Institutions and Economies
Vol. 12, No. 1, January 2020, pp. 1-36

Manufacturing Export and ICT Infrastructure in West Africa: Investigating the Roles of Economic and Political Institutions

Ibukun Beecroft[a], Evans S. Osabuohien[b], Uchenna R. Efobi[c], Isaiah Olurinola[d], Romanus A. Osabohien[e]

Abstract: *Investment in ICT infrastructure development is crucial to international trade through its provision of reliable interconnectedness via communication. This can be augmented via institutional intervention, which addresses opportunistic or rent-seeking behaviours of ICT infrastructure providers and reduces operational costs, among others. However, ICT infrastructural provision in West Africa remains low, necessitating the current drive by the regional economic community (ECOWAS) to make some advancement in this regard for enhanced trade outcomes of members. With the aim of unbundling institutional framework in the infrastructure-export nexus, this study empirically examines the relationship between manufacturing export and ICT infrastructure and articulates how economic and political institutions influence such interaction. Focusing on 14 West African countries, the study uses the Systems Generalised Method of Moments (SGMM) technique to address possible issues of endogeneity due to reverse causality. The results reveal that in the face of improved economic and political institutions, particularly those related to enforcement of contracts, the influence of ICT infrastructure in strengthening the exporting capacity from the manufacturing sector is greater. In addition, some measures of economic and political institutions matter more than others. The study recommends that ECOWAS countries promote better institutional quality, particularly in terms of transparency, accountability, corruption control, regulatory quality and the rule of law.*

[a] Department of Economics and Development Studies, Covenant University, Ota, Nigeria. *Email: ibukun.beecroft@covenantuniversity.edu.ng*

[b] Corresponding author. Centre for Economic Policy and Development Research, Department of Economics and Development Studies, Covenant University, Ota, Nigeria. *Email: evans.osabuohien@covenantuniversity.edu.ng; pecos4eva@gmail.com*

[c] College of Business and Social Sciences, Covenant University, Ota, Nigeria. *Email: uche.efobi@covenantuniversity.edu.ng*

[d] Department of Economics and Development Studies, Covenant University, Ota, Nigeria. *Email: olu.ogunrinola@covenantuniversity.edu.ng*

[e] Department of Economics and Development Studies, Covenant University, Ota, Nigeria. *Email: romanus.osahohien@covenantuniversity.edu.ng; romik247@gmail.com*

Keywords: Dynamic panel data; Infrastructural provision; Infrastructural development; Institutional framework; Institutional quality; Manufacturing export; Manufacturing value-added
JEL Classification: F14; O14; O17; O43; P45

Article Received: 11 July 2018; Article Accepted: 1 April 2019

1. Introduction

Infrastructural provision has a vital role to play in trade because most economic activities require some measure of infrastructure to thrive. Notably, infrastructural development aids national progress, facilitates trade by enhancing productivity and innovation, as well as improves the performance of manufacturing export (United Nations Economic Commission for Africa-UNECA, 2011). This includes information communication technology (ICT) infrastructure, which has been identified as a key driver of innovation (Oluwatobi et al., 2015; Karakara & Osabuohien, 2019)

The effect of ICT infrastructure on manufacturing export may be direct or indirect. In terms of the direct effect, the development of ICT infrastructure can enhance the productivity of manufacturing firms through the improvement of the internal economies of scale as a result of the transmission to a more mechanised production system. This is only possible in countries with improved ICT infrastructure, as firms in these countries will tend towards enhancing their efficiency owing to the availability of ICT infrastructure that can boost such processes. For instance, with the ICT growth in Nigeria, firms are beginning to have a more harmonised system of control and their production systems are becoming more integrated (Onu, Olabode, & Fakunmoju, 2014). This advancement will result in better production efficiency.

Also, an improvement in ICT infrastructure will enhance the rate of research and development, as well as innovative capacity owing to the development of internet facility and mobile network that makes access to information swifter and more efficient (Ejemeyovwi, Osabuohien, & Osabohien, 2018). The impact of this on manufacturing export is evident in the increase in manufacturing productivity, which can enhance the volume of output for both domestic consumption and exports. The evidence of the above is provided in Figure 1, which shows a significant positive effect between manufacturing export and ICT infrastructural provision among ECOWAS countries.

This current study relates to literature on trade and infrastructure such as Meon and Sekkat (2008), Deen-Swarray, Adekunle, and Odularu (2012),

Efobi and Osabuohien (2014), which have paid attention to general trade and export in Africa or a specific African sub-region. Though some of these studies have emphasised the role of institutions in enhancing export, gaps exist. A significant gap is the dearth of studies focusing on the manufacturing export of ECOWAS countries, except for Deen-Swarray, Adekunle, and Odularu (2012) that addressed the intra-regional trade of ECOWAS countries. However, the paper did not emphasise the role of institutional quality and how it affects the ICT infrastructure-export nexus. Efobi and Osabuohien (2016) considered the issue of ICT infrastructure, manufacturing export and institutions in ECOWAS countries, but failed to consider the unbundled institutional framework, which should provide a clearer understanding on which aspects of institutions matter more for export-infrastructure interplay. This begs the question as to what roles economic and political institutions play in improving manufacturing exports through ICT infrastructure, and which of these institutions have a greater influence on the infrastructure-export relationship?

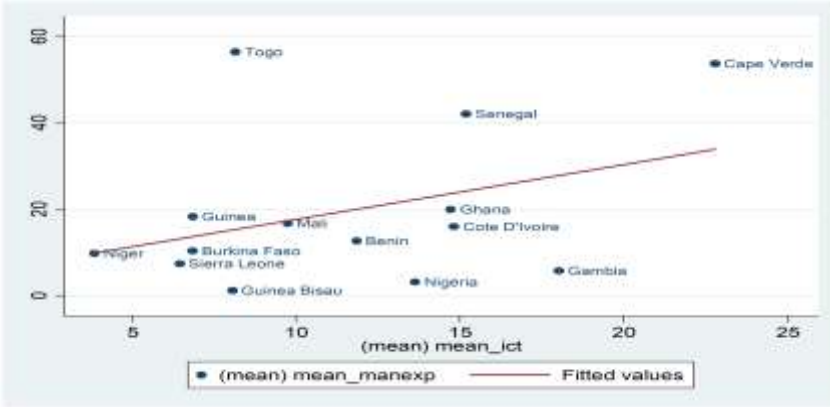
Noting the above, this study unbundles institutions into economic and political institutions using different indicators, which is novel given the fact that studies have focused on the context of ICT infrastructure and manufacturing exports. The study then investigates how economic and political institutions in ECOWAS countries can improve the effect of ICT infrastructure on manufacturing export and examines the indicators of these institutions that matter more in the ICT infrastructure and manufacturing export relationship. Two main explanations are provided on the need to unbundle institutions that can affect ICT infrastructure in enhancing manufacturing exports. The first is that economic institutions that support private property protection will restrain the tendency of the state to capture private enterprises, constrain state coercion and provide legal protection to shareholders and creditors, leading to higher insurance premium on investment (La Porta et al., 1999; Beck et al., 2003; Cavalcanti, Magalhaes, & Tavares, 2008). The resultant effect of these outcomes is that private investors that will provide ICT infrastructures will be encouraged to invest in these countries. Secondly, some of the indicators of political institutions have been noted to promote a sound governance structure that enhances the government's commitment to the overall development and growth of the country. For instance, democratic institutions push policy closer to the position of the median voters (Besley & Case, 2003) thereby implying that the interest of the electorate will most likely be catered for by the executive if the country is operating a democratic institution. More so, constraints on the executive and term limits will likely discourage the agenda of political leaders who are self-interested or "careerist" and will facilitate the election of citizen-legislators whose interest is to pursue policies that reflects the public will (Jo-Ansie, 2007).

Countries in West Africa present a veritable case in point because there is a wave within the sub-region to promote better governance principles to support the development of the ICT sector. Specifically, Articles 6, 7, 9, 10, 11, 12 and 13 of the ECOWAS Supplementary Act on the harmonisation of policies and regulatory framework for the ICT sector elucidates the role of institutions and governance structure of member countries in enhancing the extent of ICT development (ECOWAS Commission, 2007). The Act was enacted to ensure that ICT infrastructure is provided to enhance the ICT connectedness between member countries and the international community. Likewise, there is a need to improve the global relevance of ECOWAS countries through the development of the manufacturing sector. Thus, this study is of relevance as it offers empirical investigation on the issue of ICT infrastructure and manufacturing export and illustrates how political and economic institutions can play complementary roles (or otherwise), drawing from the West African sub-region.

To complement the literature and policy on trade and infrastructure in Africa, this study considers the extent to which there is a relationship between ICT infrastructural development in ECOWAS countries and manufacturing exports. Second, it examines the extent to which relevant economic and political institutional structures can enhance the relationship between ICT infrastructure and manufacturing exports in ECOWAS. Third, it highlights the most important economic and political institutional variables that can enhance this relationship. In the analysis, several checks were carried out to ensure that observed relationships were robust and reliable. The present study covers all the countries in West Africa (except Liberia and Mauritania; since Mauritania is no longer a member of ECOWAS; West Africa and ECOWAS are used synonymously in this study). The econometric model, which builds on Efobi and Osabuohien (2016), was estimated using the Systems Generalised Method of Moments (SGMM) approach.

The study is structured into six sections. Following this introductory section, section two presents brief background information on ECOWAS, while the literature review and research method are covered in the third and fourth sections, respectively. The fifth section encapsulates the empirical results while the sixth section concludes.

