

Effect of economic integration and trade facilitation on Intra-manufacturing export among ECOWAS member states

Olure-Bank Adeyinka^{1*}; Mustapha Muktar²; Ayodeji Salihu³; Fadila Kabir Usman⁴

^{1), 3), 4)} Department of Economics, Faculty of Social Sciences, Nigeria Defence Academy, Kaduna, Nigeria

²⁾ Department of Economics, Faculty of Social Sciences, Bayero University Kano, Nigeria

**To whom correspondence should be addressed: adeyinka67@gmail.com*

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Abstract

Institutional trade tariffs and non-tariff barriers are major constraints to exporters and importers. It affects many developing countries' trade flows and intra-trade performance, including ECOWAS member states. From the classical economic background, the economic problems of international macroeconomics can be examined from the position of trade costs. It further states that low trade facilitation policies such as high tariffs and non-tariff barriers alone can account for a 10% loss in a national income. From these backgrounds, the study assesses the interrelation of economic integration and trade facilitation in ECOWAS and how the member states have performed in intra-manufacturing export. Using the general method of moments (GMM) with instrumental variable (IV) estimation on a dynamic model with panel data from 15 members to analyse how regional economic integration and trade facilitation relationship promote intra-regional manufacturing exports. The findings reveal that trade facilitation in ECOWAS member states is below the world average. Due to high bureaucratic processes, thus, are high costs of exporting/importing. Again, the econometric analyses reveal economic integration significantly promotes trade facilitation in member states and can influence intra-manufacturing exports in ECOWAS. At the same time, manufacturing production has a direct and significant role in manufacturing exports. Some policy recommendations that would help facilitate trade and improve manufacturing production and intra exports in the ECOWAS sub-region were made.

Keywords: *Economic integration, Gravity model, Trade facilitation, Trade flows*

JEL classification: C23, F10, F43, O47, O55

INTRODUCTION

Exporting primary products represent about 80% of the total exports of many African countries, including ECOWAS member states. The fall in long-term prices, the decline of the terms of trade, and the instability of the commodity market are the main constraints to growth and poverty reduction for African countries (Sakyi et al., 2018).

Commodity exports are affected by fluctuations in prices and demand in the short term and the fall in terms of trade in the medium and long term. Commodities are also

often characterised by fierce price competition, whereby productivity gains are generally passed on to consumers rather than benefiting producers.

Contrary to the fragility of the commodity-dependent African economies, the manufacturing activities in developed countries that derive resources from commodity imports enjoy many static and dynamic economies of scale, generating higher revenue for countries that export manufactured goods. Africa's overdependence on exports of lower value-added commodities has caused its production intensity to decline and increase its poverty rate, putting enormous pressure on the households and government budgets.

Again, trade between ECOWAS countries has been relatively stagnant over time due to the homogeneity of export products, which are basically primary products; 11.5%, 12.8%, 10.1%, 12.5% and 12.9% in 2002, 2007, 2012, 2017 respectively with high decrease for 2020 due to COVID 19. Over-reliance on exports of similar commodities and the weak processing capacity of ECOWAS countries prevailed, making North America's and Europe's favorite trade partners and reduced intra trade in the region, even with its economic integrations.

The ECOWAS region is not only a net importer due to its weak supply response, importing highly dynamic products (higher-priced manufactured products), results into trade losses and fluctuations in growth. ECOWAS member states exports to the Europe union stood at 34.3%, 35.7%, 23.2%, 27.2% and 26.9% in 2002, 2007, 2012, 2017 respectively and decline in 2020 due to COVID 19, its imports were 55.1%, 46.6%, 49.8%, 42.0%, 36.4% and 37.2% in 2002, 2007, 2012, 2017 respectively and increase marginally in 2020 due to import of COVID 19 vaccine (ECOWAS Trade Data and World Trade Indicators). The transfer of productivity gains caused by the weak production capacity in Africa has made African economies vulnerable to changes in demand and has become a victim of world trade. (Africa trade initiative 2019).

