental Quality, GMM, Physical and Human Capital.*

## 1. Background to Study

Environmental pollution is an essential issue of discussion in the growth process of any economy. According to Hitam and Borham (2012), deterioration of the environment begins to have an impact on the quality of life or even a major threat to the survival of mankind as the growth process progresses. The effort of mankind in the process of making growth often results in environmental degradation. Such degradation could be pollution of air and some other forms which often pose a serious danger to human existence. In that wise, the management of the environment should be of paramount interest to any government. In addressing this, a certain percentage of budgets should be earmarked for ensuring the safety of the environment thereby helping in making further growth in the economy. It is worth noting that various economic activities in making growth progress often have a serious impact on the environment. The suggestion by the environmental Kuznets curve (hence EKC) hypothesis is that at the initial stage of growth, environmental degradation tends to be much but as time passes, the benefit from growth is further spent on the environment to put it in good shape. In this connection, the inflow of FDI into the country would imply that more investment is made in the country: the higher the inflows, the higher the investment and growth in the economy. However, as more effort is made for the growth, the possibility of various damages to the environment could arise and which raises an issue of making necessary policies. But policies are better made when there are adequate data at hand.

Several studies have looked into this area. The work of Zhu et al. (2016) which is a cross country study, Bao et al. (2010), Adejumo and Asongu (2019) and Bakhsh et al. (2017) which are country-specific are some of the examples of works in this area. However, Adejumo and Asongu (2019) and Zhu et al. (2016) found an inverse relationship between carbon emission and FDI and the work of Zhu et al (2016) further found little evidence of a U-shaped curve hypothesis. In their submission, Bao et al. (2010) and Bakhsh et al. (2017) found a direct relationship between FDI and pollution though using more measures for pollution than the other studies. Since a conclusion has not been reached on this issue, our intention, in this case, is to build on Adejumo and Asongu (2019) by following Bao et al. (2010) together with Bakhsh et al. (2017) for the specific case of Nigeria. However, resting on methodology, our study deviates from the two findings as it gives credence to the usage of system GMM which is more robust than the three-stage least square used in the previous aforementioned studies. Also, in examining the factors that determine FDI, we include human capital investment which other studies did not consider. Its inclusion is justified on the ground that human capital quality in the host country tends to strengthen the performance of FDI in the state. Examining the connection between FDI and the environment can thus be categorized into scale effect (income), technique effect (i.e. the effect of technology adopted in the production process) and composition effect (changing structure of the economy). The outcome was very much different (rest on the methodology) and gives further analysis for FDI-pollution studies in Nigeria.

Also, it is clear that efforts to improve the growth level of an economy often make the environment suffer major setbacks posing threat to the environment by various economic activities in the country. Hence, there arises the possibility that FDI inflow into the country could pose some threats to the environment. Thus, this study would precisely explore the impact of FDI inflow on the environment by taking necessary measures to capture environmental pollution which would include $CO_2$ emission. Also, the effort would be made to ascertain the EKC hypothesis for the case of Nigeria and which (with the use of system GMM) will provide adequate findings in this area.

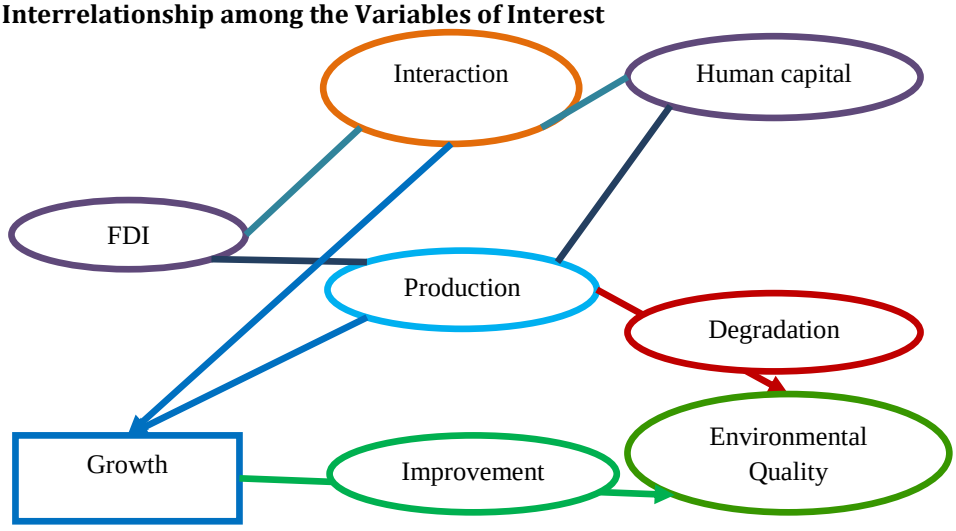
## 2. Theoretical Framework and Review of Literature