Figure 1: ICT infrastructural provision and manufacturing export



Source: Authors' computation

2. Brief Background Information about ECOWAS Countries

2.1 Manufacturing Export Performance

Manufacturing export is considered an important aspect of trade, especially exports. This is based on the fact that it involves processed and semi-processed, preserved and stored products that are expected to have more value-added than primary products (Olayiwola et al., 2015). In other words, since manufactured products are processed, they have a longer shelf-life than raw materials, which will enhance the possibility of accessing farther markets. This is deemed crucial stemming from the quest for most Sub-Saharan African (SSA) countries to industrialise for which the manufacturing sector has been noted to play important role in facilitating this process (Efobi & Osabuohien, 2016). In view of the above, this section presents the trend of manufacturing export of ECOWAS.

Currently, most West African countries have low export performance in their manufacturing sector, which is one of the prerequisites for global competitiveness. This is in tandem with the submission of United Nations Conference on Trade and Development-UNCTAD (2012) for countries to benefit from the opportunities of participating in the international trading system, they require an increase in the value-added components of the manufacturing sector. The values of manufacturing export for the ECOWAS countries presented in this section are the average of the respective countries, and they show the contribution of manufacturing export in their economies. This measure will also scale the sub-regions manufacturing export by the total merchandise export and make them more comparable. The statistics reported in Table 1 reveal that, for all of the West African countries

presented, only three performed above the average of SSA manufacturing exports. These include Cape Verde, Senegal and Togo with manufacturing exports above 40% of their total merchandise exports. The case of Cape Verde is worth noting because it is a small economy with sound macroeconomic policy. More so, it operates policies that encourage foreign presence and presents a conducive business environment for foreign firms.

To buttress the above point, the value ranks highest (after Ghana) among the West African countries in the World Bank's Ease of Doing Business Statistics (World Bank, 201). The countries with the largest economies in the sub-region-Nigeria and Ghana have not performed as well: Nigeria records between 1% and 4%, while Ghana records between 2% and 23%. These statistics revealed the import dependence of these countries and the inefficiency of the manufacturing sector. It is also important to state that the export of Nigeria has largely been driven by the extractive industries, with the majority of the export commodity stemming from crude oil. The incentive, therefore, is to develop the real sector that will drive value addition is insufficient. This may have accounted for the low ratio displayed in Table 1.

Table 1: Manufacturing export as % total merchandise export in West Africa

Countries	1991-1995	1995-2000	2001-2005	2006-2010	2011-2015
Benin	8.89	4.81	7.66	17.34	17.06
Burkina Faso	6.07	14.06	11.38	7.69	12.16
Cape Verde	76.66	82.23	84.51	28.12	13.92
Cote D'Ivoire	6.57	15.62	19.74	14.53	13.85
Gambia	35.97	15.57	22.16	19.26	24.56
Ghana	7.74	14.73	12.65	23.23	12.89
Guinea	24.29	22.46	16.56	9.14	14.49
Guinea Bissau	0.19	NA	0.75	NA	NA
Liberia	NA	NA	NA	NA	NA
Mali	NA	4.06	12.93	12.85	27.74
Niger	0.86	3.22	10.84	11.01	7.48
Nigeria	0.70	1.55	1.49	3.86	3.82
Senegal	30.50	46.16	42.93	40.19	37.67
Sierra Leone	NA	1.95	1.49	NA	9.99
Togo	7.22	14.91	51.27	47.76	53.84
SSA	0.00	25.69	17.83	27.03	21.85

Note: The values are the averages for the respective countries and periods.
NA: not available.
Source: Authors' computation using data from World Development Indicators, 2017

2.2 ICT Infrastructure

ICT infrastructural provision in West African countries has witnessed minimal progress in comparison to other countries. Subject to the trend of

ICT infrastructure in the Economic Community for West African States (ECOWAS), the West African sub-region is beginning to 'wake up' to the realisation that there is the need for regional action that will propel member states to introduce policies to enhance ICT infrastructural development. Some of these actions include the Supplementary Act of 2007 that focused on the harmonisation of policies and regulatory framework for the ICT sector in the sub-region. Article 33 of the Act provides that member states should participate in the modernisation and development of ICT infrastructure in order to provide reliable interconnectedness for regional and international communication (ECOWAS Commission, 2007).

Countries in the ECOWAS sub-region are evolving with strategies to boost their industrialisation and exports. Most important is the creation of mutual cooperation among member countries by the move towards the formation of a strong custom union, where member countries charge relatively similar tariff for imported goods (including capital inputs for manufacturing). The aim of this move, which has begun by the creation of a common external tariff (CET) in 2004, is to have an improved industrialisation and private sector development since the CET applies in relation to non-member countries and aims to enhance sub-regional trade integration through the flow of goods and services, especially inputs and intermediate goods for the industrial sector (Olayinka, 2018).

2.3 *Institutional Quality*

Institutional quality in West Africa is examined by summarising the average score for measures of control of corruption, government effectiveness and rule of law. These three measures (essentially political institutions) are considered crucial as their developments are able to ensure property right protection and security of investments, which will, in turn, enhance industrial growth and development (Asiedu, 2006; Osabuohien & Efobi, 2013; Efobi & Osabuohien, 2015). Table 2 presents the average scores of the three variables for the period from 2001-2005 and 2006-2010.

In Table 2, the level of institutional quality in Cape Verde, in terms of control of corruption, government effectiveness in making policies and pursuing such policies, and the rule of law, is better than other ECOWAS countries. This is followed by Ghana in terms of control of corruption and government effectiveness. Other ECOWAS countries had poor institutional quality because the values for institutional quality were all negative for the entire period.

The major issue that can be underscored here is that most West African countries have not performed well in terms of manufacturing export and the level of infrastructural development is still low. Likewise, the institutional framework is quite low. The fundamental question is, therefore, whether

these variables have a significant link. This can readily be inferred because some of the countries, such as Cape Verde and Ghana, that have performed better with regard to manufacturing exports, have developed infrastructures and higher institutional quality. However, there is a need for an empirical validation to shed light on the above cursory observations.

Table 2: State of institutional quality in West Africa

Countries	Control of Corruption			Government Effectiveness			Rule of Law		
	2001-05	2006-10	2011-15	2001-05	2006-10	2011-15	2001-05	2006-10	2011-15
Benin	-0.664	-0.614	-0.64	-0.393	-0.522	-0.53	-0.462	-0.625	-0.57
Burkina Faso	-0.088	-0.354	-0.22	-0.616	-0.621	-0.60	-0.598	-0.314	-0.48
Cape Verde	0.283	0.746	0.51	-0.042	0.098	0.12	0.309	0.508	0.56
Cote D'Ivoire	-0.987	-1.119	-1.05	-1.089	-1.234	-0.94	-1.39	-1.379	-0.89
Gambia	-0.496	-0.677	-0.66	-0.56	-0.664	-0.68	-0.167	-0.372	-0.63
Ghana	-0.236	0.033	-0.13	-0.121	0.009	-0.15	-0.044	-0.044	0.07
Guinea	-0.774	-1.138	-1.05	-0.896	-1.194	-1.19	-1.221	-1.493	-1.35
Guinea Bissau	-1.026	-1.078	-1.36	-1.279	-1.079	-1.38	-1.248	-1.348	-1.40
Liberia	-3.032	-0.63	-0.68	-3.954	-1.563	-1.31	-4.369	-1.289	-0.87
Mali	-0.527	-0.509	-0.74	-0.676	-0.815	-0.95	-0.224	-0.341	-0.66
Niger	-0.921	-0.731	-0.64	-0.839	-0.811	-0.67	-0.779	-0.654	-0.58
Nigeria	-1.248	-0.97	-1.18	-0.955	-1.069	-1.05	-1.38	-1.145	-1.09
Senegal	-0.006	-0.552	-0.16	-0.157	-0.366	-0.45	-0.012	-0.311	-0.24
Sierra Leone	-0.908	-0.915	-0.89	-1.333	-1.181	-1.23	-1.273	-0.98	-0.87
Togo	-0.81	-0.991	-0.93	-1.452	-1.469	-1.28	-0.943	-0.894	-0.89

Note: the three measures are valued from -2.5 (weakest institutions) to +2.5 (strongest institutions).
Source: Authors' computations using data from World Governance Indicators, 2017

3. Theoretical Foundation and Main Issues from the Literature

3.1 Factors Influencing Trade Performance

Broadly speaking, factors that can influence the performance of trade in a region or country have been documented in the literature, but with varying conclusions. For example, Yang and Gupta (2007) noted that regional trade agreements (RTAs) in Africa have not been very meaningful in enhancing trade. Some of the reasons for this were attributed to external trade barriers and low level of harmony in terms of resources among the member countries. The paper suggests that trade liberalisation and the streamlining of the RTAs

could be useful in promoting trade in the continent. In their study, Osabuohien and Efobi (2011) observe that institutional weakness constituted one of the major drawbacks to trade outcomes of Regional Economic Communities (RECs) in Africa. The study recommended that setting up institutional performance benchmarks, just like the macroeconomic convergence criteria can improve Africa's RECs trade outcome. The above is similar to the recommendation of Meon and Sekkat (2008) that used panel data for the period from 1990 to 2000 for 59 countries using the Fixed Effects and Two-Stage Least Squares techniques. The paper found that institutional quality using rule of law, government effectiveness and lack of political violence as indicators, was crucial in determining international trade performance, especially manufacturing exports.