The problem of trade cost takes a crucial position in economic development. It decides relative prices, consequently determining production and trade patterns. Trade costs include transportation, trade policies, information, government procedures, contract enforcement, and marketing costs for all the resources needed to transport products from one place to another (Anderson & Van Wincoop, 2004).

Obstfeld & Rogoff (2001) state that the economic problems of international macroeconomics can be examined from the position of trade costs. Olayiwola *et al.*, 2015 state that the cost of trade in the national economy determines the distribution of surplus and the cost of adjusting policies and shocks between regions and country. However, international trade costs have received less empirical attention in determining its impact on Africa and sub-regional integration.

The previous literature mainly assumed that trade frictions within countries are negligible in the absence of other policy tools such as trade barriers and exchange rates that hinder the flow of goods and services between countries (Agnosteva *et al.*, 2019). Until recently, studies have increasingly shown that even in advanced economies such as China, Canada, and the United States intra-country trade costs can be high (Olayiwola *et al.*, 2015; Agnosteva *et al.*, 2019). Of note is that the distribution of trade costs within a country affects the trajectory of regional development, thus, reducing the incentive for countries to implement regional commitments (Olayiwola *et al.*, 2015).

Given the unsatisfactory performance of the ECOWAS member states' regional economic integration (REI) in promoting intra-manufacturing regional trade to date, questions such as "what is the effect of REI and trade facilitation on intra-manufacturing regional trade is a contested issue. From this background, this study

main objective is to examine the effects of economic integration and trade facilitation on intra-manufactured export performance among ECOWAS member states.

The following questions are put forward to achieve the study's objectives: What are the effects of regional economic integration and trade facilitation on intra manufacturing export performance among ECOWAS member states? And Can the relationship between REI and trade facilitation increase intra manufacturing export performance among ECOWAS member states?

Therefore, the study will be of great significance to the following groups of people; Policymakers assess how the integration process in West Africa affects their respective economies and what measures can be taken to accelerate this process. Scholars and researchers who work on similar research topics will find the literature of this study crucial to the progress of their research field. Current and potential investors will use the results of this study to evaluate potential investment opportunities and how favourable is the investment environment in the ECOWAS region. The West-African Parliament, the ECOWAS Secretariat, and other stakeholders will find the study helps to guide the establishment of support and empowerment for legislative tasks on trade facilitation.

Following the introductory section, is section 2. Literature review on the concepts, theories, and empirical reviews. Section 3: reveals the study methodology and statistics. Section 4: Present the analysis of result, interpretation of the results, and the discussion of the result. Section 5: Summarise the study, conclusions, and recommendations

LITERATURE REVIEW

Regional Economic Integration (REI)

Regional economic integration is the process that leads to no discrimination between national economies. It is an agreement among countries in a geographic region to reduce, and ultimately remove, tariff and non-tariff barriers for the free flow of goods and services between each other. Regional integration is a tool for driving the growth and increasing the well-being of any county, helping create regional value chains that increase economic efficiency (Sakyi et al., 2018).

There are different methods and approaches to regional integration, trade has traditionally been the major objective of regional integration and the major driving factor. The objectives of regional economic integration are; to increase in well-being of any county and reduce the economic inequalities of integrating countries by the creation of a larger market, fostering competition, and enabling economies of scale, regional economic integration increases innovation, reduces inputs and consumer prices, helps specialization of economies and motivate the development of regional production activities.

For developing and least developed countries, regional economic integration is the major driver of poverty reduction, social equality, and economic divergence through trade and investment cooperation. Again, regional economic integration is the major driver of intraregional trade, thus, increasing employment activities and redistribution of benefits for growth and country prosperity. Increased regional economic integration leads to economic performance and fewer economic inequalities (Olayiwola et al., 2015).

Trade facilitation

Trade facilitation has become a substantive item within WTO trade round negotiations. It is frequently referred to in supply chain security initiatives and is a

feature within many customs modernisation programs. Trade facilitation is also significant within wider aid-for-trade and capacity-building initiatives (WTO 1998).

Trade facilitation is largely used by institutions that seek to improve the regulatory interface between government bodies and traders at national borders. The WTO definition: ‘The simplification and harmonization of international trade procedures’ where trade procedures are the ‘activities, practices and formalities involved in collecting, presenting, communicating and processing data required for the movement of goods in international trade’ (WTO 1998).

