

“Triple Ps” in infrastructure development and economic growth in Sub-Saharan Africa

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ABSTRACT

The study focused on the impact that public private partnerships (PPP) has had on the economies of sub-Saharan African countries. A quantitative approach was decided on to extend the limited empirical studies performed relating to the impact that PPPs have on the economies of sub-Saharan Africa. The dissertation has covered annual data extracted from the World Bank PPI database covering 47 of the 55 African states between 1995 and 2015. The analysis was designed and performed to test the impact that each of the independent variables: 1) the total PPP investment, 2) the PPP investments per type and 3) the PPP Investment per sector had on economic growth measured and presented by the Gross Domestic Product (GDP) using the System Generalised Method of Moments estimation technique.

From the panel data analysis, the study could not find a significant effect of total PPPs on economic growth. However, the disaggregation analysis shows that both Brownfield and Management and Lease contract types of PPP had a positive and significant effect on economic growth. This is in line with the theoretical suggestion that the public sector could improve the impact that infrastructure investments have on economic growth by improving operational efficiency and innovation. In terms of the difference in the results per sector, it does appear that PPPs in water and sewerage have a stronger effect on economic growth compared with PPP investments in other sectors. In addition, a positive effect of PPP in the transport sector on economic growth was also found. Although the result of the analysis does not point to conclusive evidence of a causal relationship between PPP and economic growth, the paper does provide necessary context to the growing criticism of PPP, and points to further research that should be instituted to understand the key performance criteria for PPPs and for discussions relating to the subject to be re-ignited.

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LIST OF ABBREVIATIONS

<i>BM</i>	<i>Broad money supply</i>
<i>BNDES</i>	<i>Brazilian Development Bank</i>
<i>BP</i>	<i>Breusch–Pagan</i>
<i>CSF</i>	<i>Critical success factors</i>
<i>CW</i>	<i>Cook–Weisberg</i>
<i>DCPS</i>	<i>Domestic credit to private sector</i>
<i>DFI</i>	<i>Development finance institutions</i>
<i>EAP</i>	<i>East Asia and Pacific</i>
<i>GCF</i>	<i>Gross capital formation</i>
<i>GDP</i>	<i>Gross domestic product</i>
<i>GMM</i>	<i>Generalized Method of Moments</i>
<i>IDFC</i>	<i>Infrastructure Development Finance Company of India</i>
<i>INF</i>	<i>Inflation</i>
<i>LAC</i>	<i>Latin America and Caribbean</i>
<i>LIC</i>	<i>Low-income countries</i>
<i>LMC</i>	<i>Lower middle-income countries</i>
<i>Ln</i>	<i>Natural logarithm</i>
<i>MENA</i>	<i>Middle East and North Africa</i>
<i>POP</i>	<i>Population growth</i>
<i>PPI</i>	<i>Private participation in infrastructure</i>
<i>PPP</i>	<i>Public private partnerships</i>
<i>REIPPPP</i>	<i>Renewable energy independent power producer procurement program</i>
<i>SA</i>	<i>South Africa</i>
<i>SSA</i>	<i>Sub Saharan Africa</i>
<i>UMC</i>	<i>Upper middle-income countries</i>
<i>USD</i>	<i>United States dollar</i>
<i>VfM</i>	<i>Value for money</i>
<i>WAR</i>	<i>Wooldridge test for autocorrelation</i>

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

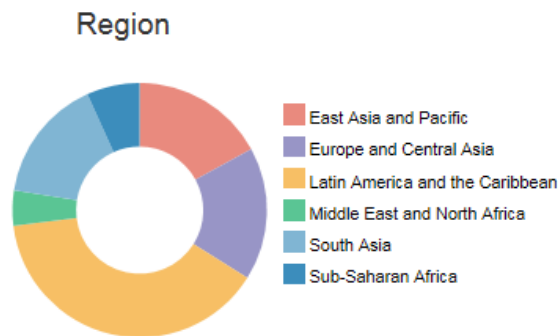
The infrastructure shortfall in Africa is estimated to be at least US\$48 billion per annum (Dornel, 2014). The African Development Bank (2018) estimates are higher: between US\$130 billion and US\$170 billion. The shortfall is a major constraint for economic development and well-being of society on the continent. Theoretically “triple P” also known as Public Private Partnerships (PPP) has a significant role to play to fill this gap and it is estimated that PPP can contribute more than US\$12 billion per annum. (Dornel, 2014).

According to Zangouinezhad & Azar (2014), PPP can be defined as being a partnership between the public sector and the private sector where a structure (project) is created to perform the disciplines required to establish infrastructure. The public sector and private sector are allocated roles and responsibilities in this structure which ideally should meet their respective goals and objectives and match their ability to perform, in accordance with their responsibilities. Thus, synergies are created, and sufficient funding mobilised to activate large scale infrastructure developments. It could be argued that the public sector in Africa is at a disadvantage due to resource constraints. This has a negative impact on the public sector in Africa’s ability to perform according to its obligations in PPP structures and to negotiate beneficial terms to ensure its goals are met through these structures. Although the impact of this constraint is expected to be significant on the success of PPP in Africa, it will not be addressed in this paper which will focus on the *potential* of PPP for sub-Saharan Africa. Risk associated with the implementation of PPP in sub-Saharan Africa should be investigated in further studies.

The World Bank recognises that PPP is an important vehicle to mobilise economic development. For the past two decades the World Bank has been a vocal supporter of PPP and the perceived benefits it offers for economic growth - a pre-requisite for its sustainable development goals. Due to the importance of PPP and its perceived potential, the World Bank collect, accumulate, and analyse data relating to PPP in developing countries. The data includes figures from 1985 to date. According to this database (World Bank, 2015) investments in PPP between 2011 and 2015 increased significantly by approximately US\$850 billion (33% of total investments). The significance of this increase is explained later in this document.

Sub-Saharan Africa shared only (7%) of the PPP developing countries’ ‘pie’. Below is the distribution from 1985 to 2015 indicating the small portion achieved by sub-Saharan Africa.

Diagram 1.1: Pie chart of PPP investment per developing region



Source: World Bank PPI Project Data Base

It is therefore clear that PPP in sub-Saharan Africa can grow significantly, and if PPP can mobilise economic growth, it is worthy of renewed focus. In a report (Dintilhac, Ruiz-Nuñez, & Wei, 2015), the World Bank confirms the benefits of PPP to economic growth, while it highlights that this conclusion is mainly supported by case studies and that empirical evidence is limited. There has always been criticism of PPPs due to the lack of transparency and the capitalist nature of such partnerships the outcome of which is enrichment of private companies at the cost of society. The criticism has been mostly based on case studies and subjective opinion. In the recent past however, the quality and basis of criticism has improved with various empirical studies now supporting the critics. It has therefore become important to once again verify if there is a causal relationship between PPP’s and economic growth and therefore test at a high level what this relationship might be in African countries.

Quantitative research performed by Zangouezinezhad & Azar (2014) concludes that there is a positive causal relationship between the amount and size of PPP projects and long term economic development. The study goes further and stipulates that the type of PPP influences the impact on economic growth. This proves that an increase in appropriate PPP will result in increased economic development and growth and supports the World Bank’s view that governments should establish specific PPP departments (institutions) to ensure the increase of PPP. Their study was published in 2014, based on data collected up to 2009. As mentioned above, PPP across the world increased by

33% between 2011 and 2015 indicating that an update of the research should be undertaken as much more data is currently available. Further to this, the study did not include data from any African countries. Although it is understood that public sector resource constraints in Africa might negate some of the potential benefits of PPP, it is important to start including data from Africa into these studies to ensure appropriate buy-in from Africa's public sector role players. From the literature review it has become apparent that the lack of strong institutions in sub-Saharan Africa is expected to have a negative drag on the impact PPPs are having on economic growth. Because the results of the regression analysis performed in this study could not establish a causal relationship between PPP investments made in the selected African countries and economic growth, it highlights the importance of building an understanding why African countries are not benefitting like their counterparts in the developing world.

This study uses the World Bank database between 1995 and 2015 to determine if a causal relationship exist between PPPs and growth in GDP. The total value (in terms of US\$ invested) of PPPs, the type of PPP and the sector into which the PPPs are invested, are identified, and segregated, to determine what the driver of growth could be. As this study analyses PPPs in Africa and its impact on GDP, all the African countries with recorded PPP data over the selection period were selected. According to some (Eberhard, Kolker, & Leigland, 2014), the most successful PPP in Africa in the last 20 years, the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) in South Africa, has been implemented in 2011. The data relating to South Africa, together with Nigeria, the largest economy in Africa (World Bank, 2016) are of particular interest.

This research expands on the problem statement, which is that sub-Saharan Africa's public sector, and global development finance institutions (DFIs) do not allocate sufficient resources to ensure that the number and size of PPP will increase and to improve PPP effectiveness to contribute more to economic growth. The research proves that the positive causal relationship between PPP and economic growth found by Zangouinezhad & Azar (2014) still exists and that the type of PPP influences the level of impact on economic growth. It then will justify the importance of the research. The literature review provides context, while the intended research methodology provides the reader with an understanding of the scope of the research.

1.2 PROBLEM STATEMENT

Sub-Saharan Africa public sector and global DFIs do not allocate sufficient resources to ensure growth in the size and number of PPP in the region so as to breach the infrastructure gap and stimulate much needed economic growth. Further to this, the lack of supporting institutions detracts from the effectiveness of PPP in the region. This study seeks to address the problem by highlighting the relationship between PPP and economic growth, a key factor for the success of both public and private sectors.

The questions the research will answer are:

Will the increase in PPP investment in sub-Saharan Africa contribute significantly to economic growth in the region?

What type of PPP would have the greatest potential impact on economic growth?

To frame the problem, the table below has been included to show that although progress has been made since 1990, between 2014 and 2015 the sub-Saharan Africa region was the only developing region where less than a third of its population had access to improved sanitary facilities and only 35% of its population had access to electricity. This is less than half of the next worst region in terms of access to electricity.