Other studies like Baunsgaard and Keen (2010) observed a panel of 125 countries (1975-2000) and concluded that high-income economies easily recover from the loss of trade revenues, while middle-income economies recover an average of 35–55% trade revenues, but low-income countries, like those in SSA, recovered none. This implies that economic performance matters in trade performance. Other reasons that have been advanced for low trade performance in Africa include poor transport facilities, high trading costs and market size (Limao & Venables, 2001; Yang & Gupta, 2007; Djankov, Freund, & Pham, 2010; Mbekeani, 2010). Subramanian and Tamirisa (2003) have equally established that the declining share of African countries trade in the world market can be traced to their growth in income, size of population, geography, and the nature of economic policy. Deen-Swarray, Adekunle, and Odularu (2012) examined the extent of infrastructure development and its impact on trade integration in West Africa countries.

3.2 ICT Infrastructural Development and Exports

Competitiveness in global trade and internationalisation emphasise the export of products from the manufacturing and services sectors, more than the traditional export of primary products (Bankole et al., 2015). This is due primarily to the brevity of the value chain of the export of primary products and marginal value-added. Taking a look at some of the factors that promote manufacturing export, the need for infrastructural development has been identified. As the World Bank (2017) noted, infrastructure can help in determining the success of manufacturing and other agricultural activities. This is perhaps because poor infrastructure can prevent the development of markets for intermediate inputs and will impede manufacturing, leading to low export capacity (Efobi & Osabuohien, 2016).

Infrastructural provision has transcended the traditional focal emphasis on 'roads and bridges' to software and other forms of technology that can

foster trade. Information and communication technology-ICT stands out in this regard because it aids diverse processes that can culminate in enhanced export volume and inclusive growth (Ejemeyovwi, Osabuohien, & Osabohien, 2018). For instance, it promotes efficient and effective innovation processes in the firm (Aloini & Martini, 2012), establishes the linkage between the manufacturing firms and the potential suppliers of resources or market for the finished products – through the use of the telephones and internet facility; and aids the communication processes that are required during the production process (Osabuohien & Efobi, 2012). Further, most modern factories are highly automated, and the dexterity of ICT cannot be overemphasised to have contributed to the overall process.

ICT infrastructure is expected to have a positive impact on export in ECOWAS. This was predicted by Longo and Sekkat (2001) who noted that a 1% increase in the stock of telecommunication and other infrastructures – in the exporting country – will boost export by about 3%. Furthermore, Yushi and Borojo (2019) noted that communication infrastructure has a positive influence on trade flows in Africa. However, the need for ICT infrastructure has been inadvertently neglected in the literature. This is particularly for the ECOWAS sub-region, despite the drive towards the improvement of the ICT provision by member countries and to enhance global integration. ICT provision is an important aspect of the drive towards the development of the manufacturing export of these countries. The reason being that the provision of ICT can enhance the communication between businesses and their suppliers, as well as potential customers and market for their goods, improve the flow of capital as ICT presence can enhance speedy access to financial information and banking services, improve human capacity to enforce improvement in business operations. In essence, it enhances the internal economies of scale of the manufacturing sector (Alberto, Margarita, & Fernando, 2013; Osabuohien et al., 2019).

3.3 Institutional Intervention

The theoretical foundation on the role of institutions in enhancing the impact of ICT infrastructure on manufacturing export can be embedded in the role of institutions in economic transactions within the framework of New Institutional Economics (NIE). NIE integrates the theory of institutions in economic analysis. In précis, institutions are those written and unwritten rules, norms and constraints that are devised by humans in order to reduce uncertainty and control their environment (North, 1991; Ejemeyovwi et al., 2018). It includes written rules and agreements that govern contractual agreements, constitutions, laws and rules that govern politics, government, finance, and society more broadly, and even unwritten codes of conduct, norms and beliefs (Mantzavinos et al., 2004; Efobi, 2015).

The implication of the foregoing is that if there is an institutional intervention within a country – in terms of the development of institutional framework – then there will likely be an improvement in the level at which ICT infrastructure influences manufacturing exports. Three plausible reasons are provided to substantiate the intuition. First, when institutions are developed, the cost of transactions will be reduced, and the implication is that those costs that would have hitherto been incurred as a result of poor institutions, will be saved and transferred to the production process of the manufacturing companies. Institutional development will, therefore, likely reduce the operational cost of ICT operators. For example, some of the attendant costs from poor institutional development, especially at the point of licencing ICT providers, will drastically be eliminated with institutional development.

The effect of this on the manufacturing sector and exports is enormous. It includes the savings that stem from the reduction of the overhead costs that would have been paid, can be channelled into the production process and this will boost the output for export. It also includes a reduction in the cost of access will also reduce the overhead cost for manufacturing firms, especially in reaching potential markets and securing orders from suppliers. Thus, in the economics of imperfect information, bounded rationality and transaction cost makes the institutional development overwhelmingly important for the growth of the manufacturing sector and their productivity in the light of ICT provision. Williamson (2005) avers these concepts as the science of contract, which includes adequate structure that infuses order, thereby mitigating conflict and realising mutual gain.

Second, the development of an institutional framework will reduce the occurrences of opportunistic behaviours by ICT infrastructure providers and firms' rights can be protected in the light of contract enforcement. For instance, anecdotal evidence suggests that in some African countries (ECOWAS inclusive), ICT providers are not mandated to pay for man-hour loss or any form of interruption to the processes of other economic agents in the case of contingencies in their operations. Third, the strengthening of institutions will improve the robustness of policies that will enhance the efficiency of ICT service providers to deepen its effect on the other dependant sectors. For example, in the absence of transparent and comprehensive policies that regulate the ICT sector in a country, ICT providers will be confronted with conflicting and confusing regulations that affect their efficiency and the consequent outcome includes the disruption, delay or inefficient service provision to other dependant sectors (e.g. manufacturing sector). Many ECOWAS countries are lagging in this area (Karakara & Osabuohien, 2019).

Kiessling (2007) examined institutions and ICT adoption across 82 countries, employing the ordinary least square (OLS) estimation technique

and argued that the quality of institutions affects the adoption of ICT infrastructure. This includes economic, financial, and to some extent, political institutions. Likewise, Asongu and Biekpe (2017) considered the institutional quality and ICT adoption in 49 Sub-Saharan African (SSA) countries and applied the SGMM technique of estimation. The paper concluded that institutional quality (particularly rule of law and corruption control) is significant in determining ICT adoption in SSA. These and other studies (Andrés, Amavilah, & Asongu, 2017; United Nations Conference on Trade and Development - UNCTAD, 2014) point to the fact that institutions can drive ICT towards positive outcomes. Thus, if ICT infrastructure enhances manufacturing export and institutions are beneficial for ICT, it is expected that institutions will serve to propel manufacturing export through ICT infrastructure.

4. Model Specification, Estimation Technique and Description of Data

4.1 Model Specification

This study formulates an empirical model that builds on Efobi and Osabuohien (2016). The paper's estimable model focused on an analysis that is closely related; however, in this current paper, the institutional quality is *unbundled* into economic and political institutions. More so, in the current study, the exchange rate was excluded since the Francophone West African countries (which form the majority of ECOWAS) have their exchange rate pegged with the French CFA. The primary explained variable (manufacturing export) is measured using the ratio of manufacturing export to total merchandise exports. This measure is preferred because it captures the component of manufactured products in the trade 'basket'. This is unlike the ratio of manufacturing export to GDP, which considers manufacturing export contribution to the GDP and may likely present blurred evidence of the volume of manufacturing exports of the sampled countries, considering that they are at varying levels of economic growth.

For the ICT infrastructure, a composite measure of ICT infrastructure was computed using the simple average of internet users, telephone users and mobile phone users. These indicators are popular in the literature (e.g. Asiedu, 2006; Asiedu, 2011; Efobi & Osabuohien, 2015) as they have been used to capture measures of infrastructure. Another reason is data availability and the intuition that most international trade transactions will require ICT infrastructure to secure a contract for sales and purchases of products abroad. As part of robustness check, only mobile phones (*ICT _Infra2)* were considered given its surge in developing countries. More importantly, the ECOWAS Supplementary Act on the harmonisation of the regulatory frameworks for the ICT sector comprehensively focused on regulations that

pertain to these measures of ICT infrastructure (ECOWAS Commission, 2007).

The second primary variable of interest is 'institutional quality'. A battery of institutional indicators is applied. This was informed by the need to examine the role of institutions from a broader perspective to provide a holistic intuition on the intervening role of institutions in ICT infrastructure *vis-à-vis* the effects on manufacturing exports. Two broad categorisations of institutions were made, namely economic and political institutions. Economic institutions include those measures of institutions that support private property protection such as the Fraser Institute's economic freedom index; the World Bank's Ease of Doing Business ranking on the enforcement of contracts. The political institutions entail the World Bank's Governance Indicators on the rule of law and regulatory quality inclusive of government's ability to make sound policies that promote private sector development. The second measure of political institutions focuses on institutions that reflect the extent of the power of the political elite and their ability to use such powers for the overall interest of the state. The indicators included in this category are the extent of democratic institutions, measured using a simple average of the political right and civil liberty dataset from Freedom House dataset; and the World Bank's Governance Indicators control of corruption.

The annual growth rate of the manufacturing value-added, labour and capital were controlled for in accordance with trade literature. In essence, the theoretical and empirical underpinnings of the determinant of trade and the application of relative indicators to measure these variables have received considerable coverage in the literature (Dollar & Kraay, 2002; Asiedu, 2006; Meon & Sekkat, 2008; Asiedu & Lien, 2011; Efobi & Osabuohien, 2016). We also control for labour and capital following the standard determinants of manufacturing capacity.