### Theoretical Framework

Theories that explain the growth process of the economy are numerous, but the choice of its applicability to any research study will depend on the composition of variables therein. Some of these theories include endogenous and exogenous growth models. Under the endogenous theory, it is believed that the variables that bring about growth are determined in the model while the exogenous model holds that such variables are determined outside the framework of the model. In relation to this study which centres on examining the connection that exists among FDI, economic growth and environmental quality in the country, we analyze our framework based on endogenous growth theory and we lend credence to the popular EKC Hypothesis. This hypothesis holds that at the initial level of growth, economic activities tend to cause more degradation to the environment. And as the growth process improves, the demand for a cleaner environment through improved growth tends to dominate the economy. As shown in figure 1, when economic activity increases, income per capita will also increase, leading to a rise in the quest for a cleaner environment which can equally lead to having adequate capacity in allocating resources for the protection of the environment.

Basically, FDI can directly affect pollution emissions as shown through the volume of production (the scale effect), the mode of technology adopted (technique) and the structural composition of the economy (composition effect). The other effect stems from the GDP per capita channel and which resulted in increasing the physical capital of the host country. Figure 1 clearly explains our variables of interest and their interconnection. This study will analyze eight variables, namely: FDI, Human capital, capital stock, labor, carbon emission (co2), industrial output, population and GDP. In explaining the connection among these variables, the inflow of FDI is expected to lead to growth but this growth will be much improved in the presence of skilful human capital. At the same time, the role played by the human capital in this model will much similar to the growth-capital flows relationship. However, the worrisome part of this analysis can be coined in the phrase: “no free lunch”. As the production process takes place, the usage of energy contributes a higher amount to the environmental quality of the economy. But with much improvement in the growth, higher demand for a cleaner environment could eventually dominate the ground which will then lead to further growth.

**Figure 1: Interrelationship among the Variables of Interest**




**Source:** Author’s Schematic.

**Literature Review**

Several works have been done in examining the efficacy of human capital in enhancing the growth effect of FDI on economic growth. The results from such findings have been very mixed. Some outcomes of the findings upheld the notion that human capital is a transmission mechanism for knowledge sharing, technological absorption and diffusion of skill which always ensure further growth in the economy. In some other studies, human capital investment is not much significant in relating FDI to economic growth. Other similar studies have however attributed much significance to human capital in influencing FDI in the growth process. Some literature has also found that though FDI contributes to the growth of the economy, its impact on damaging the environmental quality is much more prominent. Agbola (2012) investigated connection the between FDI and remittances on economic growth in Ghana taking human capital as a constraint. He made use of the Fully Modified OLS method with annual data from 1965 to 2008. The empirical result indicated that both FDI and remittances enhance economic growth in Ghana and the growth is further improved through the presence of the quality of human capital in the country. The study also found that consumption does stimulate and sustain economic growth in the country.