Table 1.1: Access to infrastructure per Developing regions

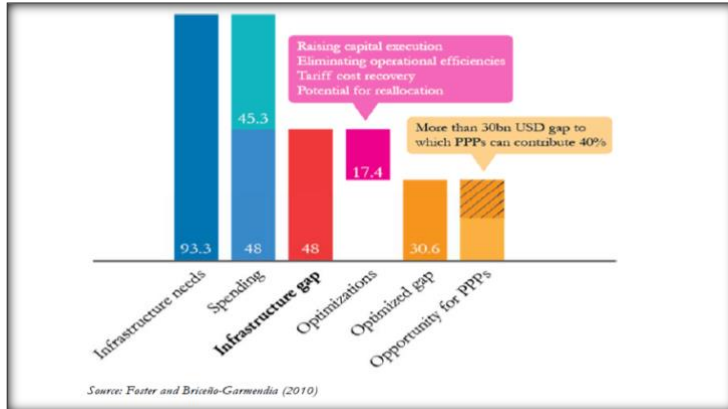
		Region					Income		
		SSA	SA	MENA	LAC	EAP	LIC	LMC	UMC
Electricity									
Total	1990	14	65	94	87	87	10	29	73
<i>percent of population (median)</i>	2014	35	76	92	95	94	23	45	89
Urban	1990	50	95	97	99	96	44	67	99
<i>percent of population (median)</i>	2014	63	96	98	98	99	62	83	98
Rural	1990	1	42	90	69	86	1	8	28
<i>percent of population (median)</i>	2014	19	72	78	85	91	8	18	67
Safe Water Sources									
Total	1990	51	69	92	86	84	48	59	91
<i>percent of population (median)</i>	2015	77	93	96	94	96	77	76	93
Rural	1990	39	64	84	68	77	36	52	83
<i>percent of population (median)</i>	2015	67	92	92	87	93	67	57	81
Improved Sanitation Facilities									
Total	1990	15	20	77	66	72	11	27	71
<i>percent of population (median)</i>	2015	29	55	92	83	85	21	30	66
Urban	1990	34	58	93	79	79	27	52	79
<i>percent of population (median)</i>	2015	38	73	96	87	88	38	37	70
Rural	1990	9	5	65	38	64	7	18	64
<i>percent of population (median)</i>	2015	25	47	82	75	83	16	25	61

Sources: World Bank, World Development indicators.
Note: EAP= East Asia and Pacific; LAC= Latin America and the Caribbean; MENA= Middle East and North Africa; SA= South Asia; SSA= Sub-Saharan Africa; LIC=low-income countries; LMC= lower-middle income countries; UMC= upper-middle income countries.

Poverty in sub-Saharan Africa remains a big problem. Solving this problem needs a bouquet of solutions which have been documented in various publications. In most of these publications the infrastructure development is listed as a top priority (Calderón et al., 2018). The following graph adopted from (Calderón et al., 2018) indicates the infrastructure finance gap estimated for the next

decade, and highlights the potential impact of PPPs to address the gap. Only US\$45.3 billion of the required US\$93.3 billion has been provided for, leaving a gap of US\$48 billion.

Diagram 1.2: Bar chart of infrastructure needs and investments



Amounts reflected are US\$ billions

The limited empirical research to infer a positive causal relationship between PPP and economic growth indicates a need for such research and/or the updating of available research previously undertaken. This paper set out to focus on the impact that PPP has had on African countries to answer the research question and to stimulate discussions relating to the benefit of PPP in the African context. Empirical research that has been identified as proving the causal relationship between PPP and economic growth was published in 2014 in the International Journal of Social Economics with the following title: “How public-private partnership projects impact infrastructure industry for economic growth” (Zangouinezhad & Azar, 2014). A weakness of this study is that no African countries were selected for inclusion. To enhance the study, the PPP and economic growth data of 47 African countries will be analysed which will provide some African context. Through the literature review it became apparent that the most prominent determinant of PPP success is the existence of strong PPP institutions. This study does not test the impact that PPP institutions have on the success in terms of economic growth created by PPPs; but recommends this for further studies.

If the positive causal relationship found by Zangouinezhad and Azar (2014) is confirmed by this proposed research, it should activate renewed focus and support of PPP by the public sector and private sector in the sub-Saharan Africa region. If the results indicate a contradiction to the Zangouinezhad and Azar (2014) study, additional research should be performed to establish why the theoretic benefits of PPP are not being achieved. This research would specifically be important

to the sub-Saharan Africa due to its infrastructure back-log and limited state/government resources, and thus its reliance on alternative funding mechanisms to fund infrastructure. Comparing the two graphs below it seems clear that PPP investments in sub-Saharan Africa are more erratic than the rest of the developing world. One of the reasons for the erratic nature of PPP investments in Sub-Saharan Africa is the inability of governments coupled with a lack of political will, to ensure sustained investments via PPP structures. By including the African countries in this study, it is expected that the long-term benefits of PPP structures would be proven even in the African contexts and that this would motivate for stronger government support for PPPs. If the rest of the developing world is benefitting from sustained PPP investments, there should be no reason why this success story cannot be repeated in sub-Saharan Africa.

Diagram 1.3: Total investment in energy, transport, and water, by section, for developing countries

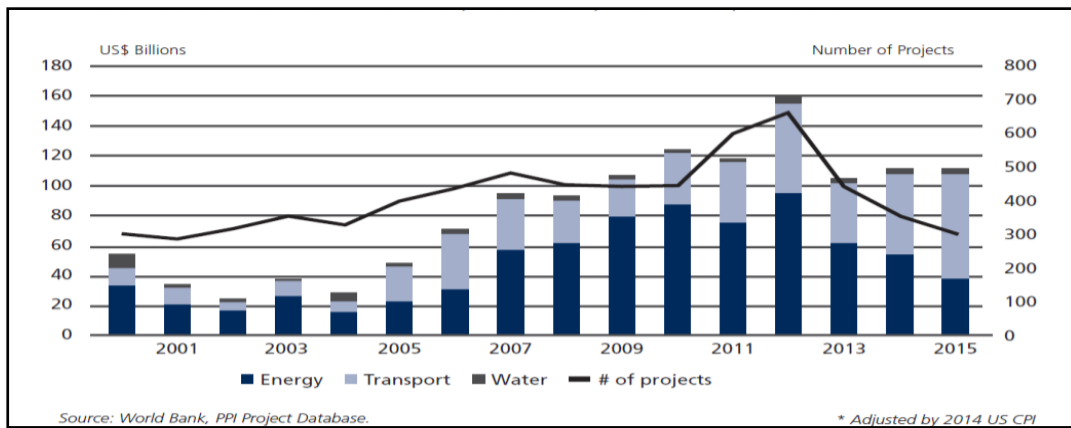
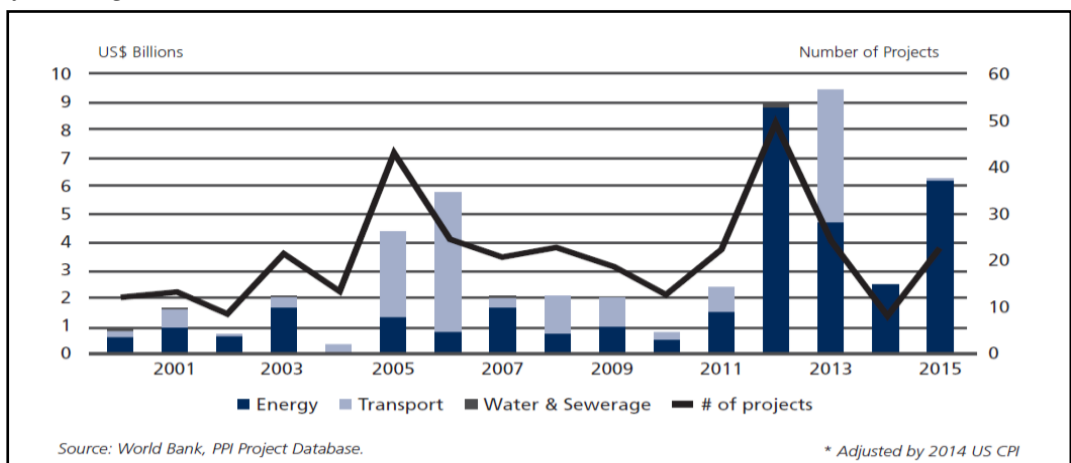


Diagram 1.4: Total investment in energy, transport, and water, by section for the Sub-Saharan Africa region



The following section provides the specific research objectives, including the hypothesis which will be tested to provide answers to the research question.

1.3 RESEARCH OBJECTIVES AND HYPOTHESIS

The objective of the research is to establish if the causal relationship found by Zangouinezhad & Azar (2014) between PPP and economic growth exist for the African countries selected.

- i. To examine the effect of PPP investments on economic growth in sub-Saharan Africa.
- ii. To examine the effect of the type of PPP investments on economic growth in sub-Saharan Africa.
- iii. To examine the effect of PPP investments dissected by sector, on economic growth in sub-Saharan Africa.

The following hypothesis will be tested:

- i)** PPP investments result in a higher growth rate of GDP.
- ii)** The type of PPP influences the rate of GDP growth resulting from the PPP
- iii)** The sector of PPP influences the rate of GDP growth resulting from the PPP

1.4 JUSTIFICATION OF THE STUDY

To understand the importance of the study, it is important to understand the objectives of the stakeholders and specifically, parties directly involved with PPP in the public and private sectors. The public sector led by government is primarily responsible to serve and thus improve, the living conditions of the people it governs. This includes the provision of social infrastructure. Success for governments would be the creation of additional infrastructure resulting from the gearing of government funds enabled by PPP. Theoretically, this will accelerate economic growth which in turn, will support the improvement of living conditions for all. According to Bhattacharya, Oppenheim & Stern (2015) the world currently spends circa US\$2.5 trillion to US\$3 trillion dollars annually on infrastructure while it requires US\$6 trillion annual infrastructure investment to reach the World Bank objectives which will result in sustainable improved living conditions, globally. Mobilising private sector funding has the potential to significantly reduce the funding gap (Bielenberg, Kerlin, Oppenheim & Roberts, 2016).

The private sector is generally defined as being the part of the economy, which is controlled by private individuals or groups, usually as a means of enterprise for profit. The private sector needs to serve its shareholders and create value for them. The private sector would be successful if it could be proven that their contributions to PPP would improve triple bottom line performance (Eadie, Millar & Grant, 2013). One of these “bottom lines” is improving the social environment, and this requires economic growth.

Economic growth is therefore the critical success factor linking the two partners in PPP. As the critical success factor it is important to establish if there is a positive causal relationship between PPP and economic growth. Due to limited empirical evidence confirming the causal relationship between PPP and economic growth in sub-Saharan Africa, the focus of the study is on sub-Saharan African countries with data of 47 countries analysed. In the sub-Saharan African context, the impact that the type of PPP and the sector into which PPP invests funds will have on economic growth is important to understand, due to limited government resources. These limited resources need to be prioritised to ensure the greatest impact on economic growth. This will include the establishment of supporting specialised institutions.

1.5 LIMITATION OF THE STUDY

This study is limited to the measurement of the impact that PPPs have on economic growth in Sub-Saharan Africa and does not provide statistical evidence of the amplifying contribution that key success factors could have on the impact on economic growth. Focus should be shifted towards these key success factors for PPP, as the literature reviewed points towards the apparent lack of strong institutions in sub-Saharan Africa having a negative drag on the impact that PPPs are having on economic growth.

1.6 ORGANISATION OF THE STUDY

The rest of the study is organised as follows:

Chapter two provides an overview of the relevant literature reviewed.

Chapter three explains the research methodology and data selection.

Chapter four discusses the finding of the analysis performed.