To improve the efficiency of the model, we control for some heterogeneities including (i) globalisation, which creates sustainable international relations among countries, and this will likely enhance cooperation – both in the transfer of capital and trade (Bergh & Nilsson, 2014; Bandyopadhyay, Sanler & Younas, 2011). (ii) The legal origin is based on the fact that countries will likely trade with countries of similar colonial heritage: this colonial heritage is tied to the legal system handed over to the former colonies by their colonial masters (La Porta et al., 2008). (iii) Resource dependency and conflict-affected features are based on the fact that countries that are natural resource dependence will most likely not focus on industrialisation and value addition for export (Asongu, 2014). (iv) National conflict will increase the cost and risk of investment in the respective country.

Therefore, the regression model is presented in equation (1)

$$Manufacturing\_export_{it} = \beta_0 + B_1 ICT\_Infrastructure_{it} + \beta_2 Institution_{it} + \beta_3 Covariates + \beta_4 X + e_{it} \quad (1)$$

To test the relevance of institutions in the infrastructure-export nexus, an interactive variable was introduced in the model. The variable is a multiplicative of the different institutional indicators and infrastructure. With these variables, it is possible to test the main intuition of this study. In this wise, Equation (2) is restated to include the interactive variable as:

$$Manufacturing\_export_{it} = \beta_0 + B_1 ICT\_Infrastructure_{it} + \beta_2 Institution_{it} + \beta_3 ICT\_Infrastructure_{it} * Institution_{it} + B_4 Covariates + e_{it} \quad (2)$$

4.2 Estimation Technique

Considering the empirical model presented above, there are plausible reasons to expect a variety of reverse causation from manufacturing export to ICT infrastructure and some of the covariates expect some endogeneity issues with the inclusion of measures of institutions. For example, an economy that enjoys an increase in the growth of the manufacturing sector, culminating to increased production may attain the size necessary to break into export markets, so that the exports also increase. There is evidence of reverse causation in the sense that much of the observed correlation between manufacturing export and the demand for ICT infrastructure is driven by larger and more productive firms self-selecting into the improvement of their technology to gain more market share (Osabuohien & Efobi, 2013).

Similarly, trade has informed the metamorphosis of institutions to reduce incidences and risk of economic losses and to protect private properties from state capture and other forms of expropriations. These arguments portray the possibility of reverse causality challenges in the empirical model. The issue of endogeneity is also a possible challenge that may likely occur from the kind of explanatory variables, especially economic and political institutions, included in the model above, which may occur due to possible correlations between some of the explanatory variables and the error term (Osabuohien & Efobi, 2013; Oluwatobi et al., 2014).

The control of these two major shortcomings of the estimable stochastic model developed for this study, as well as to avoid misleading inferences and biased estimates, requires that we apply an estimation technique that can efficiently resolve these issues. The Systems Generalised Method of Moments (SGMM) estimation technique is thus preferred. Apart from the

fact that this technique has been favoured by recent empirical studies (e.g. Asiedu & Lien, 2011; Bandyopadhyay et al., 2011; Osabuohien & Efobi, 2013; Oluwatobi et al., 2014), the SGMM technique is able to efficiently address the issues of endogeneity by using internal instruments. This is seen as being more efficient than applying a technique that would have used externally generated instruments (Blundell & Bond, 1998; 2000). The SGMM has other merits like its inclusion of reasonable stationary restrictions on its initial condition process and additional moment conditions to properly deal with the endogeneity issues. Furthermore, the SGMM is robust to heteroscedasticity and distributional assumptions (Bandyopadhyay et al., 2011).

The dynamic panel regression is presented as:

$$\begin{aligned} Manufacturing\_export_{it} = {} & \beta_0 + B_1 Manufacturing\_export_{i,t-1} \\ & + B_2 ICT\_Infrastructure_{it} + \beta_3 Institution_{it} \\ & + \beta_4 ICT\_Infrastructure_{it} * Institution_{it} \\ & + B_5 Covariates + e_{it} \end{aligned} \quad (3)$$

Covariates is the set of the country's unobserved heterogeneous factors (economic and political globalisation, the legal origin, resource dependency and conflict-affected features). The country-specific effect is *i*, while the time-specific effect is *t*. The error term remains *e*. Other variables are as earlier defined. All the variables are expected to have positive influence on manufacturing export, *ceteris paribus.*

The SGMM is confronted with the challenge of its reassurance that the internally generated instrument applied in the estimation process is not over-identified nor proliferated (Roodman, 2009). To ensure that this is not the case, the test for autocorrelation- AR(2) and Sargan test for instrument over-identification are reported. As a rule of thumb, it is expected that the probability value of the AR(2) and the Sargan test should be ≥ 0.05. The instrument ratio was also reported, and it is expected that *it* lies within the range of ≥ 1.00 (Roodman, 2009).

4.3 Data

The data for the variables included in the model were sourced from different databases as shown in Table 3. The sample for this study contains 14 ECOWAS countries for the period from 2002-2014. Liberia was excluded from our estimations because it does not have data for our primary explained variable. Guinea Bissau and Sierra Leone had some missing data for some years. We conducted checks by excluding them and re-estimating the model to observe whether there was marked difference in the results. The results (not reported) were similar to the original estimations. The sampled countries

are Benin, Burkina, Cape Verde, Cote D'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The period of study was based on data availability for the variables of interest.

Table 3: Summary statistics of variables

Variable	Measure, *Identifier*: Source	Mean	Std. Dev
Manufacturing export	Ratio of manufacturing export to total merchandise export, *Man _Exp*: World Development Indicators-WDI	21.71	21.16
ICT	Average of telephone, internet and mobile cellular usage per 100 persons, *ICT _Infra1*: WDI	11.51	10.90
Infrastructure	Mobile cellular usage per 100 persons, *ICT _Infra2*: WDI	27.96	27.34
Economic institutions	Economic Freedom Index measured as 0 (least freedom) to 100 (most free), *Eco _Free*: Fraser Institute's Economic Freedom of the World	5.94	0.51
	Time in enforcing a contract, measured in days, *Contract_Enf*: World Bank's Doing Business – WBDB	577.4	167.37
	Procedure of enforcing contract, measured in the number of procedures to enforce contract, *Contract_Proc*: WBDB	39.45	3.95
Political institution	Rule of law, measured as -2.5 poor rule of law to +2.5 strong rule of law, *Rule_Law*: World Governance Indicator – WGI	-0.72	0.57
	Regulatory quality, measured as -2.5 poor regulatory quality to +2.5 strong regulatory quality,	-0.66	0.42
	Democratic institution (simple average of the political right and civil liberty). Recoded such that it ranges from 0 (poor democracy) to 7 (strong democracy), *Dem*: Freedom House dataset.	4.33	1.44
	Control of corruption, measured as -2.5 poor control of corruption to +2.5 strong control of corruption, *Corr_Cont*: WGI.	-0.63	0.48
Covariates	Manufacturing value-added, measured in constant 2005 US$, *Man_Value*: WDI	661 Million	1, 200 Million
	Labour, total labour force in the country, *Labour*: WDI	6 Million	11 Million
	Capital: Foreign Direct Investment, ratio of FDI net inflow to GDP in Constant 2005 US$		
	FDI: WDI	5.62	10.68
Unobserved heterogeneous	Globalisation, an index where the higher value implies intense political integration with the rest of the world, *Globalisation*: KOF Index by Dreher *et al.* (2008)	67.28	15.51
Factors	Resource dependency, dummy variable where 1 represent oil-producing country and otherwise, *Resources*: Asongu (2014)	0.07	0.25

Source: Authors' computation

4. Empirical Results and Implications of Findings

To begin the estimation of the stochastic model, a pairwise correlation analysis was conducted to check the bivariate association between the explanatory variables. This study proceeds to the empirical result in Table 4. The manufacturing value-added was positive suggesting the importance of this variable in the manufacturing sector, especially in the model that contains mobile network, i.e. *ICT_Infra2* – as a measure of ICT infrastructure. The variables '*labour*' and *'FDI'* were significant with FDI being negative. The negative effect of the FDI is probably because most of the foreign investments in ECOWAS are market and resource-driven (Asiedu, 2006; Asiedu & Lien, 2011). The institutional variables, especially the measures of political institutions (i.e. the rule of law, regulatory quality, democratic institutions and control of corruption) all showed that the development of these institutions significantly matters for the improvement of the manufacturing export of West African countries. The institutions that show contract enforcement revealed that an increase in the time and procedure to secure contract would improve manufacturing exports. However, emphasis is placed on the interaction term as subsequently considered.

In Table 4, the ICT infrastructure variables behaved consistently across the columns. The variable was significant at 5%. The intuition is that an increase in the ICT infrastructure in an average ECOWAS country will result in an improvement in the volume of manufacturing export in the total merchandise exports. The magnitude of this estimated impact indicates that one standard deviation (SD=10.90) increase in the composite ICT infrastructure induces an increase in manufacturing export to total merchandise export of 8.592 (=10.90×0.788). In the same vein, when considering only mobile phone (*ICT _Infra2),* a one standard deviation increase in the supply of mobile network (i.e. SD= 27.96) induces an increase in manufacturing export to the total merchandise export of 21.55 (=27.96×0.788). The results from the estimations suggest that on the average, ECOWAS countries can increase export from the manufacturing sector by improving on the level of ICT infrastructure.

Relating this to the action plan of the regional economic community to improve the ICT infrastructural provision of member countries, this will be a laudable step towards the development of the manufacturing sector. One main channel through which ICT infrastructure can enhance the manufacturing export of ECOWAS countries is by providing access that will boost their link to the global community. This will create a leeway for them to access potential market, customers and suppliers, and the process of globalisation will be made easier as manufacturing firms will easily benchmark their operations with the global community. The substantial

effect of the mobile network also appeals to its role in the global integration of the manufacturing sector, resulting in significant improvement in the volume of manufacturing trade. The mobile network is more important for the volume of manufacturing export compared to telephone line usage and internet access. This is agreeable based on the fact that the mobile network has wider diffusion than other indicators of ICT infrastructure (Efobi & Osabuohien, 2015).