A similar study in Nigeria by Awolusi (2012) examined the long-run relationship that exists between the international factors and economic growth and also assessed the short-run impact of FDI inflows, trade and local investment on economic growth over the period between 1970 and 2010. The result from the vector error correction model shows that variables in Nigeria model have a long-run relationship with one another and were adjusted in the short run via the three channels. The result further revealed a short-run causal effect among the variables for the country. Another work by Hitam and Borhan (2012) investigate the two most important benefit and cost of FDI in Malaysia which is the growth of gross domestic output and environmental damage. The methodology for the study was a non-linear regression model with annual data between 1965 and 2010. The result indicated that the environment Kuznets curve exists and FDI increases environmental damage. For developing countries, Majeed and Ahmed (2008) had earlier evaluated how the development of human capital can be effective in attracting FDI in developing nations. This study was done from 1970 to 2004 with a panel fixed effect method for 23 developing countries.

The finding shows the importance of market-seeking motive and efficiency-seeking motive in attracting FDI. It also shows that government consumption and military expenditure are complementary and significant. The interest rate has a direct impact on FDI because higher interest rates in the foreign country mean more MNCs have a cost advantage of financing from receiving countries. Omri et al. (2014) also investigated the causality among $CO_2$ emissions, FDI and economic growth for a group of fifty-four (54) countries in Europe, Central Asia, America, the Middle East and Africa using a dynamic simultaneous-equation panel estimation model. The scope of the study was 21 years running from 1990 to 2011. The result provides evidence of one-to-one causality between FDI inflows and economic growth for all the panels and between FDI and $CO_2$ emission for all panels, except Europe and North Asia. It also indicates the existence of one-directional causality running from $CO_2$ emission to economic growth with exception of the Middle East, and Africa panels for which one-to-one causality between these variables cannot be rejected.

The work of Azam and Ahmed (2015) validates the endogenous growth model using some countries in the commonwealth states by focussing on the impact of human capital and FDI on economic growth. Annual time-series data from 1993 to 2011 was used and the methodology was panel regression of fixed effect. The result of their findings supports the hypothesis that human capital growth is critical for economic growth. Also, FDI was found to be effective in promoting the growth in the region and there exist country-specific differences across CIS. Hussaini and Kabuga (2016) however, examine the impact of FDI and human capital on growth in Nigeria using time series data between 1980 and 2016. The result from VECM with structural break gives evidence of a long-run association between FDI, human capital development and economic growth in the country. The study also found that FDI, human capital development and level of investment have a positive connection with economic growth, while it was very weak for human capital development. The results in the short run, suggest the first and second lags of FDI, HCD and GCF are positive and significantly connected to economic growth.

A similar study in China by Fafona et al. (2018) test the long-run relationship between Chinese FDI, agriculture and economic growth in the host country with annual data from 2003 to 2015 using the pool

mean group and VECM panel granger causality model. The result indicates that Chinese FDI, domestic investment and agriculture spur economic growth contrary to some studies which found that Chinese FDI does not cause economic growth. The result further shows that there is no significant panel-VECM Granger causality from Chinese FDI to economic growth, from economic growth to Chinese FDI, from agriculture to economic growth and from economic growth to agriculture. A study in MENA countries by Abdouli and Hammami (2015) examined the impact of foreign direct investment, environmental quality and capital stock on economic growth for 17 countries in the region. The data spans from 1990 to 2012 using a dynamic panel of random and fixed effects.

The empirical results show that the increase in FDI inflows and capital stock enhances the economic growth process in MENA countries. On the other hand, the findings demonstrated that economic growth in MENA countries reacts negatively to environmental degradation. A similar study by Bakhsh et al. (2017) examines the impact of foreign direct investment on environmental pollution and economic growth and also finds the determinants of FDI inflows in Pakistan using annual data series from 1980 to 2014. The study used the 3SLS methodology and the result shows that an increase in economic growth leads to more pollution emissions.