Chapter five provides the conclusion and recommendations for future studies on the subject matter.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides an overview of existing literature to contextualise the importance of quantitative studies relating to developing countries (focussing on Africa) to determine if a causal relationship exists between PPPs and economic growth. The review starts off by presenting an understanding of the literature available relating to infrastructure backlog and the potential impact of PPPs to breach the infrastructure gap in the sub-Saharan Africa. It will then provide an acceptable definition of PPPs through a process of reflecting on definitions in the literature. Context is then provided by a theoretical framework. With respect to the literature relating to critical success factors (CSF) of PPPs, a consistent theme has been present namely, the requirements of enabling institutions. A separate section dealing with this to provide further context and potential impact on the results of the qualitative tests has been created. The paper then critically reviews the empirical literature. A summary is provided, incorporating all the considerations considered in the literature review. The literature review is sub-divided to assist with reading and following the review.

2.2 OVERVIEW OF INFRASTRUCTURE NEEDS AND PPPs IN SUB-SAHARAN AFRICA

The fact that more than 60% of sub-Saharan Africa's urban population live in areas which are exposed to at least one of the following limitations: overcrowding, inadequate water and sanitation provision, unsound houses (Fox, 2014), is a clear indication that the continent is in dire need of infrastructure development! This sentiment is shared by the African Development Bank indicating that the annual infrastructure funding gap is estimated to be more than US\$67 billion (African Development Bank, 2018). This infrastructure funding gap is not expected to be closed by the public sector alone as rapid population growth and urbanisation in sub-Saharan Africa (Leck et al., 2018) will undoubtedly place an unattainable demand on government resources and capacities (Fox, 2014). Below is a table providing the state of infrastructure in selected countries, ranked with the rest of the world. In terms of population, the average ranking is 84, but in terms of infrastructure the average ranking for electricity, rail, roads and airports is between 109 and 143, highlighting the relative infrastructure lag across the African countries.

Table 2.1: Stock of infrastructure – World ranking

Country	STOCK OF INFRASTRUCTURE					
	POP.	POP.	Electricity	Rail	Roads	Airports
	(Millions)	Ranking of 237	Ranking of 219	Ranking of 136	Ranking of 224	Ranking of 237
Algeria	43.58	35	42	50	46	36
Angola	33.64	42	102	63	103	54
Benin	13.30	74	177	116	121	172
Botswana	2.35	144	135	95	95	70
Burkina Faso	21.38	59	152	108	124	133
Cabo Verde	0.00	172	172		176	156
Cameroon	28.52	51	109	89	65	111
Chad	17.41	68	190		89	81
Comoros	0.86	163	207		187	185
Congo	105.04	15	106	48	34	27
Cote d'Ivoire	28.09	52	104	104	62	124
Congo, Dem. Rep.	5.42	119	143	112	108	123
Djibouti	0.94	162	170	127	163	151
Egypt	106.44	14	22	39	74	65
Ethiopia	110.87	12	99	105	40	82
Gambia	2.22	146	182		161	220
Gabon	2.28	145	137	106	127	97
Ghana	32.37	44	94	92	45	154
Guinea	12.88	76	162	88	85	143
Kenya	54.69	27	105	52	31	28
Lesotho	2.18	147	165		144	130
Liberia	5.21	123	184	117	135	116
Madagascar	27.53	53	142	96	96	66
Malawi	20.31	62	144	99	123	112
Mali	20.14	63	136	110	38	127
Mauritius	1.39	156	134		168	180
Mauritania	4.08	128	147	100	131	114
Morocco	36.56	40	68	73	80	79
Mozambique	30.89	46	79	41	97	57
Namibia	2.68	142	145	65	83	51
Niger	23.61	56	167		118	115
Nigeria	219.46	6	67	54	29	87
Rwanda	12.94	75	164		148	171
Sao Tome and Principe	0.00	183	203		177	205
Senegal	16.08	72	126	94	120	135
Seychelles	0.00	197	175		195	150
Sierra Leone	6.81	108	185		134	161
Somalia	12.09	78	176		125	89
South Africa	56.98	26	21	13	10	20
Sudan	46.75	31	89	31	98	74
Eswatini	1.11	160	173	122	157	148
Tanzania	62.09	24	114	43	56	33
Togo	8.28	100	189	111	133	163
Tunisia	11.81	79	78	70		119
Uganda	44.71	33	130	85	112	93
Zimbabwe	14.83	73	113	58	49	29
Zambia	19.08	65	98	59	72	64
<i>Average</i>	<i>28.30</i>	<i>84</i>	<i>132</i>	<i>81</i>	<i>104</i>	<i>109</i>
<i>Adjusted average</i>		<i>84</i>	<i>143</i>	<i>141</i>	<i>110</i>	<i>109</i>

Source: <https://www.cia.gov/the-world-factbook/field>

Studies on the relationship between infrastructure and economic growth in sub-Saharan Africa are mostly limited to theoretical and case studies and there is no strong consensus arising out of empirical evidence. This can be explained by the vast differences in African countries, the type of infrastructure and the periods under study. From 10 Sub-Saharan Africa PPP case studies, Yescombe (2017) found a mixture of success and failure, but noted that all existing PPPs resulted in private sector investment of public infrastructure. Studies done to improve the success rate of PPP in Africa, and to increase the levels of PPP, includes studies focusing on successful PPPs (Osei-kyei & Chan, 2016), unsuccessful PPP (Tati, 2005) and lessons learned in Africa (Sanni & Hashim, 2014). The common learning is that governments need to create a conducive investment environment and ensure the appropriate resources, including human capital, legal structures, and funding, are in place to attract more and sustained private sector funding. This is also supported by UNCTAD (2018) stating that the economic growth rebound could benefit from certainty in Nigerian and South African development policy. They go on to state that fiscal consolidation should be expanded to improve conditions for private investment.

2.3 DEFINITION OF TERMS

2.3.1 Public Private Partnerships (PPPs)

Although McGeorge, McGeorge & Jefferies (2012) note some concern regarding the consistency of definitions presented of PPP, it would not be unreasonable to accept the following definition provided by Zangouezhad & Azar (2014): A PPP can be defined as being a partnership between the public sector and the private sector where a structure (project) is created to perform the disciplines required to establish infrastructure. The public sector and private sector are allocated roles and responsibilities in this structure which ideally should meet the respective goals and objectives of the project. This definition is supported by Gbadegesin and Aluko (2014), confirming that PPP is a concept involving the cooperation of public and private sectors. The definition also incorporates McGeorge et al. (2012) citing Jefferies and McGeorge (2008) for defining a PPP consortium as being a temporary structure of stakeholders with competing goals and objectives. Leck et al. (2018)'s definition of a PPP focusses on risk transfer being a critical component of PPP. This is incorporated in the accepted definition as part of the responsibility allocation component.

2.4 THEORETICAL FRAMEWORK: PPPs AND ECONOMIC GROWTH

For centuries, economic growth has been studied. Various growth models have been developed and refined to provide an understanding of how, and why, economic growth occurs, and what influences growth. Different models tend to highlight different drivers of economic growth.

The work of Zangouinezhad & Azar (2014) refers to the definition for economic growth provided by Yoo and Ku (2009), concluding that economic growth is the increase of GDP per capita, and it states that economic growth is primarily a long-run concern. GDP is estimated by a country's statistical agency. This is then compared or divided by the number of people in the country and equates to GDP per capita. The difference between the previous GDP per capita and the current GDP per capita is the growth, which is then used to reflect the economic growth for the period between the two measurement dates. Productivity stimulates economic growth which explains why economic growth started to be significant at the time of the industrial revolution. The relevance of economic growth in an economy is that it improves the quality of life of those living within that economy. For this reason, the topic has been research significantly.

Some of the most pertinent theories have been reviewed, and specific reference to the impact of infrastructure investment have been extracted, to work towards a theoretical impact assessment of PPPs on economic growth. In the 18th century, T Malthus created the Malthusian model which concluded that economic growth will be limited over time as population growth will counter higher productivity (Kogel & Prskawetz, 2001). Malthus further predicted that economic growth would be limited by limited resources, climate change and overcrowding. His view was popular prior to the impact of the industrial revolution between 1760 and 1840. To date Malthus's predictions have not materialised, due to the rise of technology and science and the ability to adapt and utilise alternative resources to replace scares resources. One of the limited resources was agricultural land, but the ability to transport produce mitigated the risk of famine posed by this limitation. This was made possible by the revolution in transportation partially caused by massive infrastructure investment into railroads. According to Field (2011), post-World War II growth was partially driven by the building of highways and capital investments in manufacturing and chemical industries. The neoclassic growth model of Solow (1956) concludes that to increase the rate of economic growth, investment as a percentage of GDP needs to increase. However, he qualifies this by stating that exponential growth will return to a steady state over time due to returns reducing as a result of the increased rate of investment. The alternative to ensure higher economic growth is to improve

technology, which increases productivity of capital or labour. He further suggests that poorer countries (this includes most sub-Saharan African countries) that invest a greater percentage of their GDP should see a greater economic growth than richer countries. Although Romer (1986) placed focus on increasing both capital, and labour productivity by technological advancement, they also argued that additional investments would not necessarily lead to reduced returns as stated by Solow. They highlighted that the type of investment played a significant role on the impact it had on economic development. More recently Munnell (1992) performed an analysis in the wake of criticism of the US government using research findings to support the strategy for increased infrastructure investment. She found that the evidence *did* support the inference that infrastructure investment resulted in immediate economic stimulus and had a significant positive impact on output growth.

In terms of the sub-Saharan Africa context, Estache et al. (2005) measured the impact of infrastructure on the economy in all sub-Saharan countries. Of the five types of infrastructure analysed, they concluded that all but sanitation infrastructure influenced economic growth positively.

In the World Bank's incomplete study by Dintilhac et al.(2015) the following statement is made:

The academic empirical literature on the links between infrastructure and economic growth is extensive and there are a few comprehensive literature reviews to comprehensive studies performed to support the notion that infrastructure development supports economic growth.
(2015: p3).

Existing literature and policy experts support the argument that more infrastructure reduces production costs of goods and services resulting in increased productivity and subsequently economic growth (Ansar, Flyvbjerg, Budzier, & Lunn, 2018), inferring that a higher level of infrastructure development will result in a higher level of economic growth.

Further to this, the literature reviewed indicates that PPP brings additional sources of funding for to public sector infrastructure investment. If appropriately utilised, accelerated economic growth should ensue. This becomes one of the benefits of PPP listed by Yescombe (2017). Infrastructure projects in Nigeria linked to transportation, electricity, water provision, and natural resources, are suitable areas for PPPs, while projects linked to education, property construction, tourism, and cultural facilities, are less suitable (Babatunde, Opawole, & Akinsiku, 2012).

2.5 THE ROLE OF INSTITUTIONS IN THE SUCCESS OF PPPs

A country's economic environment has the greatest impact on the level of infrastructure investments. This has a direct impact on the level of economic growth (Khan & Reinhart, 1990). With this as a basis, it is understandable that the following statement was made:

“Certain key factors are necessary for PPPs to be successful. These include the need for a clear institutional framework to govern PPPs, legislation and its enforcement, political will, transparency, as well as developing the capacity of staff in government to effectively prepare and implement projects.” (Sanusi, 2012. p 6)

In the above quoted keynote address, the slow PPP implementation in Nigeria and limited infrastructure development is compared to Brazil and India, two developing countries having much more success in this department.