The coefficients and inferences garnered from the estimations in Table 4 are reliable and are not susceptible to a Type 1 error. The preliminary checks, such as the AR(2), Hansen test and the number of instruments included in the analysis suggest that the results are not influenced by the presence of a second-order serial correlation between the instruments and the error term, and the instruments included in the estimations were not proliferated. In essence, the estimations do not suffer from the inclusion of too many instruments. The instrument ratio meets the criteria as stipulated by Roodman (2009).

Table 4: SGMM regression – manufacturing export and ICT infrastructure

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Man_Exp (Lag)	-0.48[a] (0.00)	-0.30[a] (0.00)	-0.03 (0.56)	-0.09[a] (0.00)	-0.05 (0.20)	-0.07 (0.27)	-0.03 (0.56)	-0.04 (0.51)	-0.21[b] (0.02)	-0.30[a] (0.01)	0.02 (0.82)	-0.00 (0.92)	0.19[a] (0.01)	0.21[a] (0.01)	0.04 (0.26)	0.04 (0.34)	0.14[a] (0.00)	0.14[a] (0.00)	0.09[b] (0.02)	0.09 (0.15)
ICT_Infra1	0.673[a] (0.00)	---	0.81[a] (0.00)	---	0.84[a] (0.00)	---	0. 76[a] (0.00)	---	0.66[a] (0.00)	---	1.23[a] (0.00)	---	0.61[a] (0.00)	---	0.85[a] (0.00)	---	0.84[a] (0.00)	---	0.60[a] (0.00)	---
ICT_Infra2	---	10.13[a] (0.00)	---	3.06[a] (0.00)	---	0.16[b] (0.02)	---	0.27[a] (0.00)	---	0.21[a] (0.01)	---	0.41[a] (0.00)	---	0. 13[b] (0.03)	---	0.21[b] (0.02)	---	0.24[a] (0.00)	---	0.18[a] (0.01)
Man_Val	0.17 (0.85)	3.65[a] (0.00)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Labour	---	---	5.45[a] (0.00)	5.64[a] (0.00)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FDI	---	---	---	---	-0.74[a] (0.00)	-0.29[c] (0.05)	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Eco_Free	---	---	---	---	---	---	0.26 (0.90)	1.23 (0.66)	---	---	---	---	---	---	---	---	---	---	---	---
Contract_Enf	---	---	---	---	---	---	---	---	15.3[a] (0.01)	15.59[a] (0.00)	---	---	---	---	---	---	---	---	---	---
Contract_Proc	---	---	---	---	---	---	---	---	---	---	1.30[a] (0.00)	1.55[a] (0.00)	---	---	---	---	---	---	---	---
Rule_Law	---	---	---	---	---	---	---	---	---	---	---	---	16.38[a] (0.00)	18.91[a] (0.00)	---	---	---	---	---	---
Reg_Qual	---	---	---	---	---	---	---	---	---	---	---	---	---	---	13.91[a] (0.00)	16.68[a] (0.00)	---	---	---	---
Dem	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	6.42[a] (0.00)	7.19[a] (0.00)	---	---
Corr_Cont	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	19.26[a] (0.00)	20.87[a] (0.00)
Constant											-50.85[a] (0.00)	-56.14[a] (0.00)	22.42[a] (0.00)	27.10[a] (0.00)	18.75[a] (0.00)	24.28[a] (0.00)	-19.97[a] (0.00)	-19.71[a] (0.00)	25.07[a] (0.00)	27.90[a] (0.00)
AR(2)	0.29	0.39	0.20	0.06	0.23	0.14	0.19	0.26	0.09	0.06	0.53	0.20	0.14	0.06	0.11	0.05	0.52	0.31	0.32	0.17
sen	0.13	0.12	0.11	0.11	0.20	0.19	0.14	0.14	0.35	0.29	0.33	0.44	0.02	0.26	0.27	0.27	0.13	0.15	0.26	0.27

Note: The mobile phone users per 100 persons *'ICT_Infrastructure2'*, manufacturing value-added *'Manufact_Value'*, Labour *'Labour'*, time taken to enforce contract *'Contract_Enf'* were presented in their logged form. The values in parenthesis are the probability values. The superscripts [a], [b] and [c] indicate significant at 1, 5 and 10%, respectively. The # cross-section (n) =15; the # instrument is 11; therefore, the instrument ratio (n/i) = 1.36. All estimations include constant but not all were reported for space.
Source: Authors' computation

5.1 Considering the Interaction Term

Moving on to the interaction term, the measures of institutions are included as a multiplicative of the ICT infrastructure variables. The interaction terms are presented in Tables 5 and 6.

Table 5 was generated for the estimations that include only the manufacturing value added as covariates alongside the ICT infrastructure variables and the measures of institutions. On the other hand, Table 6 includes the estimations that pertain to the inclusion of labour, FDI, ICT infrastructure and measures of institutions. The reason for separating these covariates into different tables is to have a clear view by unbundling results. More so, the behaviour of the interaction term in the two tables will show the robustness of the results in order to draw an inference on the role of the measures of institutions on the ICT infrastructure-manufacturing export nexus.

The analysis in both Tables 5 and 6 shows that the results were not plagued by instrument proliferation and can be relied on for inference. The interaction term between economic freedom and measures of ICT infrastructure (i.e. *Eco_Free ×ICT_Infra,*) behaved contrary to expectations. The variable was significantly negative in both Tables suggesting that economic freedom of ECOWAS countries will reduce the impact of ICT infrastructure on manufacturing exports. This measure of institution (i.e. economic freedom) captures the openness of the economy and the reduction of the interference of state power in the market. This kind of institution is expected to support the industrial development of the ECOWAS community, resulting in improved provision of ICT infrastructure that will aid manufacturing exports. However, just the openness of the economy and probably the reduction of state interference, will not be enough to yield increasing productivity of the manufacturing sector despite the presence of ICT. This may likely be attributed to the absence of definite rules to monitor and regulate economic agents, and also reduce the transaction cost that comes with economic freedom. In essence, just expecting economic freedom to translate the presence of ICT into productivity of the manufacturing sector will be basing the estimates on the assumption of bounded rationality; that is not considering the possibility of self-interest, on the side of the service

providers and likely cascading the expected outcome from their presence in the economy. Williamson (2005) noted that adequate structure infuses order resulting in the realisation of mutual gain.

The contract enforcement variables – in terms of time of enforcing the contract and the procedures of doing so – displays a negative and significant effect on the ICT-manufacturing export nexus. In all the columns in Tables 5 and 6, the contract enforcement variable plays a complementary role in enhancing the effect of ICT infrastructure on manufacturing exports. The negative effect of these variables implies that the provision of ICT infrastructure will translate into manufacturing exports in the face of reducing time and procedure of enforcing contracts. What this implies is that ICT provision will be cheaper and budding-manufacturing businesses will maximise their output for possible export through the cost-saving benefit from the reduced ICT prices that comes with efficient contract enforcement. This is also applicable when considering political institutions that reflect the strength of the rule of law, regulatory quality and control of corruption. These aspects of institutions complement improvements in ICT provisions and the resultant effect on manufacturing exports.

Unexpectedly, the democracy variable was not significant in Tables 5 and 6. This suggests that the democratisation of West African countries matter less for the realisation of the manufacturing export benefits from ICT provisions. This can be situated in light of the effectiveness of rule and regulatory-based institutional framework in ensuring the benefits from ICT presence. It stresses the need of taking those institutional patterns that relate to contract enforcement, effectiveness of governance in making and enforcing sound policies without private interest and of moving beyond the narrow assumption that democracy and opening up the economy will yield immense benefit to the global competitiveness of indigenous industry. In essence, despite the anticipated positive effect of ICT infrastructure on manufacturing exports, when some economies and politics are not developed to complement it, the volume of manufacturing export will be affected.

5.2 Robustness: Considering Other Country Heterogeneity

Robustness checks were carried out to test the consistency of the results, particularly the interactive variables, by considering the country's heterogeneities. In this case, two specific heterogeneous factors were considered. Tables 7a and 7b present the different estimates when considering the extent of globalisation and the dependence on natural resources using only labour and capital as the main covariates for space and brevity of presentations.

In Table 7a, the globalisation variable was included, and this variable behaved expectedly in some of the columns with the coefficients assuming

significant and positive signs. Considering the interaction terms, there was no much difference from the behaviour of the variable as it was in the earlier Tables (Tables 5 and 6). The interaction between the measure of rule of law, regulatory quality and the control of corruption, and ICT infrastructure (i.e. *Rule_Law ×ICT_Infra, Reg_Qual ×ICT_Infra* and *Corr_Cont ×ICT_Infra)* was positive and significant in Table 7a, which is not significantly different from the behaviour in Tables 5 and 6.

The estimations when including the heterogeneous factor – resource dependence – were presented in Table 7b. This variable was significant and negative in most of the columns, suggesting that resource dependency will likely repress the incentive to develop the manufacturing sector for exports. However, moving on to the variable of interest, the behaviours of the interaction term was examined across the columns in the Table. There was no much difference observed. In effect, the implication of these robustness checks is that the main variables of interest were not in any form influenced by the inconsideration of the globalisation and the resource dependence factors that may likely affect ECOWAS countries' exports. The result is consistent irrespective of the extent of globalisation and resource dependence of the countries.