Scale effect shows that stock of capital and labor has a positive effect on the economic growth of Pakistan while pollution has a negative effect on growth. On capital accumulation effect, economic growth and foreign direct investment have a positive and significant effect on the stock of capital. Also, economic growth declines as pollution cross a certain limit. Foreign direct investment is also found to be positively related to pollution. In another study, Li, Dong, Huang and Failler (2019) investigate the impact of FDI on environmental performance through a panel quantile regression model. The data scope runs from 1990 through 2014. Their evaluation was based on environmental performance in 40 countries. Their findings show that FDI has little significance on environmental performance. It further shows that the impact of FDI varies from developed to developing countries, in which heterogeneity of outcome exist for the sample size in the various region sampled. Also, the work of Wang, Wang and Sun (2020) analyzes the interactive effect between corruption and FDI on environmental pollution through the application of a spatial econometric model to the panel data of China's 29 provinces from 1994 to 2015 with a comparative effect between Eastern part, central and western regions. According to their findings, FDI inflows reduce environmental quality, while such an impact on the environment with the presence of corruption leads to an inflow of low-quality FDI. With this, it weakens the spill-over effect of FDI and thus leads to further environmental pollution.

## 3. Methodology

**Model Specification and Estimation**: In the original Solow growth model, the rates of savings, population growth and technological progress are assumed to be exogenous, with two inputs, namely, capital and labor. Assuming a Cobb-Douglas production function, the production at time t is given by

$$Y_t = K_t^{\alpha}(A_t L_t)^{1-\alpha} \qquad where\ 0 < \alpha < 1 \qquad 3.1$$

Where Y is output, K is capital, L is labor and A is the level of technology. L and A are assumed to grow exogenously. In this model, the central prediction is concerned with the impact of saving and population growth on real income. However, Mankiw et al. (1992) modified this model by adding human capital such that the total savings from output Y are now invested and shared between physical and human capital. The modified model is as follows:

$$Y_t = K_t^{\alpha}(H_t, FDI_t)^{\beta}(A_t L_t)^{1-\alpha-\beta} \qquad 3.2$$

Where FDI is the foreign direct investment flows that are being aided by the available level of human capital (H) in the economy and all other variables are as defined before. The belief, concerning this model, is that human capital investment plays many roles in the growth process of the economy.

Following the equation model in the theoretical framework adopted by this study and after incorporating relevant variables in the model, the following system equations will be estimated by this study. The effect of FDI on the environment of the host country could be of the following channels: scale effect (Gross Domestic Product), technique and composition effects (Bakhsh et al., 2017). Thus, we categorize pollution emission into the following three effects:

$$PE = RGDP + TE + CE \quad 3.3$$

In this equation, the scale effect is measured through physical capital stock K, composition effect, through the ratio of industrial output to GDP and technique effect through the ratio of total pollution to industrial output. In studying the scale effect of foreign direct investment, we are going to analyze how a foreign direct investment will affect economic growth by enhancing domestic physical capital accumulation. This effect can be examined by estimating the following equation:

$$RGDP = \delta_0 + \delta_1 FDI + \delta_2 K + \delta_3 H + \delta_4 PE + \varepsilon_t \quad 3.4$$

From equation 2, GDP is real GDP, FDI is foreign direct investment, K is stock of capital, H is human capital, and PE is pollution emissions. $\delta_0$ is constant, $\delta_1$ to $\delta_5$ are the parameters to be estimated, $\varepsilon_t$ is a white noise error term.

Coefficient of pollution emission is expected to have a negative sign because of its effect and its recovery cost from the damage. According to Cole et al. (2011), FDI directly affects economic growth while Zhang et al. (2004) hold that it indirectly increases the physical capital stock in the country. This indirect effect of FDI on economic growth forms the following equation:

$$PK = \beta_0 + \beta_1 FDI + \beta_2 GDP_{t-1} + \varepsilon_t \quad 3.5$$

In this equation, the lagged value of GDP is used to show the level with which economic growth and its environmental imbalance affect capital accumulation. FDI is believed to influence the stock of capital of an economy. For technique effect, we are going to estimate the following equation:

$$TE = \alpha_0 + \alpha_1 FDI + \alpha_2 PD + \alpha_3 GDP + \varepsilon_t \quad 3.6$$

TE is measured as a ratio between pollution emission per unit of industrial output and every other variable remained as defined before while PD is population density. As a matter of consequence, the technique effect will increase the damage cost and the process of recovering that cost will negatively affect output. However, in this case, an increase in economic activities (GDP) raises per capita income, which will eventually lead to higher demand for a cleaner and better environment.