The important role that a central development finance institution (DFI) plays in the success of PPPs, with specific reference being made to the success achieved by the Brazilian Development Bank (BNDES) and the Infrastructure Development Finance Company (IDFC) of India, is highlighted as a critical success factor (CSF). Development Finance Institutions are an important factor of creating a clear institutional framework to govern PPP's, legislation, and its enforcement (Sanusi, 2012). Analysis of panel data on PPP infrastructure projects between 1990 and 2003 have indicated that market conditions are the most important determinants of PPPs. In other words, larger market size attracts more private investors to PPPs. Global development agents play a key role in assisting underdeveloped countries attract private investors into PPPs, to create infrastructure development, and to stimulate economic growth (Hammami, Ruhashyankiko, & Yehoue, 2006).

“Institutions can be defined as persistent and connected sets of rules that prescribe behavioral roles, constrain activity and shape expectation” (Keohane, 1988). Although this definition can be interpreted widely, the intention is to focus on the more narrow interpretation and specify formal institutions created by government, as PPPs support vehicles. Understanding that these institutions develop differently in different countries is important and can contribute to the understanding of the impact that PPPs have on economic growth. Jooste, Levitt & Scott (2011) did a case study, including Victoria (Australia), British Columbia (Canada) and South Africa to understand how the ‘PPP institution’ developed in the three geographic areas. The study refers to role players within the

institutions introducing PPPs. In the analysis of PPPs in South Africa they found that international development agencies played a significant role in the absence of a central agent. However in Victoria and British Columbia, evidence indicated that a strong central agent expedites the implementation and quality of the PPP-enabling institutions. Similar to South Africa, the indications are that other sub-Saharan Africa countries need to introduce and improve institutions to support PPPs. The low level of CSF studies in developing countries can be attributable to the PPP concept not yet being fully explored. China is the anomaly being the only developing country included in the list of countries where the greatest amount of research has been done on this subject. Research in these countries has shown to improve the implementation of PPPs (Osei-Kyei & Chan, 2015).

In a study (Panayides, Parola, & Lam, 2015) focusing on port development in developing countries by implementing PPP, it was found that the impact of institutional variables was statistically significant for the success of the PPP projects. The importance of institutional development is highlighted by Zhang, Gao, Feng & Sun (2015) stating that the introduction of PPPs needs to be supported by changes in institutional arrangements as it has a direct effect on the performance of PPPs. While the above represents a critical success factor, Zhang et al., (2015) found that the approach followed by China to implement PPPs and learn each time from experience is also necessary to expedite the growth of this funding structure for infrastructure. Three of the five CSFs for PPP according to Hardcastle, Edwards, Akintoye & Li (2005) refer to strong institutional oversight. The links are explained per CSF: 1) Effective procurement requires well organised and committed public agency; 2) Good project implementation includes the necessity for a favourable legal framework and a favourable economic policy support 3) Favourable economic conditions. Babatunde et al.(2012) adds to this by confirming in their nine CSFs that a favourable framework and sound economic policy are necessary to improve effectiveness of PPPs.

Institutional shortcomings has become a significant risk to the success of PPPs in Brazil (Barral & Haas, 2007). Barral and Haas predicted a boom of infrastructure projects in Brazil following the government's Growth Acceleration Plan, and suggested that the successful implementation of PPPs could be a catalyst for this boom. The concern is that the institutional risk associated with sub-Saharan African countries might influence the outcome of the current research and dilute the causal relationship between PPPs and economic growth.

2.6 EMPIRICAL LITERATURE

Using a long-run historical dataset on infrastructure capital, Farhadi (2015) concluded that increased infrastructure influenced productivity positively, but not substantially. Khan and Reinhart (1990) found (empirically) that private investments into infrastructure projects have a larger direct effect on economic growth than public investments. The study does however qualify this finding by highlighting the fact that the indirect impacts were not tested. The study performed by Zangouezhad & Azar (2014) concluded that infrastructure PPPs can influence economic growth and development significantly and it can fill the gap between demand and government resources by accessing private sector financial resources, especially in developing countries. Further to this, a recent unpublished study (Mofokeng, 2018) found that PPPs contribute positively to economic growth at a ten percent level of significance. However, in the same study the data was stratified in sectors, and none of the individual sectors were shown to contribute to economic growth. Economic growth and development are reliant on infrastructure (Bhattacharya et al., 2015) and if government resource limitations limits infrastructure development, PPP provides a solution to such limitation (Yescombe, 2017). PPP provides integrated solutions for public infrastructure (Cheung, E., Chan, A., Kajewski, S., 2013) as the private sector is more innovative about seeking feasible solutions (Gbadegesin & Aluko, 2014), (Cheung et al., 2013), (Eadie et al., 2013) and (Zou, Wang, & Fang, 2008). Mohamad, Ismail, & Mohd Said (2018) found that the more innovation introduced in PPPs resulted in better value for money. PPP is also a solution for the limited resources of governments as it is an alternative source of funding (Cheung et al., 2013), (Ameyaw, Adei-Kumi, & Owusu-Manu, 2015) and (Wibowo & Alfen, 2015). PPP is likewise a solution for increased investments needs resulting from the infrastructure gap of developing countries, but to achieve the value for money objectives, the risks need to be allocated appropriately (Ibrahim, Price, & Dainty, 2006). PPP should lead to improved efficiency (Trangkanont & Charoenngam, 2014), (Ameyaw et al., 2015) and (Zou et al., 2008) resulting in positive value for money (VfM). This has become the main focus when the benefits of PPP are analysed (Eadie et al., 2013), (Ameyaw et al., 2015) and (Zou et al., 2008). Da Cruz, Simões & Marques (2014) found that feasibility studies should guide the decision regarding a funding structure for infrastructure projects. PPP is one such structure, which should be chosen if there is evidence that it provides a superior VfM proposition.

Unfortunately, current research linking economic growth *specifically* with PPP is not without contestation and the use of evidence-based research is growing. This is reflected in statements like these:

“The underlying rationale of PPPs as a tool of governance is that both the public sector and private sector have specific qualities, and if those qualities are combined, then the result will be better for all.” (Vaillancourt Rosenau, 1999)

The private sector often interprets this to mean that market pressures inevitably make the private sector more efficient than their public sector equivalent. However, this view is strongly disputed by Crouch (2003), Sheil (2003) and others who subscribe to the view that PPPs are more to do with political motivation than efficiency.” (McGeorge et al., 2012. p 419)

Even harsher criticism is evident in a study performed by Shankar Nayak (2018) which states that the objectives of PPPs are to privatise and maximise profit for private companies while allocating the risks to the public sector and communities. Ansar et al. (2018) warns against high-level, poor-quality infrastructure projects as while studying China’s infrastructure development, they found that a typical project failed to yield positive risk-related returns and that unproductive infrastructure projects are a drag on the economy. It is conceded that PPP has some inherent limitations, specifically from the perspective of governments. These include its limited transparency due to the private sector’s requirement of confidentiality (Ameyaw et al., 2015). The lack of transparency results in governments taking too much risk, to the result of their being inexperienced in negotiating such partnerships (Zou et al., 2008) and no public review is undertaken to point out potential risks. Due to the complex arrangements, the time and cost of planning and formalising the arrangements for PPP are high (Zou et al., 2008) and result in the aborting of a high ratio of projects (Trangkanont & Charoenngam, 2014). It would indicate that PPPs are more suitable to larger projects and might be too expensive for smaller projects. The private sector prices risk into its offered funding which results in relative high funding rates, making the projects expensive (Eadie et al., 2013) and (Ameyaw et al., 2015).

The following key success factors have been extracted from the literature to be considered when the conclusion of the study is analysed or when application thereof is considered. The importance of government support is (obviously) critical as a partner, but a suitable regulatory framework within which a PPP can operated is required (Atmo & Duffield, 2014) and (Wibowo & Alfen, 2015). A key principal for PPP is the sharing or allocation of risks (Gbadegesin & Aluko, 2014), (Cheung

et al., 2013) and (Wibowo & Alfen, 2015). This is specified for example by the Hong Kong administration's Efficiency Unit (2003) that recommended risk should be allocated according to the party's ability to manage or control that applicable risk. For the private sector to accept some of the risk however, factors must be in place to mitigate the risk such as guarantees from international organisations and host governments. These will be essential for securing private investment (Atmo & Duffield, 2014). And finally a water tight legal framework (Wibowo & Alfen, 2015) is required to ensure a fair distribution of risks and benefits.

2.7 SUMMARY

In theory PPPs should increase economic growth as additional sources of funding combines with state funding to create infrastructure supporting economic growth. It is argued that PPPs will result in better value for money outcomes as private sector efficiency could improve performance and output. Although the synergies created by PPP could be disputed, it is factual that the private sector controls a significant portion of global savings that could be put to use to close the infrastructure investment gap. PPP thus presents a means to mobilise private sector funding. Africa remains a dark horse as limited state resources, a significant infrastructure backlog, growing populations, and resource riches all point towards the need for PPP. Yet the number and value of public-private projects over the last ten years have been erratic, indicating that changes are required to ensure a sustained increase in growth enhancing public and private sector partnerships.

The following study seeks to prove that increased levels of PPP will result in increased economic growth even in sub-Saharan Africa. The proposed analysis is deemed to be the most appropriate to address the problem statement and to meet the objective of this study. Concern exists about the impact of inefficient institutions might have on the research results and therefore further studies into the reasons for failed PPPs is probably required.

CHAPTER 3

METHODOLOGY OF RESEARCH

3.1 INTRODUCTION

This chapter describes the approach that has been taken and followed to perform analysis to address the research question. The research design and data sampling are presented in this chapter and an explanation is provided for the analytical framework and estimation approach, including the regression equation. It then elaborates on the variables and the rationale for its use in the regression equation.

3.2 RESEARCH APPROACH

The study is about testing a theory, and the hypotheses will be tested by quantitative methods. It is an appropriate methodology as limited quantitative studies have been performed to establish the causal relationship between PPPs and economic growth. Most studies performed are case studies, which are influenced by case specific influences. The quantitative approach comprises a regression equation that encompasses longitudinal data analysis of variables that change over time, to establish if there are any interrelationships between the independent and dependent variables used in the analysis. System Generalised Methods of Moments (SGMM) for panel data was utilised to do the estimations as recommended by Bond, Hoeffler & Temple (2001) and Hoeffler (2002) to ensure unbiased estimates and to limit the risk of endogeneity among variables.

3.3 DATA SAMPLING

Data from the Private Participation Infrastructure database (World Bank, 2015) relating to PPP data and the World Bank Database reporting on the gross domestic product of the selected countries, will be used. The studied period will be from 1995 to 2018. This is secondary data, ideal for the research as it allows for longitudinal and international (regional) studies both of which are non-obtrusive.