The fundamentals of trade facilitation are transparency, simplification, coordination, and standardization (National Board of Trade, Sweden (2017)

- a) Transparency with inside authorities increase the openness and accountability of government and administrative actions. It involves disclosing information so that the public can easily access and use the information. This information includes; general applicable laws, regulations and administrative decisions, budgets, procurement, and meetings. Where possible, regulatory information should be released and disseminated before implementation so that stakeholders can notice and make necessary changes. In addition, relevant stakeholders and the public should be invited to participate in the legislative process and express their opinions on the proposed law before the legislation.
- b) Simplification removes all unnecessary elements and repetitions in trade procedures, processes, etc. It should be based on an analysis of the status quo of "As-Is" situation.
- c) Harmonization is the unification of national procedures, operations, and documents with international conventions, standards, and practices. It can come from adopting and implementing the same standards as REI member countries, as part of a regional integration process, or the result of trade decisions.
- d) Standardization is formulating internationally recognized practices and procedures, documents, and information formats for all parties. Then use standards to adjust and ultimately harmonize practices and methods. In order to realize these principles, full cooperation between government authorities and the private sector community is imperative.

The supply chain

Activities promoted and carried out under the general heading of trade facilitation tend to focus on customs administration. Although customs are a key player in trade facilitation, it is not enough to focus solely on these institutions and their processes. Trade facilitation should cover the entire trade environment, participants, and processes involved in the transaction. The international supply chain point of view should be taken. The supply chain includes all the activities necessary to produce goods and deliver them to final consumers. These activities include purchasing raw materials, preparing transportation, applying for import licenses, preparing customs clearance documents, customs clearance, payment, and delivery to consumers. The supply chain involves the seller and the buyer, at least two parties. The supply chain involves many different aspects. They can be private sector traders, transport operators, service intermediaries, or public sector regulators. From the supply chain perspective, you can see and understand all possible processes and interconnections. It provides a framework for logically connecting different participants, procedures, and requirements in the trading environment picture. By emphasizing dependencies, it is obvious that improvements have been made along the chain, but changes in one area can easily be offset by stagnation in other areas.

There are many variations in the supply chain. Therefore, from the supply chain perspective, a theoretical model needs to simplify its complexity and be used as a reference model.

The Buy, Ship and Pay (BSP) model developed by UN/CEFACT is an example of this model. It represents the supply chain as a series of trading processes that can be grouped into top-level domains for purchasing, shipping, and payment.

The supply chain barriers model of economic regional integration focus on removing or reducing tariffs with third countries or regions. However, the key gains of regional economic integration are; increased well-being of member states and the creation of a larger market that can be achieved when trade barriers are reduced. It leads to increased market access and helps the gains of economic integration, meaning that improving intraregional trade is important to remove supply chain barriers, which are more significant impediments to trade than import tariffs.

The World Economic Forum lists four main types of supply chain barriers which are:

- i. Lack of transport infrastructure is the inadequate and good road network, rail, sea, and air transportation networks that increase the costs and impediments massively to moving goods and persons across borders.
- ii. Non-tariff measures are safety and sanitary requirements, technical standards, and goods additional regulations that increase importing or exporting compliance costs.
- iii. Border administrations are inefficient border control and burdensome or non-transparent import or export procedures.
- iv. Business environments are discriminated against, unstable regulatory environment, physical security issues along the way supply chain.

Figure 1 reveals supply value chains cost, making it imperative for policymakers to understand trade facilitation as a tool for all countries to break supply value chain barriers by incorporating policies aimed at facilitating trade into their long-term development agenda. Making the promotion of trade facilitation measures a key imperative for the 2013 World Trade Organization (WTO) trade facilitation agreement that will speed up the clearance and movement of goods across borders globally. Trade facilitation involves all arrangements to increase border and transport efficiency and reduce transaction costs relating to trade flows.