To examine this effect (i.e. the composition effect), we will estimate the foregoing equation:

$$CE = \gamma_0 + \gamma_1 FDI + \gamma_2 PK + \gamma_3 GDP + \gamma_4 H + \varepsilon_t \quad 3.7$$

Where CE is the composition effect which is the ratio of industrial output to GDP and H is the level of available human capital. The relationship between industrial output and physical capital is expected to be positive as the higher capital stock would cause industrial output to rise. Also, change in the level of economic activities is expected to reflect the industrialization process of the economy and the demand for a cleaner environment. The incorporation of the variable H is to explain the contribution of human capital in boosting industrial activities. Factors influencing FDI are numerous and could be time and country-specific. In that wise, we will establish these factors by estimating equation 3.6 below to show the determinant of FDI via the Nigerian economy.

$$FDI = \varphi_0 + \varphi_1 FDI_{t-1} + \varphi_2 H + \varphi_3 POL_{t-1} + \varepsilon_t \quad 3.8$$

One period lag value of FDI is used in the equation to avoid the endogenous problem and to estimate the self-accumulation of FDI. The variable H is introduced in the model to show the impact of human capital on the FDI while PE is the amount of pollution emission determining the impact of the decision to invest in Nigeria. Thus, equations 3.4 to 3.8 will be estimated.

Equations 3.4 and 3.5 are for scale effects while equations 3.6 and 3.7 are for technique and composition effects respectively. Equation 3.8 is to estimate the determinants of FDI in the Economy. However, estimation of system equations of this nature requires that we follow the usual rank and order conditions. Examining the equations further and avoiding the endogeneity problem requires that the estimation is done through either two stages least square, three-stage least square, or system GMM among others. But it is generally known that GMM is more efficient as it ensures the application of a weighing matrix that is more robust to heteroscedasticity of unknown form. Thus, our estimation is done using the GMM Time-series (HAC) whose

robustness extends to the autocorrelation of unknown forms. For easy interpretation, all our variables were in log form before estimation.

**Data Sources and Variable Measurement**

**Data Sources:** The study makes use of secondary data. The data for the study were sourced from various data banks which will include the Central bank of Nigeria bulletin, Nigeria Bureau of Statistics, NBC, World Development Indicator, WDI, and the Penn world Data bank. The scope of the study spans from 1981 to 2020. This period is adjudged to incorporate major policies of the Nigerian economy which hitherto involved those made to ensure foreign participation as a way to boost the economy.

**Measurement of Variables**

**Table 1: Description and Measurement of Variables**

| S/N | Variable | Description | Sources |
|---|---|---|---|
| 1 | FDI | Foreign direct investment inflows | WDI |
| 2 | L | Labour employed | Penn world Tables |
| 3 | POP | Population | Penn world Tables |
| 4 | H | Human Capital | Penn world Tables |
| 5 | EMO | $CO_2$ Emission | Penn world Tables |
| 6 | GDPPC | Gross Domestic Product Per Capita | CBN |
| 7 | IO | Industrial Output | CBN |
| 8 | PC | Physical Capital | Penn world tables |

**Source:** Author's Compilation.

**4. Results and Discussion of Findings**

This section will present the result of our GMM and OLS estimations.

**Scale Effect of FDI:** The result for the scale effect is illustrated in table 1. According to the statistics therein, both physical and human capital contribute positively to economic growth, though that of physical capital is not significant. Possibly, its insignificance could be arising from the nature of the Nigerian economy which is still developing where attention to the capital building is not prominent. The direct impact of FDI on growth was found to be positive and significant. As shown in the table, a 1% change in FDI will raise economic growth by 0.283% which is much lower when compared to the impact of human capital.