The applied information consists of various projects, and the applicable data relating to 47 of the 55 African states from both mentioned data bases. The eight states which have been omitted had no PPP data listed on the PPI database. They are Burundi, Central African Republic, Equatorial Guinea, Eritrea, Eswatini, Guinea-Bissau, Libya, and South Sudan. The 47 countries selected will test and validate the model and the related coefficients. The countries which are outside of the sub-Saharan

Africa region have also been included to create awareness of the potential of PPPs to generate economic growth, and act as comparators for sub-Saharan African nations.

3.4 ANALYSTICAL FRAMEWORK

3.4.1 Regression Equation

The relationship between PPP investments and economic growth is modelled by using the Bond et al. (2001) dynamic panel growth equation below:

$$y_{it} = \alpha y_{i,t-1} + x'_{it}\beta + \mu_i + \epsilon_{it} \quad i= 1,,N \text{ and } t= 2,,\dots,T$$

Where

y_{it} : GDP per capita growth rate

$y_{i,t-1}$: lagged value of GDP per capita growth rate

x'_{it} : vector of growth

μ_i : country specific fixed effect

ϵ_{it} : error term

By using this equation, we will analyse the impact that PPP investments have on economic growth. The role that gross capital formation, population growth, inflation, DFIs and private sector, play in PPP investments is controlled in the model. To determine if the type of PPP and sector into which the PPP investment is made plays a role on the impact on economic growth, the model will be adjusted to ring-fence each type of PPP and each sector. For this, PPPs have been divided in four types namely, greenfield, brownfield, management and lease, and divestiture. The sectors identified are information and communication, energy, transport, and water.

Applying the growth equation to determine the impact of PPP on economic growth as adopted from Mofokeng (2018):

$$y_{i,t} = \alpha_i + \beta_1 y_{i,t-1} + \beta_2 PPP_{i,t} + \beta_3 GCF_{i,t} + \beta_4 POP_{i,t} + \beta_5 INF_{i,t} + \beta_6 BM_{i,t} + \beta_7 DCPS_{i,t} + \mu_i + \epsilon_{i,t} \quad (\text{Equation 1})$$

Where i and t denote country and year, respectively; PPP is PPP investments in US\$; GCF represents gross capital formation; POP denotes population growth; INF is the inflation rate; BM is broad money supply and DCP represents the domestic credit to the private sector.

To ring fence each type of PPP, the total PPP has been substituted by PPP per typology to create equation two.2.

$$y_{i,t} = \alpha_i + \beta_1 y_{i,t-1} + \beta_2 PPP_TYPE_{i,t} + \beta_3 GCF_{i,t} + \beta_4 POP_{i,t} + \beta_5 INF_{i,t} + \beta_6 BM_{i,t} + \beta_7 DCPS_{i,t} + \mu_i + \varepsilon_{i,t} \quad (\text{Equation 2})$$

Where PPP_TYPE is a dummy variable coded as zero for no investments and one for the Greenfield type (PPP_G), two for PPP for brownfield investments (PPP_B), three for PPP for management and lease investments ($PPP_M\&L$), four for PPP for divestiture is (PPP_D), and five for multiple types of PPP (PPP_M).

To ring fence each sector into which the PPP was made, the total PPP has been substituted by PPP per sector to create equation three.

$$y_{i,t} = \alpha_i + \beta_1 y_{i,t-1} + \beta_2 PPP_SECTOR_{i,t} + \beta_3 GCF_{i,t} + \beta_4 POP_{i,t} + \beta_5 INF_{i,t} + \beta_6 BM_{i,t} + \beta_7 DCPS_{i,t} + \mu_i + \varepsilon_{i,t} \quad (\text{Equation 3})$$

Where PPP_SECTOR is a dummy variable coded as zero for no investments and one.1 for PPP for the information and communication sector (PPP_IC), two for the energy sector (PPP_E), three for PPP for transportation is (PPP_T), four for PPP for water (PPP_W) and five multiple sectors (PPP_MS).

3.5 DESCRIPTION OF VARIABLES

This section presents the description of the variables in the regression model and theoretical linkages between each independent variable and the dependent variable.

3.5.1 GDP growth rate

Economic growth is the dependent variable which is presented in this study as the GDP Growth rate. This is measured annually and shows the change in the gross domestic product from year to year.

3.5.2 PPP investments

The three independent variables applied in the regression equation all relate to PPP investments, being total PPP Investments, PPP investments per type of investment and PPP investment per sector into which the investments were made. Theoretically, investments in infrastructure improves productivity leading to economic growth. PPP provides the platform for the private sector investment in infrastructure side by side with government. Total PPP investments increases investment in infrastructure as it supplements investment in infrastructure by the public sector. Therefore, the expectation that an increase in Total PPP investment will result in higher economic growth. The second predictor variable is the PPP investment per type of investment. The type of investments has been categorised as greenfield projects, brownfield projects; investments in management and lease contract; divestiture and where multiple project types have received investment. Greenfield investments relates to new infrastructure and expected growth follows as explained with the total PPP investments. For brownfield, management and lease and divestiture, the notion of superior productivity and innovation in the private sector is expected to improve productivity from the existing infrastructure and therefore increase economic growth. The third predictor variable is the PPP investment per sector of investment. Estache et al. (2005) found that of the five types of infrastructure analysed, they concluded that all but sanitation infrastructure has positively influenced economic growth.

3.5.3 Gross capital formation LC

Gross capital formation (which includes PPPs) is an indication of investments made into infrastructure as additions to fixed assets, increase in stocks, and net acquisitions of valuables, can be linked to infrastructure. Economic growth and development are reliant on infrastructure (Bhattacharya et al., 2015) as the expansion of infrastructure reduces production costs of goods and services, resulting in increased productivity and subsequently economic growth (Ansar, Flyvbjerg, Budzier & Lunn, 2018). The higher the GCF, the higher the economic growth is expected to register.

3.5.4 Population growth

Population growth impacts economic growth measured by the growth in GDP per capita. Population is a denominator in the formula calculating GDP per capita. If GDP remains static while population grows, it results in negative per capita GDP. This is in-line with the historically popular Malthusian model. Population growth is therefore expected to have a negative impact on economic growth. This however ignores the potential impact that population growth has on competition and subsequent technological advances improving productivity and reversing the dragging effect on economic growth. The study remains cognisant of this potential counter impact.

3.5.5 Inflation

Inflation is a rise in the general price level as a percentage: year-on-year. There is a wide belief that inflation is not neutral in relation to economic growth, and that specifically high inflation results in depressed economic growth. This is supported by a study performed by Barro (1995) who estimated a reduction in real GDP growth after 30 years of between four and seven percent if the long-term average inflation is increased by ten percent. It is therefore understood that higher inflation results in a reduction in economic growth in the long run. For this reason, it has been included as a control variable.

3.5.6 DFI involvement (Broad money supply)

DFIs and other multilateral entities exist specifically to support and mobilise development which is specifically aligned to economic growth. These institutions are necessary to assist underdeveloped countries to attract private investors for infrastructure development programmes, and stimulate economic growth (Hammami et al., 2006). It is expected that an increase in DFI investments should increase economic growth. To measure the impact that DFI and other multilateral entities have on PPPs, broad money supply, which is a measure of the amount of money circulating in a national economy, has been included as a proxy.

3.5.7 Private sector (Domestic credit to the private sector)

The private sector has more investable capital than the private sector with two out of three total investments in Africa being made by the private sector (Stampini, Leung, Diarra, & Pla, 2013). The impact of private sector investment on economic growth is included via a proxy, being the credit extension to the private sector. This include financial resources provided to the private sector such as loans and advances, purchases of non-equity securities, trade credits, and other accounts receivable (Olowofeso, Adeleke, & Udoji, 2015). These resources can then be invested in public infrastructure among other investments.

The model will be tested to see if the selected independent variances, together with the control variables explain most of the change in the dependent variable. If this can be confirmed the regression model will be acceptable.

Table 3.1: Description of variables

	Measurement	Expected Sign
Dependent Variable		
Economic Growth	Movement in gross domestic product per capita – year-on-year	
Independent Variable		
PPP_Invest	Total investment via public private partnership (PPP) to establish infrastructure	Positive
PPP_Type	PPP type of investments defined as zero if no investments; one for investments in greenfield projects, two for investments in brownfield projects; three for investments in management and lease contracts; four for investments in divestiture and five for investments in multiple project types	Positive
PPP_Sector	PPP sector investments defined as zero if no investments during the year; one for investments in ICT; two for investments in energy, three for investments in water and sewerage; four for investments in transport and five for investments in multiple sectors	Positive
Control variables		
Gross capital formation	Gross capital formation is gross additions to fixed assets; increase in stocks and net acquisitions of valuables, an indication of investments made into infrastructure.	Positive
Population	Population growth as percentage: year-on-year	Negative
Inflation	Inflation is a rise in the general price level as a percentage: year-on-year.	Negative
Broad Money supply	Broad money is a measure of the amount of money, circulating in a national economy	Positive
Domestic credit to the private sector	Financial resources provided to the private sector, such as loans and advances, purchases of non-equity securities, trade credits and other accounts receivable (Olowofeso et al., 2015).	Positive

3.6 ESTIMATION APPROACH

In the estimation of the dynamic panel models (1-3), the system GMM is preferred above simple cross-section regression for dynamic panel data (Bond et al., 2001) and (Hoeffler, 2002). Ding & Knight (2009) found that by using GMM estimation techniques, the augmented Solow model can explain economic growth in China. Furthermore, Hoeffler (2002) confirmed that by using a dynamic panel data approach to deal with omitted values and endogeneity, the augmented Solow growth Model could explain Africa’s low economic growth. Bond et al., (2001) recommends that the regression equation is presented as a dynamic panel data model. Unobserved time-invariant

country-specific effects can be mitigated by taking first differences. The righthand side of the variables in the first-difference equation should be adjusted by using levels of the series lagged two periods or more.

To select the best model, significance must be 0.05; if a similar result, then the model with a higher F statistic will be chosen. The results of the best model per independent variable will then be analysed against the hypothesis and empirical evidence from which a conclusion will be derived. Each of the above statements and techniques will be assessed for validity and compared to acceptable research methodology.

System GMM is a system of two equations and the `Xtabond2` command allows wide capabilities for Stata. System GMM is desirable as it has the potential of solving difficult estimation problems. System GMM accounts for unobserved country-specific data and endogeneity in growth models is controlled by using instrumental variables. It is the most efficient estimator for dynamic panel data models (Bond et al., 2001). The result is unbiased, and estimations are consistent. The disadvantage of System GMM is that it is complicated and can easily generate invalid results. It further increases the risk that estimators could be misused or misunderstood (Roodman, 2009).

CHAPTER 4 DISCUSSION OF FINDINGS

4.1 INTRODUCTION

This chapter discusses the findings from the data analysis that set out to establish if there is a causal relationship between PPP investments and economic growth. The findings relate to the impact that PPP have on economic growth for selected African countries. The type and sector-specific findings indicate if the type and sector of PPP investments influence the effectiveness measured in terms of economic growth. The chapter is structured in four sections: the description of the statistics, a review of the correlation of variables, a regression results discussion, and a summary of the key findings.