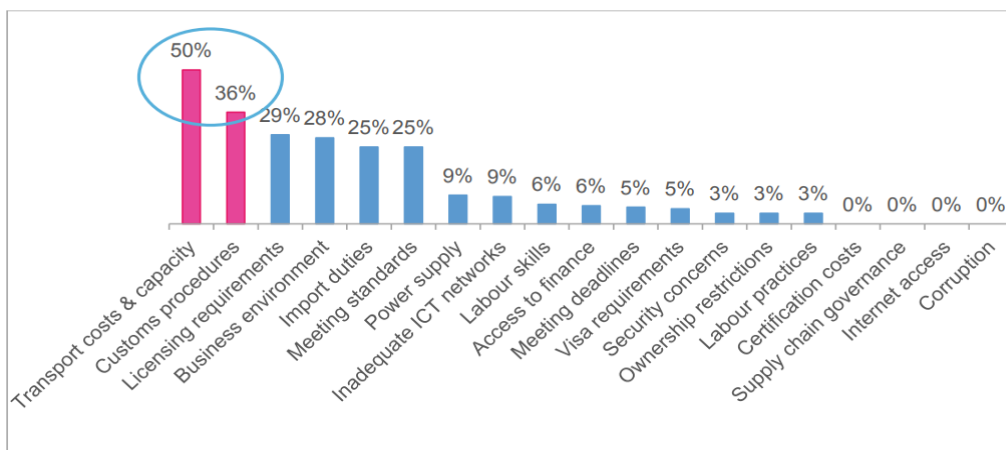


Figure 1. The main barriers in Supply value chains
 Source: OECD/WTO Aid for Trade Questionnaire 2018.

The trading environments are complex, which provides a broad space for trade facilitation. It is easy to calculate 60 or more different exchange procedures (Grainger 2007a) for goods and services, vehicles that transport goods (ships, planes, and trucks),

or their operators (drivers, seafarers, and crew). Control objects include income collection, protection and safety, environment and health; consumer protection; and trade policy. In most countries, an important part of these controls will be carried out by the customs or under customs supervision.

Table 1: International trade related regulatory activity

Regulatory measures	Activity
Revenue Collection	Collection of Customs duties, excise duties, and other indirect taxes; payment of duties and fees; management of bonds and other financial securities
Safety and Security	Security and anti-smuggling controls; dangerous goods; vehicle checks; immigration and visa formalities; export licenses
Environment and Health	Phytosanitary, veterinary and hygiene controls; health and safety measures; CITES controls; ships' waste
Consumer Protection	Product testing; labelling; conformity checks with marketing standards (e.g., fruit and vegetables)
Trade Policy	Administration of quota restrictions; refunds; suspensive regimes

Source: Grainger 2007

Commercial arrangements inside global trade aren't any much less complex. The global movement of products consists of several operational steps before export, including packaging, storage, transport, port entry, customs procedure, and loading to ships. Once arrived within the destination port, operations consist of off-loading, storage, launch from the port and customs clearance, transport to the client, unpacking, after-income services (assembly, warranties, and guarantees), etc. Depending on the buying and selling phrases among client and seller, contractual obligations for the operations can lie with one of the opposite party, or it could be cut up everywhere alongside the manner relying on the Incoterms used (ICC 1999)

Theoretical framework

The “gravity equation,” according to Narayan & Nguyen (2016), has been employed as the econometric estimation of the ex-post partial (or direct) impacts of economic integration agreements, national borders, currency unions, language, and other measures of trade costs on bilateral international trade flow. In specifying the equation, two major variables explaining bilateral trade flow between trade partners are usually considered: the economic strength of a country (variable GDP) and geographical proximity (variable distance). From the theoretical and empirical literature reviews for this study, the following conceptual framework is used for the study.