**Table 2: Scale Effect**

| Variables | RGDP | |
|---|---|---|
| | GMM | OLS |
| Constant | 3.017 (0.00)* | 11.54 (0.00)* |
| FDI | 0.283 (0.00)* | 0.041 (0.17) |
| K | 0.003 (0.52) | -0.026 (0.28) |
| H | 1.076 (0.00)* | 3.423 (0.00)* |
| PE | 0.307 (0.00)* | -0.062 (0.69) |
| *Adj-$R^2$* | *0.89* | *0.97* |

P-Values are in parentheses. *Shows 1% sig. However, the indirect effect of FDI can be measured through its effect on capital stock which is the multiplication of the coefficient of capital stock in equation 5.4 and of FDI 5.5. This gives 0.001188 (0.003 x 0.396). In total, the impact of FDI on growth is found by summing up the direct and indirect effect which is 0.284. This figure is still not significantly different from the parameter of the direct effect-an indication of the weak impact of capital stock in the country. The pollution emission and its impact on economic growth were significant and positive. It contributes about 0.31% to growth, implying that technological adoptions by multinationals in the country are becoming environmentally friendly. This was in line with Bao et al. (2010) and Bakhsh et al. (2017). The effect of previous growth on physical capital accumulation was positive and significant in Nigeria [$\alpha$ = 0.181, p-value (0.01)]. Table 2 and 3 shows that the

GMM model behaves better than the OLS (see the value of adjusted $R^2$). This possibly raises an issue of the presence of an endogeneity problem in the model which has been solved using system GMM.

**Table 3: Capital Stock Effect**

| Variables | Capital Stock, K | |
|---|---|---|
| | GMM | OLS |
| Constant | 3.906 (0.05)** | 4.386 (0.31) |
| FDI | 0.396 (0.00)* | 0.379 (0.09)*** |
| GDP PC | 0.181 (0.01)** | 0.144 (0.27) |
| *Adj-R²* | *0.39* | *0.40* |

P-values are in parentheses. *, ** and *** show 1, 5 and 10% of sig.

**Technique Effect:** The result in table 4 shows the technique effect of FDI on the host country. Our result indicates a positive relationship between pollution emission and the flow of FDI in the country. This shows that marginal pollution damage rises with a higher FDI. According to statistics therein, a 1% increase in FDI will increase the pollution per unit of industrial output by 1.73%. This is very enormous damage indeed. This significant effect is attributed by Bakhsh et al. (2017) to the refusal of foreign investors to follow appropriate strategies for pollution abatement. The parameter of population density was positive and significant in its effect on pollution per unit of industrial output. This indicates that as population density rises, pollution emission becomes relatively larger and this might necessitate strict pollution regulation measures by the government authority. The impact of GDP per capita was negative and significant, indicating lower marginal pollution damage from rising GDP per capita. This suggests that people are becoming aware of the damages of the pollution and are making effort to control it. On this ground, it could be said (as put by Bao et al., 2010) that the country is 'over the hump' of the EKC.

**Table 4: Technique Effect**

| Variables | Tech | |
|---|---|---|
| | GMM | OLS |
| Constant | -89.70 (0.00)* | -6.547 (0.04)** |
| FDI | 1.726 (0.00)* | -0.035 (0.45) |
| PD | 12.97 (0.00)* | 1.642 (0.02)** |
| GDP PC | -3.587 (0.00)* | -1.115 (0.00)* |
| *Adj-R²* | *0.45* | *0.99* |

P-values are in parentheses. * and ** show 1 and 5% of sig.