Table 5: SGMM regression – manufacturing export and ICT infrastructure, including interaction terms

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Man_Exp (Lag)	-0.81[a]	-0.64[a]	-0.61[a]	-0.38[c]	-0.39	-0.09	-0.05	0.06	-0.15	-0.33[a]	0.39	0.69[a]	-0.08	0.27
	(0.00)	(0.00)	(0.01)	(0.06)	(0.12)	(0.66)	(0.71)	(0.65)	(0.41)	(0.01)	(0.76)	(0.01)	(0.44)	(0.22)
ICT_Infra1	16.69[a]		33.87[a]		3.53[b]		2.44[b]		3.15[a]		0.67		5.68	
	(0.00)	---	(0.00)	---	(0.03)	---	(0.05)	---	(0.01)	---	(0.26)	---	(0.00)	---
ICT_Infra2		49.55[a]		26.92[a]		-20.16[a]		17.26[a]		24.65[a]		7.21		48.81[a]
	---	(0.00)	---	(0.00)	---	(0.01)	---	(0.00)	---	(0.00)	---	(0.32)	---	(0.00)
Man_Val	-17.49[a]	-9.64[a]	-2.78[c]	-6.59[a]	-5.74	-7.87[a]	6.10[a]	6.31[a]	6.15[c]	3.51[c]	0.39	0.31	6.03[a]	10.67[a]
	(0.00)	(0.00)	(0.08)	(0.00)	(0.11)	(0.00)	(0.00)	(0.01)	(0.06)	(0.09)	(0.76)	(0.62)	(0.00)	(0.00)
Eco_Free	-10.44	-29.04[b]												
	(0.53)	(0.02)	---	---	---	---	---	---	---	---	---	---	---	---
Eco_Free × ICT_Infra	-2.59[a]	-7.05[a]												
	(0.00)	(0.01)	---	---	---	---	---	---	---	---	---	---	---	---
Contract_Enf			-74.33[a]	-20.87[a]										
	---	---	(0.00)	(0.00)	---	---	---	---	---	---	---	---	---	---
Contract_Enf × ICT_Infra			-5.47[a]	-69.29[a]										
	---	---	(0.00)	(0.00)	---	---	---	---	---	---	---	---	---	---
Contract_Proc					1.45[b]	7.20[b]								
	---	---	---	---	(0.04)	(0.04)	---	---	---	---	---	---	---	---
Contract_Proc × ICT_Infra	---	---	---	---	0.10[a] (0.01)	3.16[a] (0.01)	---	---	---	---	---	---	---	---
Rule_Law							5.27	26.46						
	---	---	---	---	---	---	(0.70)	(0.17)	---	---	---	---	---	---
Rule_Law × ICT_Infra							3.25[a]	21.59[a]						
	---	---	---	---	---	---	(0.00)	(0.00)	---	---	---	---	---	---
Reg_Qual									14.40	55.23[a]				
	---	---	---	---	---	---	---	---	(0.33)	(0.01)	---	---	---	---
Reg_Qual × ICT_Infra									4.39[a]	30.55[a]				
	---	---	---	---	---	---	---	---	(0.00)	(0.00)	---	---	---	---
Dem											22.20[a]	31.87[a]		
	---	---	---	---	---	---	---	---	---	---	(0.00)	(0.00)	---	---

Table 5: (Continue)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dem × ICT_Infra	---	---	---	---	---	---	---	---	---	---	0.22 (0.29)	3.75 (0.14)	---	---
Corr_Cont	---	---	---	---	---	---	---	---	---	---	---	---	33.15[a] (0.00)	12.30[a] (0.00)
Corr_Cont × ICT_Infra	---	---	---	---	---	---	---	---	---	---	---	---	7.92[a] (0.00)	74.01[a] (0.00)
AR(2)	0.42	0.33	0.60	0.45	0.55	0.22	0.35	0.11	0.46	0.36	0.79	0.66	0.30	0.50
Hansen	0.52	0.12	0.64	0.58	0.18	0.26	0.22	0.32	0.45	0.24	0.09	0.22	0.47	0.96

Note: The mobile phone users per 100 persons *'ICT_Infrastructure2'*, manufacturing value-added *'Manufact_Value'*, time taken to enforce contract *'Contract_Enf'* were presented in their logged form. The values in parenthesis are the probability values. The superscripts [a], [b] and [c] indicate significant at 1, 5 and 10%, respectively. The # cross-section (n) =15, while the # instrument is 11. Therefore, the instrument ratio (n/i) = 1.36. Constant was not included for space.

Source: Authors' computation

Table 6: SGMM regression – manufacturing export and ICT infrastructure, including interaction terms, labour and FDI

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Man_Exp	-0.22[a]	-0.24[a]	0.03	-0.47[b]	0.04	0.19	0.02	0.20	0.30	-0.19	0.99[a]	0.63[a]	0.05	0.08
	(0.00)	(0.01)	(0.81)	(0.03)	(0.73)	(0.12)	(0.86)	(0.46)	(0.80)	(0.29)	(0.01)	(0.00)	(0.50)	(0.47)
ICT_Infra1	16.29[a]		18.45[b]		3.61[b]		2.24[a]		4.20[a]		5.48[b]		2.27[c]	
	(0.00)	---	(0.05)	---	(0.04)	---	(0.00)	---	(0.00)	---	(0.05)	---	(0.06)	---
ICT_Infra2		32.07[b]		-93.26[a]		26.21		15.03[a]		37.03[a]		14.44		7.50[a]
	---	(0.02)	---	(0.00)	---	(0.67)	---	(0.00)	---	(0.01)	---	(0.30)	---	(0.01)
Labour	-8.87[a]	3.37	8.30[a]	-5.67	-6.72[a]	-7.87[a]	9.90[b]	10.61	15.04[a]	1.25	3.50	-0.63	16.02[a]	0.81
	(0.00)	(0.39)	(0.01)	(0.17)	(0.00)	(0.00)	(0.03)	(0.13)	(0.01)	(0.75)	(0.15)	(0.85)	(0.00)	(0.89)
FDI	-3.41[a]	0.77	1.00	-1.35	-2.30[b]	-0.88[c]	-2.39	-0.16	2.65	-1.80	-0.26	-2.23[a]	1.00	-7.18[a]
	(0.00)	(0.22)	(0.35)	(0.74)	(0.03)	(0.08)	(0.16)	(0.86)	(0.11)	(0.12)	(0.80)	(0.01)	(0.37)	(0.01)
Eco_Free	37.00[a]	33.08[b]												
	(0.00)	(0.03)	---	---	---	---	---	---	---	---	---	---	---	---
Eco_Free × ICT_Infra	-2.68[a]	-42.19[b]												
	(0.00)	(0.02)	---	---	---	---	---	---	---	---	---	---	---	---
Contract_Enf			-61.15	-54.02[b]										
	---	---	(0.11)	(0.02)	---	---	---	---	---	---	---	---	---	---
Contract_Enf × ICT_Infra	---	---	-3.21[b]	-80.17[a]	---	---	---	---	---	---	---	---	---	---
			(0.05)	(0.01)										
Contract_Proc					-0.04	4.53								
	---	---	---	---	(0.96)	(0.45)	---	---	---	---	---	---	---	---
Contract_Proc × ICT_Infra	---	---	---	---	0.11[b]	-0.23[c]	---	---	---	---	---	---	---	---
					(0.02)	(0.07)								
Rule_Law							4.39	24.97[c]					---	---
	---	---	---	---	---	---	(0.49)	(0.08)	---	---	---	---		
Rule_Law × ICT_Infra	---	---	---	---	---	---	2.11[a]	18.43[a]	---	---	---	---	---	---
							(0.00)	(0.00)						
Reg_Qual									43.92	26.56[b]				
	---	---	---	---	---	---	---	---	(0.14)	(0.02)	---	---	---	---
Reg_Qual × ICT_Infra	---	---	---	---	---	---	---	---	4.90[a]	40.42[b]	---	---	---	---
									(0.01)	(0.05)				

Table 6: (Continue)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dem	---	---	---	---	---	---	---	---	---	---	1.16[c] (0.07)	31.78[a] (0.01)	---	---
Dem × ICT_Infra	---	---	---	---	---	---	---	---	---	---	46.52 (0.11)	2.96 (0.35)	---	---
Corr_Cont	---	---	---	---	---	---	---	---	---	---	---	---	9.88 (0.70)	15.97[b] (0.03)
Corr_Cont × ICT_Infra	---	---	---	---	---	---	---	---	---	---	---	---	2.42[c] (0.10)	90.73[a] (0.01)
AR(2)	0.60	0.93	0.97	0.58	0.68	0.48	0.12	0.89	0.42	0.50	0.09	0.33	0.72	0.64
Hansen	0.10	0.12	0.96	0.57	0.10	0.16	0.84	0.38	0.83	0.28	0.27	0.17	0.50	0.45

Note: Same as in Table 5
Source: Authors' computation

Table 7a: SGMM regression – manufacturing export and ICT infrastructure, including interaction terms, FDI and globalisation