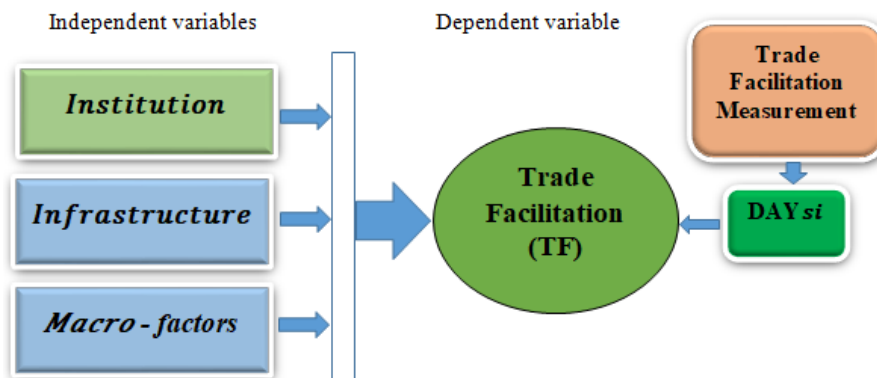


Figure 1. The conceptual framework or model of the study

Empirical measure of trade facilitation and economic integration.

This work does not intend to prove any of the previous propositions. Still, it has the objective of examining the interrelationship between regional economic integration and trade facilitation on the performance of manufacturing exports in West Africa.

Safaeimanesh & Jenkins (2021) estimate the potential annual economic gain from trade facilitation by the Economic Community of West African States (ECOWAS). A partial equilibrium welfare economics framework employs sets of export supply and import demand elasticities for each country derived using a general equilibrium estimation method of the gravity model.

The annual economic welfare gains resulting from the reduction of high trade compliance costs for the region are estimated to be between US\$1.6 billion to US\$2.7 billion (2019 prices). This is between 0.24% and 0.42% of the combined GDPs of these countries. The welfare gain is between 6% and 10% of the combined governments' budgets assigned for education and is between 33% and 58% of their budgets allocated for health. In the absence of reform, these inefficient practices waste equal between 15% and 26% of the annual net official development assistance these countries receive. The finding implies that the implementation strategies of reforms do not look at countries specific development of the political economy of trade facilitation reform.

In another study, Akinlo & Okunlola (2021) look at Sub-Saharan Africa's trade openness, institutions, and economic growth. The research investigates the interactive effect of trade openness and institutional quality on economic growth in sub-Sahara Africa. The sample consists of 38 sub-Saharan African countries and covers 1986 to 2015. Pooled OLS, fixed effect, and dynamic GMM were used as estimation techniques. The study found that corruption, government stability, law and order, and bureaucratic quality as institutional quality variables harm trade and economic growth. The interaction of trade openness and institutional quality variables positively impacted economic growth. This finding implies that policymakers must pay attention to institutional quality and trade openness in the region. The policymakers must introduce policies that simultaneously target institutional quality development and enhance trade openness.

Despite many studies on trade facilitation and economic integration in West Africa, few econometric methods quantify the effect of trade facilitation and economic integration on trade flows among the ECOWAS member states. However, Safaeimanesh & Jenkins (2021), Osabuohien et al. (2019), and Olayiwola et al. (2015) used econometric methods to quantify the effect of trade facilitation on trade flows in Africa. Specifically, Olayiwola et al. (2015) use the system general method of moments (GMM) with instrumental variable (IV) estimation on a dynamic model of panel data from 15 ECOWAS member states to analyze how trade facilitation and regional economic integration affected intra-regional agricultural exports, trade facilitation is proxy by the required processing days and documents, found that a 1% decline in the number of days to process the export of agriculture commodities correlated with an expansion of approximately 0.07% of agricultural exports. They state that Trade facilitation measures would decrease border and documentary compliance time and costs of international trade administration. Regional economic integration and trade facilitation are comprehensive, integrated approaches to reducing the complexity and cost of the trade transactions process, thereby enhancing the trade flow efficiency, transparency, and predictability of international trade.