**Composition Effect**: The composition effect is illustrated in table 5. In the case of FDI, its contribution to the share of industrial output in the overall economy is negative and significant. This is due to more pollution damage emanating from an increase in FDI. Thus, the cost is much more effectual than the benefit arising from the share of industrial output in the economy. Also, capital per unit of labor affects industrial output share in a negative and significant manner, suggesting inadequacy of capital stock in the industrialization process of the economy. The GDP per capita was negative and significant. This implies that as per capita income increases, the industrial composition tends to change toward developing clearer and more value-added products and services. It can be further argued that an increase in per capita income leads to generation or more pollution whose negative impact is reflected in industrial composition.

**Table 5: Composition Effect**

| Variables | Comp | |
|---|---|---|
| | GMM | OLS |
| Constant | 0.603 (0.02)** | -1.324 (0.02)** |
| FDI | -0.044 (0.00)* | 0.039 (0.20) |
| GDP PC | -0.024 (0.00)* | -0.082 (0.00)* |
| K/L | -0.093 (0.00)* | -0.052 (0.02)** |
| *Adj-R²* | *0.47* | *0.65* |

P-values are in parentheses. * and ** show 1 and 5 % of sig.

**Determinants of FDI Inflows in Nigeria:** In table 6, the results of the determinants of FDI in the country are illustrated. First, the self-accumulation effect of FDI is found as a significantly positive effect of previous FDI. According to our result, a 1% change in the previous FDI in Nigeria will increase the current FDI by 0.79%. Also, the contribution of human capital development to FDI is found to be significant and positive. This goes to explain that the presence of human capital in the country tends to attract more FDI inflows. Also, an associated parameter of pollution emission is found to be negative and significant. This suggests the possibility of various efforts by the government to ensure a clearer environment which might necessitate a higher cost of production for the multinationals and incidentally affects FDI inflows.

**Table 6: FDI Determinants**

| **Variables** | **FDI** | |
|---|---|---|
| | **GMM** | **OLS** |
| Constant | 9.199 (0.00) | 17.04 (0.07)** |
| $FDI_{t-1}$ | 0.789 (0.00)* | 0.407 (0.02)* |
| H | 2.210 (0.00)* | 4.752 (0.03)* |
| $PE_{t-1}$ | -0.521 (0.00) | -0.592 (0.49)* |
| *Adj-$R^2$* | *0.72* | *0.76* |

P-values are in parentheses. *, and ** show 1 and 5% of sig.

## 5. Conclusion, Recommendations and Policy Implications

This study investigates environmental pollution arising from FDI inflows in the country through scale, technique and composition effects. Our findings are very striking and give further evidence on FDI-Pollution analysis in the country. Our result shows that physical and human capital contributes positively to the economic activities and both direct and indirect impact of FDI was found to be significant and positive on growth. As for the pollution, its effect was positive indicating that entry of FDI in the country is becoming more environmentally friendly. Also, the various economic activities in the country contribute positively to the stock of capital which further intensifies the impact of FDI on growth. On the technique effect, the marginal damage arising from FDI inflows becomes larger as FDI increases. The damage becomes more prominent from rising population density though the effect of per capita income suggests that people are becoming aware of maintaining a cleaner environment. Our findings from industrial composition suggest that environmental damage arising from FDI inflow into the industrial sector is significant. The result further reveals that the capital-labor ratio is not large enough to command a higher share for the industrial sector than the whole economic activities in the country.

On the determinant of FDI, both self-accumulation of FDI and human capital investment attract FDI inflows in the country while the possible cost arising from strict environmental management measures of the host country dispels it. Our observation from the forgoing suggests that FDI inflows contribute to economic improvement through scale effect (output) and to rising pollution emission through technique and composition effects. We thus suggest that the institutional structure of the country should be made to encourage FDI inflows and regulate the activities of the multinationals and local firms toward the adoption of environmentally friendly technology. Also, government and various economic stakeholders should make effort to invest in both physical and human capital given their importance in driving growth and attracting foreign investment. The policy implication arising from the study gives rise to the fact that more consideration should be energized to ensuring the free flow of FDI into the country and in doing this attention should be directed to environmental protection. Also, industrial activities should be placed under adequate control to such an extent that will not constitute a threat to the environmental condition of the people.

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