4.2 DESCRIPTIVE STATISTICS

The table below provides the summary of the weighting of the various types and sectors into which PPPs have been made over the study period in terms of the number of PPPs and the average size (value) of the PPPs across the 47 selected countries.

Table 4.1: Summary statistic relating to PPPs

	Mean	N
PPP Total investments		
No PPP investment		843
PPP Investment	444.6869	285
PPP Type of investments		
No PPP investment over a twelve-month period		788
Greenfield project	329.4453	156
Brownfield project	279.0875	55
Management and lease contract	3.1	34
Divestiture	325.7727	22
Multiple	722.193	73
PPP Investments by sector		
No PPP investment during year		843
Information and communication technology (ICT)	241.2011	54
Energy	482.3064	110
Water and sewerage	205.3857	7
Transport	183.3186	59
Multiple	880.0674	55

Source: Candidate's estimate from research data

The data was extracted on an annual basis and therefore in both type and sector a category of 'Multiple' has been added to distinguish from single-type, and sector, investments on an annual basis. The averages indicated above are the average investment per year of investments, and not necessarily the average value of each PPP. The average size of the Multiple category is higher than the other averages as it includes investments across types and sectors.

In the years that only one sector or type has been preferred, it seems like sufficient data still exists to indicate specific type, and sector, comparisons, and preferences. As expected, most (45%) of the number of exclusive investments occurred in the Greenfield typology. This is in line with expectation as it relates to new infrastructure which the governments would favour due to political benefits. The average value for Greenfield PPPs was the largest in terms of the specific types. The average value of the Managed and Lease Contracts was significantly lower than the other types, making this the least significant type. In terms of the sectors, the energy sector was favoured, attracting 39% of the exclusive PPPs with the average size of those PPPs also being significantly higher than the PPPs for other sectors. This could be explained by the successful REIPPPP implemented since 2011 in South Africa which was very well supported by both the South African government, the South African private sector, and the international private sector. The low number of years where water and sewerage have been exclusively selected for PPPs indicate that this is a less preferred sector for PPP investments.

The statistic for the control variables analysed are presented in the table below. This indicates that the following variables have outliers: Inflation (INF), Domestic credit to private sector (DCPS) and Broad Money (BM). The standard deviation of INF and DCPS seems very high compared to the mean, which could be the result of outliers resulting from the vast difference in the economies of the countries selected.

Table 4.2: Summary statistics

	Mean	Median	Std Dev.	Min	Max	N
LnGDP	22.838	22.803	1.594	18.146	27.066	1093
GDP (US)	3.01E+10	8.00E+09	6.73E+10	7.60E+07	5.68E+11	1093
INF	9.964	5.369	33.449	-60.496	541.909	999
LnGCF	21.396	21.383	1.585	18.687	24.406	1009
GCF(US)	7.51E+09	1.93E+09	1.52E+10	-2.06E+07	9.74E+10	1009
DCPS	21.969	13.873	25.702	0.491	160.125	971
LnBM	25.766	26.288	2.800	15.516	31.120	1070
Broad Money	1.59E+12	2.61E+11	3.78E+12	5478652	3.27E+13	1070
LnPOP	15.881	16.245	1.626	11.229	19.093	1128
POP	1.99E+07	1.14E+07	2.74E+07	75304	1.96E+08	1128

Note: GDP=Gross domestic product; INF=Inflation; GCF=Gross capital formation; DCPS=Domestic credit to private sector; BM=Broad money supply; POP=Population growth. The prefix Ln = Natural logarithm of the variable. Source: Candidate's estimate from research data

A natural log transformation was performed on the dependent variable, on GDP, and three of the independent variables, namely gross capital formation (GCF), broad money and population growth (POP), to reduce skewness of data and to ensure reliability of the results.

4.3 CORRELATION RESULTS

The table below shows the correlation between the variables. The larger values indicate a stronger relationship, and correlation between variables in the regression analysis. This is also an indication of multicollinearity. Values below 0.7 are acceptable, while results higher than this number is an indication of a high correlation which could influence the output of the regression model. Correlation coefficients ranging between 0.5 and 0.7 are notable.

The independent variables do not seem to correlate highly with one another, while POP and GCF does seem to correlate highly with the dependent variable GDP. Other notable correlations which are higher than 50% is the correlation between PPP-type and PPP-sector, which is expected, coming from the same dataset. This is not a concern as these two variables are not used in the same regression model. The correlation between POP with BM and GCF is just above 50% and is deemed to be acceptable. The risk of the regression analysis results being biased due to multicollinearity is acceptable due to the relatively low levels of correlation between the independent variables.

Table 4.3: Correlation matrix

	1	2	3	4	5	6	7	8	9
1.GDP	1.000								
2.PPP_TYPE	0.214	1.000							
	<i>0.000</i>								
3.PPP_SECTOR	0.307	0.675	1.000						
	<i>0.000</i>	<i>0.000</i>							
4.PPP_Invest.	0.464	0.158	0.281	1.000					
	<i>0.000</i>	<i>0.008</i>	<i>0.000</i>						
5.INF	0.030	0.007	-0.024	-0.166	1.000				
	<i>0.342</i>	<i>0.827</i>	<i>0.453</i>	<i>0.007</i>					
6. GCF	0.820	0.185	0.279	0.412	0.064	1.000			
	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.053</i>				
7. DCPS	0.300	0.061	0.151	0.283	-0.194	0.378	1.000		
	<i>0.000</i>	<i>0.056</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>			
8. BM	0.556	0.163	0.200	0.168	-0.233	0.403	0.034	1.000	
	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.005</i>	<i>0.000</i>	<i>0.000</i>	<i>0.294</i>		
9. POP	0.791	0.208	0.250	0.317	0.177	0.533	-0.050	0.504	1.000
	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.000</i>	<i>0.122</i>	<i>0.000</i>	

Note: GDP=Gross domestic product; PPP_TYPE=PPP type investment; PPP_SECTOR= PPP sector investment; PPP_Invest= PPP aggregate investments; INF=Inflation; GCF=Gross capital formation; DCPS=Domestic credit to private sector; BM=Broad money supply; POP=Population growth. Italicised values indicate p-values, defined as 1% if $p < 0.001$; 5% if $p < 0.05$ and 10% if $p < 0.1$. Source: Candidate's estimate from research data

4.4 REGRESSION RESULTS

4.4.1 PPP investments and economic growth

The Hausman test was performed to select the most appropriate regression model. The output of this test indicated that the Null hypothesis, to accept the Random Effect model, should be rejected in favour of the Fixed Effect model. The probability (p) values were less than 5% resulting in the rejection of the null hypothesis. The Fixed Effect model has therefore been selected as the most appropriate regression model to be used.

To ensure the robustness of the regression results, analytical tests were performed to identify if there was a significant risk of heteroscedasticity or autocorrelation which could result in biased coefficient estimates. The Breusch Pagan / Cook Weisberg test was applied to test for the risk of heteroskedasticity. A statistically significant chi-squared value implies the absence of heteroscedasticity. For PPP investments in total, and PPP investments by sector, it does not pose a significant risk, but the contrary seems to be the case for PPP by type. The probability of chi-squared

for the regression model testing the impact of the PPP type on economic growth is 0.000. This model's variables are heteroscedastic and therefore the regression has to be run with robust standard errors to mitigate the risk of biased coefficient estimates.

To test the assumption that the error terms are independent of one another, the Wooldridge test for autocorrelation has been applied to test for the existence of autocorrelation within the research variables. The results of the tests performed on all three models have highlighted the risk of autocorrelation within the model variables, as significant p-values are less than 5%.

The R-squared measurement is an indication of how well the independent variables explain the change in dependent variable. Across the three models the R-squared value ranged between 89% to 92%. The independent variables explain more than 89% of the change in the dependent variable indicating a good fit of the model. This is further supported by the Wald-F test results being greater than 130 for all three regression models. The results in terms of coefficients estimates does correlate this.

The results from the first regression model testing the impact of total PPPs invested on economic growth are presented in Table 4.4. The results from the regression does not support the expected causal relationship between PPP investments and economic growth. The statistical impact that PPPs have on economic growth in the targeted African countries between 1995 and 2018 seems to be insignificant. This contradicts previous findings by Zangouinezhad & Azar (2014) and Mofokeng (2018) who found significant statistical evidence that PPPs contribute positively to economic growth. The reason for the difference in results is probably due to the selection of countries studied. Zangouinezhad & Azar (2014) study was limited to China, Brazil and India and although the Mofokeng (2018) study included six African countries, it only represented 16% of the total countries selected. In her study, the contribution by the African countries to the data was even less significant than 16%, considering the low level of PPP investments in Africa, compared with the rest of the developing world (refer to diagram 1.1). Zangouinezhad & Azar (2014) specifically note that PPP investments in sub-Saharan Africa lag significantly behind China, Brazil, and India due to the investment environment not being conducive to PPP investments. A further potential reason for the results could be that the PPP investments made in Africa have been linked to poor quality infrastructure projects which results in a drag on the economy noted by Ansar et al. (2018).

Table 4.4: Results for PPP investments and economic growth

Dependent variable: Ln (Gross domestic product)				
	Fixed Effects		OLS-PCSE	
	<i>Coefficient</i>	<i>std. err.</i>	<i>Coefficient</i>	<i>std. err.</i>
Constant	10.352**	4.665	6.121***	0.330
PPPI	0.022	0.014	0.003	0.008
INF	-0.006**	0.003	-0.004***	0.001
LnGCF	0.277***	0.070	0.496***	0.021
DCPS	-0.008***	0.002	0.009***	0.001
LnBM	0.060	0.057	-0.002	0.010
LnPOP	0.309	0.316	0.369***	0.020
F/Wald χ^2	130.05***		3994.81***	
R-squared	0.9238		0.9992	
Hausman χ^2	154.39			
Prob > χ^2	0.000			
BP/CW Hetttest χ^2	0.29			
Prob > χ^2	0.5888			
WAR(1): F	123.507			
Prob > F	0.000			
Countries	45		45	
Observations	839		839	

Note: PPP Dummy = PPP investment dummy defined as 0 if no investments and 1 otherwise. INF= Inflation; LnGCF= Natural logarithm of gross capital formation; DCPS=Domestic credit to private sector; LnBM= Natural logarithm of broad money supply; LnPOP= Natural logarithm of population. Hausman χ^2 denotes the test of fixed versus random effect models, WAR(1) denotes Wooldridge test for autocorrelation in panel data; BP/CW Hetttest denotes Breusch–Pagan/Cook–Weisberg test for heteroskedasticity. ***, and ** denotes significance at 1% and 5%, respectively. Source: Candidate’s estimate from research data using STATA 17.