The major fallout from the extant studies reviewed is that the issue of trade facilitation and economic integration has not been related to manufacturing export

performance with a focus on ECOWAS members. This study stands to address the fallout. However, the study will be limited to the potential impact of economic regional integration and trade facilitation on intra-manufacturing export performance, specifically the intra-trade improvement through border and transport efficiency, the number of documents required to export, cost to export, time to export, cost to import, time to import, and the distance to frontier. According to the World Bank Doing Business reports, the major reason for these trade facilitation variables is that ECOWAS member countries have one of the highest bureaucracies and custom procedures. These shortcomings have somehow contributed to the knowledge gap in the literature, thus warranting a study on the effect of economic integration and trade facilitation: the case for intra-manufacturing export performance in West Africa

METHODS

Model specification

As specified by Olayiwola et al. (2015) and modified experimental research baseline model for analysis of country *i*'s trade facilitation (TF, proxied by the days required to process imports or exports) – as a function of political institutions, infrastructure services, and general economic conditions – can be specified as:

$$TF = day_{si} = f(Institution, Infrastructure, Macro) \dots\dots\dots(1)$$

Where:

- TF = Trade Facilitation proxied by one of the key indicators – number of days taken to process exports (xdays) or imports (mdays) by country *i*.
- Institution = Political institutional factors proxied by the rule of law index and control of corruption index. Data on political institutions will be sourced from the World Governance Indicators (WGI).
- Infrastructure services = Service infrastructure measured by number of internet users per 100 inhabitants and telephone lines (fixed + mobile) per 100 inhabitants. Data on Service infrastructure will be sourced from the World Development Indicators (WDI), including electricity production/consumption as one of the infrastructure indicators.
- Macro = Macroeconomic factors measured by Per capita Real Gross Domestic Products (PCRGDP). Data on macroeconomic factors will be sourced from the World Development Indicators (WDI).

In more explicit form, equation (1) in its static form is decomposed into the number of days taken to process exports or imports equations and may be re-written as follows:

$$xdays_{it} = \delta_0 + \delta_1 institution_{it} + \delta_2 infrastructure_{it} + \delta_3 macro_{it} + \epsilon \dots\dots\dots (2)$$

$$mdays_{it} = \beta_0 + \beta_1 institution_{it} + \beta_2 infrastructure_{it} + \beta_3 macro_{it} + \epsilon \dots\dots\dots(3)$$

Where:

- $xdays_{it}$ = days to process exports of country *i* to country *t*;
- $mdays_{it}$ = days to process imports of country *i* from country *t*; and
- ϵ and ϵ are error terms assumed to be.

On a priori ground, we expect: that $\delta_j < 0$ and $\beta_k < 0$. (where j, k=1,2,3), i.e., processing days go down with better political institutions, infrastructure services, and economic conditions.

Other variables are as previously defined. Dynamically this becomes

$$xdays_{it} = \delta_0 + \delta_1 xdays_{i,t-1} + \delta_2 institution_{it} + \delta_3 infrastructure_{it} + \delta_4 macro_{it} + \epsilon \dots (4)$$

$$mdays_{it} = \beta_0 + \beta_1 mdays_{i,t-1} + \beta_2 institution_{it} + \beta_3 infrastructure_{it} + \beta_4 macro_{it} + \epsilon \dots (5)$$

It is also expected, following theoretical relationships: $\delta_j < 0$ and $\beta_k < 0$. (where j, k =1,2,3,4), i.e., that processing days also go down with higher processing days in the previous period.

The baseline model for analysis of manufacturing exports (measured as a percentage of a country's GDP¹) is a function of the country's manufacturing production, political institutions, infrastructure services, regional integration, and trade facilitation (xdays) can be specified as:

$$manex = f (integration, institution, infrastructure, TF, manpdt) \dots (6)$$

Where:

- manex = manufacturing export and measured as a percentage of country i GDP
- Integration = trade integration variable and is proxy as an intra-regional export share of the country I
- institutions = political institution variable and is proxied by the regulatory quality (RQ) indicator for the country I
- TF = trade facilitation variable which is proxied here by the number of days taken to process exports (xdays).

This is because the emphasis is on the influence of trade facilitation on manufacturing export; manex is the annual manufacturing production of the country I; infrastructure remains as previously defined.