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Man_Exp	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ICT_Infra1	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---
ICT_Infra2	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes
Labour	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FDI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eco_Free	Yes	Yes	---	---	---	---	---	---	---	---	---	---	---	---
Eco_Free ×ICT_Infra	-0.69 (0.15)	-7.41[c] (0.10)	---	---	---	---	---	---	---	---	---	---	---	---
Contract_Enf	---	---	Yes	Yes	---	---	---	---	---	---	---	---	---	---
Contract_Enf ×ICT_Infra	---	---	-7.58[b] (0.05)	-99.01[b] (0.04)	---	---	---	---	---	---	---	---	---	---
Contract_Proc	---	---	---	---	Yes	Yes	---	---	---	---	---	---	---	---
Contract_Proc × ICT_Infra	---	---	---	---	0.33[a] (0.01)	-10.60[c] (0.09)	---	---	---	---	---	---	---	---
Rule_Law	---	---	---	---	---	---	Yes	Yes	---	---	---	---	---	---
Rule_Law × ICT_Infra	---	---	---	---	---	---	4.34[a] (0.00)	25.16[a] (0.00)	---	---	---	---	---	---
Reg_Qual	---	---	---	---	---	---	---	---	Yes	Yes	---	---	---	---
Reg_Qual × ICT_Infra	---	---	---	---	---	---	---	---	5.75[c] (0.10)	36.39[b] (0.04)	---	---	---	---
Dem	---	---	---	---	---	---	---	---	---	---	Yes	Yes	---	---
Dem × ICT_Infra	---	---	---	---	---	---	---	---	---	---	-1.46 (0.24)	-2.41 (0.53)	---	---
Corr_Cont	---	---	---	---	---	---	---	---	---	---	---	---	Yes	Yes
Corr_Cont × ICT_Infra	---	---	---	---	---	---	---	---	---	---	---	---	5.22[b] (0.03)	29.22[a] (0.01)
Globalisation	1.66[a] (0.00)	1.30[b] (0.02)	1.79 (0.58)	-1.27 (0.17)	-0.42 (0.56)	12.46[c] (0.10)	-0.92 (0.47)	-1.39 (0.23)	-0.69 (0.64)	0.14 (0.87)	0.68 (0.18)	0.79 (0.14)	2.14[b] (0.05)	0.57 (0.47)

Table 7: (Continue)

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
AR(2)	0.89	0.68	0.83	0.97	0.13	0.57	0.54	0.59	0.52	0.52	0.10	0.13	0.66	0.67
Hansen	0.51	0.50	0.99	1.00	1.00	1.00	0.97	0.82	0.93	0.25	0.87	0.13	0.75	0.59

Note: Same as in Table 5. 'Yes' implies that the respective variables were included in the specific estimation. However, only the variables of interest were reported in the Table.

Source: Authors' computation

Table 7b: SGMM regression – manufacturing export and ICT infrastructure, including interaction terms, FDI and dummy for oil producing countries

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Man_Exp	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ICT_Infra1	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---
ICT_Infra2	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes	---	Yes
Labour	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FDI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eco_Free	Yes	Yes	---	---	---	---	---	---	---	---	---	---	---	---
Eco_Free × ICT_Infra	-3.08[c] (0.08)	-44.81[b] (0.04)	---	---	---	---	---	---	---	---	---	---	---	---
Contract_Enf	---	---	Yes	Yes	---	---	---	---	---	---	---	---	---	---
Contract_Enf × ICT_Infra	---	---	-4.40[c] (0.06)	-15.34[a] (0.00)	---	---	---	---	---	---	---	---	---	---
Contract_Proc	---	---	---	---	Yes	Yes	---	---	---	---	---	---	---	---
Contract_Proc ×ICT_Infra	---	---	---	---	-0.08[a] (0.00)	-4.59[c] (0.10)	---	---	---	---	---	---	---	---
Rule_Law	---	---	---	---	---	---	Yes	Yes	---	---	---	---	---	---
Rule_Law × ICT_Infra	---	---	---	---	---	---	3.67[a] (0.01)	4.17[c] (0.09)	---	---	---	---	---	---
Reg_Qual	---	---	---	---	---	---	---	---	Yes	Yes	---	---	---	---
Reg_Qual × ICT_Infra	---	---	---	---	---	---	---	---	4.78[b] (0.04)	60.60[b] (0.03)	---	---	---	---
Dem	---	---	---	---	---	---	---	---	---	---	Yes	Yes	---	---
Dem × ICT_Infra	---	---	---	---	---	---	---	---	---	---	1.38 (0.15)	-3.19 (0.27)	---	---
Corr_Cont	---	---	---	---	---	---	---	---	---	---	---	---	Yes	Yes
Corr_Cont × ICT_Infra	---	---	---	---	---	---	---	---	---	---	---	---	4.30[a] (0.01)	32.52[c] (0.10)
Resources	6.67 (0.82)	-40.52[c] (0.09)	39.20[c] (0.10)	-22.43 (0.19)	-33.51[b] (0.04)	-33.82[a] (0.01)	-1.21 (0.97)	-7.13 (0.61)	-1.25 (0.96)	-5.62 (0.61)	-44.58[c] (0.09)	-10.24 (0.46)	-40.76[b] (0.04)	-26.23 (0.12)
AR(2)	0.78	0.04	0.15	0.51	0.10	0.80	0.87	0.74	0.43	0.73	0.34	0.57	0.95	0.17
Hansen	0.13	0.11	0.67	0.99	0.60	1.00	0.98	0.87	0.87	0.18	0.71	0.10	1.00	0.78

Note: Same as in Table 7a
Source: Authors' computation

6. Conclusion

This study presents new insights on the discourse between manufacturing exports and infrastructure (focusing on Information Communication Technology-ICT) by elaborating on the possible role that economic and political institutions can play in such a relationship. It provides empirical analysis for the period between 2002 and 2014 using 14 countries in West African sub-region that are also members of the Economic Community of West African States (ECOWAS). Estimating the formulated model using System GMM, several important findings emerged, some of which are highlighted herein. It was established that an increase in the ICT infrastructure in West Africa holds the possibility of improving the volume of manufacturing export, which implicates that, on the average; the exporting capacity of the manufacturing sector in West Africa can be enhanced by improving the level of ICT infrastructure in the sub-region. This is of essence, as improvements in ICT infrastructure can enhance the manufacturing export of ECOWAS countries through the provision of enhanced access that will create better linkage to the global economy.

The results from the analyses equally show that indicators of economic and political institutions exhibit some multiplicative influence on the *nexus* between ICT Infrastructure and manufacturing exports. It was observed that in the face of improved economic and political institutions, particularly those that are related to enforcement of contracts, the influence of ICT infrastructure on manufacturing export would be increased significantly. Thus, the main policy implication of these findings is that the Economic Community of West African States (ECOWAS) as a recognised Regional Economic Communities (RECs) in Africa, is capable of playing a supportive role in the desired enhancement of trade performance, particular the economic development of member states. One of such roles should be the tasking of member countries concerning promoting their institutional quality such as better transparency, accountability and resolution to fighting corruption with all dexterity. Countries in the ECOWAS sub-region have made efforts to ensure that they improve their ICT infrastructural provisions for enhanced impact on trade and the development of efficient institutions.

Other policy recommendations could include the use of formidable regulations, anchoring and adherence to the tenets of the rule of law. This would reduce both transaction cost and time significantly. The role of the ECOWAS Commission in pursuing the realisation of this recommendation cannot be underplayed. This is because the Commission can help to propel and galvanise the involvement as well as the political will of Heads of States and Government, Council of Ministers, and the Parliament and other relevant organs of the governments in the sub-region on the need to work towards this common goal. This will also help in pursuing and overcoming the *age-long*

monster of corruption by ensuring the rule of law on economic and political issues in the ECOWAS member countries.

This study did not take into consideration the issue of ICT infrastructure and manufacturing exports in the light of sectoral analysis, which can be taken up in future studies. A sectoral analysis would have provided more in-depth insight into how ICT affects the productivity of different sectors in the economy. This can be addressed in future studies to provide a clearer understanding of the discourse on manufacturing export, ICT infrastructure and institutions.

References

Alberto, B., Margarita B., & Fernando, L. (2013). Perceived performance effects of ICT in manufacturing SMEs. *Industrial Management and Data Systems*, *113*(1), 117 – 135. https://doi.org/10.1108/02635571311289700.

Aloini, D., & Martini, A. (2012). How Firms Deal with Discontinuous Innovation: An Empirical Analysis. In Ekekwe, N., & Islam, N, (Eds.), *Disruptive Technologies, Innovation and Global Redesign: Emerging Implications* (pp. 128-146). IGI Global doi:10.4018/978-1-4666-0134-5.ch008

Andrés, A. R., Amavilah, V., & Asongu, S. (2017). Linkages between Formal Institutions, ICT Adoption, and inclusive human development in sub-Saharan Africa. In *Catalyzing Development through ICT Adoption* (pp. 175-203). In: Kaur H., Lechman E., Marszk A. (eds) *Catalyzing development through ICT adoption*. Springer, Cham. https://doi.org/10.1007/978-3-319-56523-1_10

Asiedu, E. (2006). Foreign direct investment in Africa: The role of natural resources, market size, government policy, institutions and political stability. *World Economy*, *29*(1), 63-72. https://doi.org/10.1111/j.1467-9701.2006.00758.x.

Asiedu, E., & Lien, D. (2011). Democracy, foreign direct investment and natural resources. *Journal of International Economics*, *84*, 99-111. https://doi.org/10.1016/j.jinteco.2010.12.001

Asongu, S. (2014). On taxation, political accountability and foreign aid: Empirics to a celebrated literature. *South African Journal of Economics*, *83*(2), 180 – 198. https://doi.org/10.1111/saje.12064

Asongu, S., & Biekpe, N. (2017). Government quality determinants of ICT adoption in Sub-Saharan Africa. *African Governance Development Institution (AGDI) Working Paper*, WP/17/024.