Of the control variables, only the POP and GCF seems to have a notable effect on economic growth as was indicated from the correlation matrix. GCF has a positive correlation with growth as expected. Per expectation, INF showed a minor negative correlation with economic growth, although less profound than expected. The DCPS was expected to have a positive influence on GDP, this however has not been the case and it seems like the conclusion reached by Birdsall & Ellis (2003) that private sector focus on profit, and not to create public infrastructure, was still applicable for the timeframe of this study even though the private sector is busy changing to include triple bottom line and ESG considerations. BM, being the proxy for DFI involvement, was expected to have a positive correlation with the dependent variable, the results not supporting this inference therefore raise significant concerns over the way that DFI invest in Africa, and this needs further investigation.

4.4.2 PPP-type investments and economic growth

The remaining two regression models have specifically been designed and run to establish if the type of PPP or the sector for investment, has a significant impact on the resultant expected economic growth. The results of the model testing the impact of a particular type of PPP on economic growth presented in Table 4.5, resembles the results from the total PPP investment. The results from the regression do not support the expected relationship between any type of PPP investment and economic growth. Notably, the impact of both Brownfield and Management and Lease Contracts is significant at a 5% significance level. This is in line with the theoretic suggestion that the public sector could improve infrastructure impact on economic growth by improving operational efficiency and innovation. This is applicable to Management and Lease Contracts, where private sector operates public infrastructure, and with Brownfields, where previous infrastructure is changed or improved by the PPP investment. Although Divestiture is the only type with a negative coefficient, the correlations are low across all 5 types of PPPs, and from this analysis it cannot be concluded that the type of PPP significantly causes economic growth.

Table 4.5: Results for PPP-type investments and economic growth

Dependent variable: Ln (Gross domestic product)				
	Fixed Effects		OLS-PCSE	
	Coef.	Std. Err.	Coef.	Std. Err.
Constant	-4.964***	1.184	3.194***	0.249
PPP-type (no investments)				
Greenfield project	0.003	0.020	-0.056*	0.032
Brownfield	0.081**	0.033	0.135**	0.052
Management and Lease Contract	0.099**	0.042	0.008	0.066
Divestiture	-0.015	0.062	-0.077	0.081
Multiple	0.007	0.028	0.007	0.046
INF	0.001	0.002	0.004*	0.002
LnGCF	0.408***	0.022	0.713***	0.025
DCPS	-0.001	0.002	0.008***	0.001
LnBM	0.135***	0.014	0.007	0.006
LnPOP	0.981***	0.100	0.262***	0.023
F/Wald χ^2	612.87***		13706.84***	
R-squared	0.8866		0.9453	
Hausman χ^2	24.31			
Prob > χ^2	0.0038			
WAR(1): F	233.344			
Prob > F	0.000			
BP/CW Hetttest chi2	19.67			
Prob > χ^2	0.000			
Countries	45		45	
Observations	839		839	

Note: PPP_TYPE=PPP-type investment, defined as 0 if no investments; 1 for Greenfield project, 2 for Brownfield project; 3 for Management and lease contract; 4 for Divestiture and 5 for Multiple project types. INF=Natural logarithm of inflation; LnGCF= Natural logarithm of gross capital formation; DCPS=Domestic credit to private sector; LnBM= Natural logarithm of broad money supply; LnPOP= Natural logarithm of population. Hausman χ^2 denotes the test of fixed versus random effect models, WAR(1) denotes Wooldridge test for autocorrelation in panel data; BP/CW Hetttest denotes Breusch–Pagan/Cook–Weisberg test for heteroskedasticity. ***, ** and * denotes significance at 1%, 5% and 10% respectively. Source: Candidate's estimate from research data using STATA 17.

4.4.3 PPP sector investment and economic growth

The results from the regression analysis testing the impact of PPPs per sector on economic growth is presented in Table 4.6. In terms of the difference in the results per sector, it does seem like the PPPs in water and sewerage had a stronger influence on GDP than PPP investment in the other sectors. This contradicts the expectation which was supported by Estache et al. (2005) concluding that, of the investments in the 5 infrastructure sectors analysed, all but sanitation infrastructure influenced economic growth, positively. This could once again be driven by poorly structured PPPs in Africa

resulting in poor quality infrastructure. The impact of PPP in the transport sector on economic growth is significant at 10% significance level. This supports a long-standing relationship between transport infrastructure and economic growth, already evident since the industrial revolution when infrastructure investment in transport resulted in economic growth defying projections made by early economists like Malthus.

Table 4.6: Results for PPP sector investment and Economic growth

Dependent variable: Ln (Gross domestic product)				
	Fixed Effects		OLS-PCSE	
	Coef.	Std. Err.	Coef.	Std. Err.
Constant	-63.485**	5.652	-6.424	4.123
PPP_Sector (no investments)				
ICT	-0.032	0.030	-0.085*	0.051
Energy	0.025	0.023	-0.026	0.037
Water and sewerage	0.104	0.075	0.062	0.110
Transport	0.049*	0.028	0.082*	0.049
Multiple	0.010	0.029	0.045	0.055
INF	0.000	0.001	0.005**	0.002
LnGCF	0.408***	0.020	0.703***	0.027
DCPS	-0.008***	0.002	0.007***	0.001
LnBM	0.070***	0.014	0.003	0.006
LnPop	0.019	0.131	0.267***	0.024
F/Wald χ^2	640.75***		13974.43***	
R-squared	0.9000		0.9454	
Hausman χ^2	148.84			
Prob > χ^2	0.000			
WAR(1): F	129.71			
Prob > F	0.000			
BP/CW Hetttest χ^2	0.000			
Prob > χ^2	0.9742			
Countries	45		45	
Observations	839		839	

Note: PPP_SECTOR= PPP sector investment defined as 0 if no investments; 1 for ICT; 2 for energy, 3 for water and sewerage; 4 for transport and 5 for multiple sectors; INF=Natural logarithm of inflation; LnGCF= Natural logarithm of gross capital formation; DCPS=Domestic credit to private sector; LnBM= Natural logarithm of broad money supply; LnPOP= Natural logarithm of Population. Hausman χ^2 denotes the test of fixed versus random effect models, WAR(1) denotes Wooldridge test for autocorrelation in panel data; BP/CW Hetttest denotes BresBreusch–Pagan/Cook–Weisberg test for heteroskedasticity. ***, ** and * denotes significance at 1%, 5%, and 10%, respectively. Source: Candidate's estimate from research data using STATA 17.

4.5 CHAPTER SUMMARY

Although the R-squared measurement indicated that the models selected was a good fit for the data with around 90% of the difference in the dependent variable being explained by the independent variables across the three models. The results of the regression do not support the hypothesis that PPP investments in the selected African countries have created economic growth. Comparing these results with those of previous studies and the theoretical case, highlights the necessity to seek to understand why the impact on African countries does not mimic the impact that PPP has on other developing countries. It validates the concern about the impact of inefficient institutions on the effect PPP has on economic growth, referred to in Chapter 3 where the literature is reviewed.

CHAPTER 5 CONCLUSION

5.1 INTRODUCTION

This chapter provides an overview of the research performed and contextualises the findings against the objective of the research. It then moves on to provide some recommendations for the public sector in sub-Saharan Africa to consider when approaching PPP to generate economic growth. The chapter concludes with suggestions for further studies to be built upon this research.

5.2 SUMMARY AND CONCLUSION

This dissertation examined the public sector of sub-Saharan African countries to focus on PPP to bridge the infrastructure gap and enable necessary economic growth in order to achieve global development targets set by the World Bank. Private sector capital and operational efficiency inserted into infrastructure investment via PPP is expected to alleviate pressure on public finance and achieve these goals. The study was specifically focused on sub-Saharan Africa to create a context and to stimulate further studies on Africa, by providing empirical evidence of past performance of PPP in this region and comparing it to the theoretical hypothesis.

PPP data of 47 of the 55 African states were selected between 1995 and 2018 and analysed by using an expanded convergence growth model to determine if a causal relationship between PPP and economic growth could be inferred. The analysis was extended to test if the specific type or sector into which the PPP is made, has an impact on the economic growth benefit flowing from PPPs. The models were found to be a good match for the data, but the results of the analysis did not indicate any conclusive evidence of economic growth being caused by PPP in the countries selected. This contradicts studies covering Brazil, India and China that conclude, PPP has improved economic growth in developing economies. The study does conclude however that PPPs linked to public sector infrastructure managed by the private sector referred to as Management and Lease Contracts, and existing infrastructure which have been expanded (Brownfield) does have a significant influence on economic growth. It also points to a significant impact PPPs have on economic growth when investing in the transport sector. Comparing these results with those of previous studies and the theoretical case, highlights the necessity to seek to understand why the impact on African Countries does not mimic the impact

that PPP has on other developing countries. It validates the concern about the impact of inefficient institutions on PPPs contributing to economic growth and supports the World Bank's view that governments should establish specific PPP departments (institutions) to ensure equally, the increase of PPP and successful outcomes. This study therefore succeeds in highlighting PPP as a solution to address the infrastructure gap, but not as it was designed to do. Instead of proving that PPP in sub-Saharan Africa has stimulated economic growth, it has re-iterated that PPPs cannot succeed in isolation. and it has become clear that much more focus needs to go into getting it right on the continent.

5.3 RECOMMENDATIONS

Focus should be shifted towards the key success factors for PPP, reviewed as part of the literature review of this paper. The literature points towards the apparent lack of strong institutions in sub-Saharan Africa having a negative drag on the impact that PPPs are having on economic growth. Another barrier is the limited economic size of African countries which detracts from the private sector's appetite to enter PPPs. A way to overcome these barriers as well as the resource limitations of the public sector in Africa is to create regional PPP institutions which can collaborate with global development agencies and negotiate with large private sector role players. This should result in more equitable risk sharing, and value for money, in the roll out of PPPs across the continent.

5.4 FURTHER STUDIES

This current study should be extended to track the impact of institutions on economic development and growth resulting from PPP. The existence of such institutions and their strength is not directly available from World Bank data, but the strength of governance in each country can serve as a proxy for the existence of strong specific PPP institutions. Worldwide governance indicators, available from the World Bank website can be used by applying a score to each of the categories. These scores per category should be equally weighted to create a weighted-strength-of-institutions score which can be included in the regression. It is expected that the countries with higher scores allow for a better investment landscape which will support PPPs and increase subsequent economic growth stimulated through PPP infrastructure development. It is recommended that the largest three economies in Africa, together with India, Brazil, and China, be selected for the analysis so as to act as comparators for the selected African countries. A further area for investigation will be the key risks associated with the

implementation of PPP in sub-Saharan Africa and why these are not mitigated sufficiently to improve the impact of PPPs.