In more explicit form, eq (6) in its static and dynamic forms may be re-written r as follows:

$$manex_{it} = \gamma_0 + \gamma_1 integration_{it} + \gamma_2 institution_{it} + \gamma_3 infrastructure_{it} + \gamma_4 TF_{it} + \gamma_5 manpdt_{it} + \varphi \dots (7)$$

$$manex_{it} = \pi_0 + \pi_1 manex_{i,t-1} + \pi_2 integration_{it} + \pi_3 institution_{it} + \pi_4 infrastructure_{it} + \pi_5 TF_{it} + \pi_6 manpdt_{it} + \omega \dots (8)$$

For manufacturing exports of country i to country t in year y; where φ and ω are error terms assumed to be randomly and normally distributed.

In terms of theoretical relationship, we expect: $\gamma_0, \gamma_1, \gamma_2, \gamma_3, \gamma_5 > 0$; and $\gamma_4 < 0$ and $\pi_0, \pi_1, \pi_2, \pi_3, \pi_4, \pi_6 > 0$; and $\pi_5 < 0$, i.e., that exports go down with xdays but up with everything else.

Scope and data of the Study

Data for the period 2016–2020 will be used to achieve the study's objectives, the reason for the 2016 trade facilitation measure of the WTO came into effect in 2015. In achieving the study's objectives, the study uses the current data on trade facilitation variables of the World Bank Doing Business Database (DBD) for the sample of 15 West-African countries.

DBD provides comprehensive cross-country data for useful information relating to trade facilitation. Most trade facilitation indicators are directly related to border and transport efficiency. Namely, time to export, the cost to export, the number of

documents required to export, time to import, cost to import, and the number of documents required to import are used. As several authors have shown (Ogundipe et al., 2014; Olayiwola et al., 2015; Sakyi et al., 2017), these indicators have a key role in the international trade and intra manufacturing export performance of countries. For robust results of the study and these indicators, an institution is the political-institutional factors proxy by the rule of law index and control of corruption index.

Data on political institutions are sourced from the World Governance Indicators (WGI). Service infrastructure is measured by internet users per 100 inhabitants and telephone lines (fixed + mobile) per 100 inhabitants. Data on Service infrastructure are sourced from the World Development Indicators (WDI). Efforts were made to include electricity production/consumption as one of the infrastructure indicators; however, the data for most ECOWAS members over the study period were not available. Macroeconomic factors are measured by Per capita Real Gross Domestic Products (PCRGDP). Data on macroeconomic factors are sourced from the World Development Indicators (WDI).

Table 2. Definition of variables and data source

Variables	Definitions	Sources
GDP_{it}	Exporting country's GDP measured in million US\$ at time t	WDI
GDP_{jt}	Importing country's GDP measured in million US\$ at time t	WDI
$Polity2_{it}$	Polity2 score in country i at time t	WGI
$Polity2_{jt}$	Polity2 score in country j at time t	WGI
$Doc\ export_{it}$	Number of document required to export from country i at time t	WBDBD
$Time_export_{it}$	Number of days required to export from country i at time t	WBDBD
$Cost\ to\ export_{it}$	Cost to export from country i at time t	WBDBD
Doc_import_{it}	Number of document required to import from country i at time t	WBDBD
$Time_import_{it}$	Number of days required to import from country i at time t	WBDBD
$Cost\ to\ import_{it}$	Cost to import from country i at time t	WBDBD
RTA_{ijt}	Dummy variable with value 1 if i and j belong to the same RTA at time t , 0 otherwise	CEPII
WTO_{ijt}	Dummy variable with value 1 if i and j belong to the WTO at time t , 0 otherwise	CEPII
$Contiguity_{ij}$	Dummy variable with value 1 if i and j share a land border, 0 otherwise	CEPII
$Com.\ currency_{ijt}$	Dummy variable with value 1 if i and j use the same currency, 0 otherwise	CEPII
$Distance_{ij}$	Geographical distance between country i and j in km	CEPII

Note: CEPII, Centre d'Etudes Prospectives et d'Informations Internationales; GDP, gross domestic product; RTA, Regional Trade Agreement; WBDBD, World Bank Doing Business Database; WTO, World Trade Organization. Higher values of the trade facilitation indicators imply better outcomes or improved levels.