Bandyopadhyay, S., Sandler, T., & Younas, J. (2011). Foreign Direct Investment, Aid, and Terrorism: An Analysis of Developing

Countries. Federal Reserve Bank of St. Louis Working Paper No. 2011-004A https://doi.org/10.1093/oep/gpt026

Bankole, F, O., Osei-Bryson, K., & Brown, I. (2015). The impact of information and communications technology infrastructure and complementary factors on intra-African trade, *Information Technology for Development, 31*(1), 12-28. https://doi.org/10.1080/02681102.2013.832128

Baunsgaard, T., & Keen, M. (2010). Tax revenue and (or?) trade liberalization. *Journal of Public Economics*, *94*(9-10), 563-577. https://doi.org/10.1016/j.jpubeco.2009.11.007

Beck, T., Demirguc-Kunt, A., & Levine, R. (2003). Law, endowments, and finance. *Journal of Financial Economic*. 70, 137–81. https://doi.org/10.1016/S0304-405X(03)00144-2

Bergh, A., & Nilsson, T. (2014). Is globalization decreasing absolute poverty? *World Development*, 62, 42-61. https://doi.org/10.1016/j.worlddev.2014.04.007

Besley, T., & Case, A. (2003). Political institutions and policy choices: Evidence from the United States. *Journal of Economic Literature*. *41*(1), 7-73. http://hdl.handle.net/10419/71518

Blundell, R., & Bond. S. (2000). GMM estimation with persistent panel data: An application to production functions. *Econometric Reviews*,*19*(3),321-340 http://dx.doi.org/10.1920/wp.ifs.1999.9904

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143. https://doi.org/10.1016/S0304-4076(98)00009-8

Cavalcanti, T., Magalhaes, A. M., & Tavares, J. (2008). Institutions and economic development in Brazil. *The Quarterly Review of Economics and Finance*. 48, 412-432. https://doi.org/10.1016/j.qref.2006.12.019

Deen-Swarray, M., Adekunle, B., & Odularu, G. (2012). Infrastructure development and intra-regional trade: The case of ECOWAS, *Journal of West African Integration, 1* (1), 161-186.

Djankov, S., Freund, C., & Pham, C. S. (2010). Trading on time. *The Review of Economics and Statistics*, 92(1), 166-172. https://doi.org/10.1162/rest.2009.11498

Dollar, D., & Kraay, A. (2002). Growth is good for the poor. *Journal of Economic Growth*. *7*(3),195-225. doi:10.1023/a:1020139631000

ECOWAS Supplementary Act A/SA.1/01/07 on the Harmonisation of Policies and the Regulatory Framework for the Information and Communication Technology (ICT) Sector 2007, adopted on the Thirty-First Session of the Authority of Heads of State and Government, Ouagadougou, 19th January 2007.

Efobi, U. (2015). Politicians' attributes and institutional quality in Africa: A focus on corruption. *Journal of Economic Issues*, *49*(3), 787-813. https://doi.org/10.1080/00213624.2015.1072393

Efobi, U., & Osabuohien, E. (2016). Manufacturing exports, infrastructure and institutions in Africa: Reflections from ECOWAS. In Seck. D (Ed.) *In accelerated economic growth in West Africa* (pp. 157-179). Geneva: Springer International Publishing. 10.1007/978-3-319-16826-5_8

Efobi, U. R., & Osabuohien, E. (2015). Technological utilisation in Africa: How do institutions matter? In Majumdar, S., Guha, S., and Marakkath, N., (Eds.), Technology and innovation for social change, 67-84 India: Springer. DOI: 10.1007/978-81-322-2071-8_5.

Ejemeyovwi, J. O., Osabuohien, E. S., & Osabohien, R. (2018). ICT investments, human capital development and institutions in ECOWAS. *International Journal of Economics and Business Research*, *15*(4), 463-474. https://doi.org/10.1504/IJEBR.2018.092151

Jo-Ansie, V. W. (2007). Political leaders in Africa: presidents, patrons and profiteers? African Centre for the Constructive Resolution of Disputes (ACCORD), Occasional Paper Series, 2(1) 2007. https://hdl.handle.net/10520/AJA16083954_4.

Karakara, A. A., & Osabuohien, E. (2019). Households' ICT access and bank patronage in West Africa: Empirical insights from Burkina Faso and Ghana. *Technology in Society*, *56*, 116-125. https://doi.org/10.1016/j.techsoc.2018.09.010

Kiessling, J. (2007). Institutions and ICT technology adoption. Department of Economics. Sweden: Stockholm University. http://www2.ne.su.se/paper/wp06_07.pdf

La Porta, R., Florencio, L.S., Andrei, S., & Robert, W. V. (1999). The quality of government. *Journal of Law, Economic and Organization. 15*, 222–79. https://doi.org/10.1093/jleo/15.1.222

La Porta, R., Lopez, F., & Shleifer, A. (2008). The economic consequences of legal origins. *Journal of Economic Literature*, 4(2), 285 - 332. DOI:10.3386/w13608

Limao, N., & Venables, A. (2001). Infrastructure, geographical disadvantage, transport cost and trade. *World Bank Economic Review, 15* (3), 451-479. https://doi.org/10.1093/wber/15.3.451

Longo, R., & Sekkat, K. (2001). Obstacle to expanding intra-African trade. OECD Development Centre, *Technical Papers* No. 169. https://doi.org/10.1787/18151949

Mantzavinos, C., North, D. C., & Shariq, S. (2004). Learning, institutions, and economic performance. *Perspectives on politics*, *2*(1), 75-84. https://doi.org/10.1017/S1537592704000635

Mbekeani, K. (2010). Infrastructure, trade expansion and regional integration: Global experience and lessons for Africa. *Journal of African Economies*, *19*(1), 88-113. https://doi.org/10.1093/jae/ejp021

Meon, P., & Sekkat, K. (2008). Institutional quality and trade: Which institutions? Which trade? *Economic Inquiry*, *46*(2), 227-240. https://doi.org/10.1111/j.1465-7295.2007.00064.x

North, D. C., (1991). Institutions. *Journal of Economic Perspectives*, *5*(1), 97-112. doi:10.1257/jep.5.1.97

Olayinka, I. K., (2018), The impact of common external tariffs on household's welfare in a rich African country with poor people. *Advances in Economics and Business*, *6*(2): 114-124. 10.13189/aeb.2018.060204

Olayiwola, K. W, Osabuohien, E. S., Okodua, H., & Ola-David, O. (2015). Economic integration, trade facilitation and agricultural exports performance in ECOWAS Sub-Region. In M. Ncube, I. Faye & A. Verdier-Chouchane (Eds.), *Regional Integration and Trade in Africa* (pp.31-46). New York: Palgrave Macmillan.

Oluwatobi, S., Efobi, U., Olurinola, I., & Alege, P. (2015). Innovation in Africa: Why institutions matter. *South African Journal of Economics*, *83*(3), 390-410. https://doi.org/10.1111/saje.12071

Onu, C. A., Olabode, I. O., & Fakunmoju, S. K. (2014). Effect of information technology on SMEs productivity and growth. *European Journal of Humanities and Social Sciences*, *32*(1): 1718-1737.
https://pdfs.semanticscholar.org/424d/5397ca3770a739aa47ad937d4f22bfdfb093.pdf

Osabuohien, E., & Efobi, U. (2011). Trade outcomes in Africa's regional economic communities and institutional quality: Some policy prescriptions. *Petroleum-Gas University of Ploiesti Economic Sciences Series*, *LXIII*(4), 19-32. https://ssrn.com/abstract=2388426

Osabuohien, E. S., & Efobi, U. (2012) Technological diffusion and economic progress in Africa: Challenges and opportunities. In N. Ekekwe and N. Islam (eds.) *Disruptive technologies innovation and global redesign: Emerging implications* (pp. 425-440). New York: IGI-Global. doi:10.4018/978-1-4666-0134-5.ch024.

Osabuohien, E. S., & Efobi, U. R (2013). Africa's money in Africa. *South African Journal of Economics*, *81*(2), 292-306. https://doi.org/10.1111/saje.12012

Osabuohien, E., Efobi, U., Odebiyi, J, Fayomi, O., & Salami, A. (2019). Bilateral trade performance in West Africa: A gravity model estimation. *African Development Review*, 3 (1), 1-14. Doi: 10.1111/1467-8268.12359

Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, 71, 135-58. https://doi.org/10.1111/j.1468-0084.2008.00542.x

Subramanian, A., & Tamirisa, N. (2003). Is Africa integrated in the global economy? *IMF Staff Papers, 50*(3), 352–372. https://www.jstor.org/stable/4149937

United Nations Conference on Trade and Development-UNCTAD (2012). *Trade and Development Report, 1981-2011*, New York: United Nations.

United Nations Conference on Trade and Development-UNCTAD (2014). A framework for information and communications technology policy reviews: Helping countries leverage ICT for development. New York and Geneva: United Nations. https://unctad.org/en/PublicationsLibrary/dtlstict2013d6_en.pdf.

United Nations Economic Commission for Africa-UNECA (2011), *Seventh Session of the Committee on Trade, Regional Cooperation and Integration.* Addis Ababa: UNECA.

World Bank (2017). *World Development Indicators.* Available online at http://data.worldbank.org/data-catalog/world-development-indicators HYPERLINK "http://data.worldbank.org/data-catalog/world-development-indicators". (Accessed March 2017).

Yang, Y., & Gupta, S. (2007). Regional trade arrangements in Africa: Past performance and the way forward. *African Development Review*. *19*(3), 399-431. https://doi.org/10.1111/j.1467-8268.2007.00169.x

Yushi, J., & Borojo, D. G. (2019). The impacts of institutional quality and infrastructure on overall and intra-Africa trade. *Economics e-Journal*. No. 2019-10. http://dx.doi.org/10.5018/economics-ejournal.ja.2019-10