BIBLIOGRAPHY

- African Development Bank. (2018). *AFRICAN ECONOMIC OUTLOOK 2018, CHAPTER 3 - AFRICA'S INFRASTRUCTURE: GREAT POTENTIAL BUT LITTLE IMPACT ON INCLUSIVE GROWTH.*
- Ansar, A., Flyvbjerg, B., Budzier, A., Lunn, D., Clark, P. G., Cowan, S., ... Vickerman, R. (2018). Does infrastructure investment lead to economic growth or economic fragility? Evidence from China. *Oxford Review of Economic Policy*, 32(3), 360–390.
<https://doi.org/10.1093/oxrep/grw022>
- Atmo, G., & Duffield, C. (2014). *Improving investment sustainability for PPP power projects in emerging economies Value for money framework.* <https://doi.org/10.1108/BEPAM-10-2013-0051>
- Barral, W., & Haas, A. (2007). Public-Private Partnership (PPP) in Brazil. *The International Lawyer.*
- Barro, R. J. (1995). Inflation and economic growth. *Federal Reserve Bank of St. Louis Review*, Vol. 78.
- Bhattacharya, A., Oppenheim, J., & Stern, N. (2015). *Driving sustainable development through better infrastructure: key elements of a transformation program* (No. ISSN: 1939-9383). Washington, DC.
- Bielenberg, A., Kerlin, M., Oppenheim, J., & Roberts, M. (2016). *Financing change : How to mobilize private- sector financing for sustainable infrastructure.*
- Bond, S., Hoeffler, A., & Temple, J. (2001). GMM Estimation of Empirical Growth Models. *CEPR Discussion Paper*, (3048).
- Calderón, C., Cantú, C., & Chuhan-Pole, P. (2018). *Infrastructure Development in Sub-Saharan Africa A Scorecard.*
- Cheung, E., Chan, A. P. C., Kajewski, S., Cheung, E., Chan, A. P. C., & Kajewski, S. (2013). *Suitability of procuring large public works by PPP in Hong Kong.*
<https://doi.org/10.1108/09699981011038088>
- Clio Dintilhac, Ruiz-Nuñez, F., & Wei, Z. (2015). *The Economic Impact of Infrastructure*

and Public-Private Partnerships : Literature Review. 1–19.

- Collins Ameyaw, Adjei-Kumi, T., & Owusu-Manu, D.-G. (2015). *Exploring value for money (Vfm) assessment methods of public-private partnership projects in Ghana A theoretical framework.* <https://doi.org/10.1108/JFMPC-01-2015-0003>
- Da Cruz, N. F., Simões, P., & Marques, R. C. (2014). The hurdles of local governments with PPP contracts in the waste sector. *Environment and Planning C: Government and Policy.* <https://doi.org/10.1068/c111158>
- Ding, S., & Knight, J. (2009). Can the augmented Solow model explain China's remarkable economic growth? *Journal of Comparative Economics*, 37(3), 432–452.
- Dornel, A. (2014). *Project Finance for Infrastructure in Africa.* (March).
- Eadie, R., Millar, P., & Grant, R. (2013). *PFI / PPP , private sector perspectives of UK transport and healthcare.* <https://doi.org/10.1108/BEPAM-02-2012-0005>
- Eberhard, A., Kolker, J., & Leigland, J. (2014). *South Africa ' s Renewable Energy IPP Procurement Program : Success Factors and Lessons.* Washington, DC.
- Farhadi, M. (2015). Transport infrastructure and long-run economic growth in OECD countries. *Transport Research*, 74, 73–75. <https://doi.org/org/10.1016>
- Field, A. J. (2011). *A great leap forward : 1930s Depression and U.S. economic growth.* Yale University Press.
- Fox, S. (2014). The Political Economy of Slums : Theory and Evidence from Sub-Saharan Africa. *World Development*, 54, 191–203. <https://doi.org/org/10.1016/j>
- Gbadegesin, J. T., & Aluko, B. T. (2014). Public private partnerships / private finance initiatives for financing infrastructure in public tertiary institutions in Nigeria. *Built Environment Project and Asset Management*, 4(2), 199–215. <https://doi.org/10.1108/BEPAM-04-2013-0010>
- Hammami, M., Ruhashyankiko, J.-F., & Yehoue, E. B. (2006). *Determinants of Public-Private Partnerships in Infrastructure.*
- Hardcastle, C., Edwards, P. ., Akintoye, A., & Li, B. (2005). Critical Success Factors for Ppp

- / Pfi Projects in the Uk Construction Industry : a Factor Analysis Approach. *Construction Management and Economics*, 23(5), 459–471.
<https://doi.org/10.1080/01446190500041537>
- Hoeffler, A. E. (2002). The augmented Solow model and the African growth debate. *Oxford Bulletin of Economics and Statistics*, 64(2), 135–158+84. <https://doi.org/10.1111/1468-0084.00016>
- Ibrahim, A. D., Price, A. D. F., & Dainty, A. R. J. (2006). The analysis and allocation of risks in public private partnerships in infrastructure projects in Nigeria. *Journal of Financial Management of Property and Construction*, 11(3), 149–164.
<https://doi.org/10.1108/13664380680001086>
- Jooste, S. F., Levitt, R., & Scott, D. (2011). Beyond ‘one size fits all’: how local conditions shape PPP-enabling field development. *Engineering Project Organization Journal*, 1(1), 11–25. <https://doi.org/10.1080/21573727.2010.549612>
- Keohane, R. O. (1988). International Institutions : Two Approaches Studies Association. *International Studies Quarterly*, 32(4), 379–396.
- Khan, M. S., & Reinhart, C. M. (1990). Private investment and economic growth in developing countries. *World Development*, 18(1), 19–27. [https://doi.org/10.1016/0305-750X\(90\)90100-C](https://doi.org/10.1016/0305-750X(90)90100-C)
- Kogel, T., & Prskawetz, A. (2001). Agricultural Productivity Growth and Escape from the Malthusian Trap. *Journal of Economic Growth*, 6(4), 337–357. Retrieved from <http://www.jstor.org/stable/40216048>
- Leck, H., Pelling, M., Adelekan, I., Dodman, D., Issaka, H., Johnson, C., ... Nwokocha, E. (2018). Towards Risk-Sensitive and Transformative Urban Development in Sub Saharan Africa. *Mdpi*, 1–21. <https://doi.org/10.3390/su10082645>
- McGeorge, M. J. W. D., Jefferies, M., & McGeorge, W. D. (2012). *Using public-private partnerships (PPPs) to procure social infrastructure in Australia*.
<https://doi.org/10.1108/09699980910988348>
- Mofokeng, M. B. (2018). *Public Private Partnerships and economic growth in developing countries: An empirical analysis (Master's Thesis - GSB University of Cape Town .*

- Mohamad, R., Ismail, S., & Mohd Said, J. (2018). Performance indicators for public private partnership (PPP) projects in Malaysia. *Journal of Economic and Administrative Sciences*, 34(2), 137–152. <https://doi.org/10.1108/jeas-04-2017-0018>
- Munnell, A. H. (1992). Infrastructure Investment and Economic Growth. *Journal of Economic Perspectives*, 6(4).
- Olowofeso, E. O., Adeleke, A. O., & Udoji, A. O. (2015). Impact of private sector credit on economic growth in Nigeria. *CBN Journal of Applied Statistics*, 6(2), 81-101.
- Olusola Babatunde, S., Opawole, A., & Emmanuel Akinsiku, O. (2012). Critical success factors in public-private partnership (PPP) on infrastructure delivery in Nigeria. *Journal of Facilities Management*, 10(3), 212–225. <https://doi.org/10.1108/14725961211246018>
- Osei-kyei, R., & Chan, A. P. C. (2016). Implementing public – private partnership (PPP) policy for public construction projects in Ghana : critical success factors and policy implications. *International Journal of Construction Management*, 17(2), 113–123. <https://doi.org/10.1080/15623599.2016.1207865>
- Osei-Kyei, R., & Chan, A. P. C. (2015). Review of studies on the critical success factors for public-private partnership (PPP) projects from 1990 to 2013. *International Journal of Project Management*, 33(6), 1335–1346. <https://doi.org/10.1016/j.ijproman.2015.02.008>
- Panayides, P. M., Parola, F., & Lam, J. S. L. (2015). The effect of institutional factors on public–private partnership success in ports. *Transportation Research Part A*. Retrieved from <http://hdl.handle.net/10220/25773>
- Romer, P. M. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Economy*, 94(5). Retrieved from <http://www.journals.uchicago.edu/t-and-c>
- Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9(1), 86–136. <https://doi.org/10.1177/1536867x0900900106>
- Sanni, O. A., & Hashim, M. (2014). Building infrastructure through Public Private Partnerships in sub- Saharan Africa : Lessons from South Africa. *Procedia - Social and Behavioral Sciences*, 143, 133–138. <https://doi.org/10.1016/j.sbspro.2014.07.374>
- Sanusi, S. L. (2012). the Role of Development Finance Institutions in Infrastructure

Development : What Nigeria Can Learn From Bndes and the Indian Infrastructure Finance Company. *Keynote Address By Sanusi Lamido Sanusi, Con Governor, Central Bank of Nigeria*, (July), 1–12.

Shankar Nayak, B. (2018). Reification and praxis of public private partnerships in history. *Society and Business Review*. <https://doi.org/10.1108/sbr-04-2018-0034>

Solow, R. M. (1956). A contribution to the theory of economic growth: Old and New. *The Quarterly Journal of Economics*, 70(1), 65–94. <https://doi.org/10.5897/jeif2013.0518>

Stampini, M., Leung, R., Diarra, S. M., & Pla, L. (2013). How large is the private sector in Africa? Evidence from national accounts and labour markets. *South African Journal of Economics*, 81(1), 140–165. <https://doi.org/10.1111/saje.12000>

Tati, G. (2005). Public-Private Partnership (PPP) and Water-Supply Provision in Urban Africa : The Experience of Congo-Brazzaville. *Development in Practice*, 15(3), 316–324.

Trangkanont, S., & Charoenngam, C. (2014). *Private partner ' s risk response in PPP low-cost housing projects*. <https://doi.org/10.1108/PM-02-2013-0008>

UNCTAD. (2018). *Fact sheet # 9 : Foreign direct investment*.

Wibowo, A., & Alfen, H. W. (2015). *Government-led critical success factors in PPP infrastructure development*. <https://doi.org/10.1108/BEPAM-03-2014-0016>

World Bank. (2015). *2015 Sub-Saharan Africa (AFR) PPI 1 Update*.

World Bank. (2016). WDI.

Yescombe, E. R. (2017). *Public-Private Partnerships in Sub-Saharan Africa Case Studies for Policymakers*. UONGOZI Institute.

Zangouinezhad & Azar. (2014). *How public-private partnership projects impact infrastructure industry for economic growth*. <https://doi.org/10.1108/IJSE-04-2013-0083>

Zhang, S., Gao, Y., Feng, Z., & Sun, W. (2015). PPP application in infrastructure development in China: Institutional analysis and implications. *International Journal of Project Management*, 33(3), 497–509. <https://doi.org/10.1016/j.ijproman.2014.06.006>

Zou, P. X. W., Wang, S., Fang, D., Zou, P. X. W., Wang, S., & Fang, D. (2008). *A life-cycle risk management framework for PPP infrastructure projects*.
<https://doi.org/10.1108/13664380810898131>