Model estimation techniques

As used by Olayiwola et al. (2015), the gravity model is modified as the empirical tool to analyse the effects of REI and trade facilitation on intra manufacturing exports in the ECOWAS region. The gravity model is most used to explain trade flows between countries, trade flow from supply potential (proxy by manufacturing exports ratio to GDP) of the exporting states to the market demand potential (proxy by real GDP) of the importing states, and the trade cost (proxy by days and numbers of documents needed to export and import) between the exporting and importing countries.

Classically, the gravity model shows GDP and distance variables augmented with observable trade cost variables (trade agreements, days, and numbers of documents needed to export and import) (Sandberg et al., 2006). Anderson & van Wincoop's (2003) emphasis is on Multilateral Resistance Term (MRT) within bilateral trade. The MRT states bilateral trades between two or more countries are not determined only by the bilateral variables between the two countries but in relation to the position of the two countries in global trade. MRTs are an unobserved variable and are difficult to

capture. The study uses the dyadic fixed effects to control for the MRT (Feenstra, 2004) cited in Sakyi et al., (2019). The fixed effects also control for unobserved time-invariant heterogeneity that is likely to correlate with trade flows as well as trade cost variables (Sakyi et al., 2019). To take these econometric problems, the study specifies an empirical baseline model.

$$\ln(X_{ijt}) = \pi_{ij} + \pi_t + \beta \ln M_{it} + \gamma \ln M_{jt} + \alpha D_{ij} + \delta TF_{ijt} + \varepsilon_{ijt} \dots\dots\dots (9)$$

Where X_{ijt} measures trade flow between countries i and j at time t ; α_{ij} is the dyadic country fixed effects; α_t are the time dummies; ε_{ijt} is the error term, and $M_{[i(j)t]}$ is the vector of monadic variables of the exporter (importer) in the gravity equation, and they consist of GDP, MRT, and Infrastructure. Included in the set of monadic variables are also political indicators that can affect trade flows,

Concerning political variables, the study uses continuous variables that can show the intensity of these variables rather than the use of dummy variables that show less variation. These include combined political institution (regulatory quality (RQ)) proxy by the rule of law index or control of corruption index as indicators (Marshall *et al.*, 2017). $D_{[ij(t)]}$ is the vector of dyadic time-invariant (variant) variables, consisting of the distance between i and j , indicator variables that equal one if i and j share a contiguous border, have a common language, have a common currency and are both members of Regional Trade Agreements, WTO/General Agreement on Tariffs and Trade. For the dyadic variables, the use of dyadic fixed effects (α_{ij}) in the baseline equation controls for them, thus, differenced away in the gravity model estimation. TF_{ijt} is a vector of the different measures of trade facilitation indicators.

The next major econometric problem is zero flows in trade measurement data. Regularly, a high percentage of zero trade flows come up in the statistical sum-up due to small trade volumes or values between countries, which leads to selection bias if the problem is not taken care of. Studies on trade flow among African countries often develop a selection bias problem (Sakyi et al., 2019). Afesorgbor (2017) states nil flows in trade data of about 55% of countries sample. It is believed in trade flows study that looking trade flow from distant past gives selection bias outcomes. To eliminate the selection bias problem, trade flows that spanned a more current period (2016–2021) are used for the study, eliminating zero flows from the study data set.

Another major econometric problem is the multidimensionality of trade facilitation indicators (time to export, cost to export, the number of documents required to export, time to import, cost to import, and the number of documents required to import) and distance to frontier (dtf) variables [time to export (dtf), the cost to export (dtf), the number of documents required to export (dtf), time to import (dtf), the cost to import (dtf) and the number of documents required to import (dtf)] these variables are strongly correlated with one another. So, to eliminate or reduce multidimensionality, the Principal component analysis (PCA) approach is used in addition to the variables in each equation separately looked at by providing composite indicators of trade facilitation.

The first principal composite indicators are; time to export, cost to export, and the number of documents required to export ($\text{borderx}_{\text{pcao}}$). Second, principal composite indicators are; time to export (dtf), the cost to export (dtf), and the number of documents required to import (dtf) ($\text{borderx}_{\text{pcadtf}}$). Third, principal composite indicators are; time to import, cost to import, and the number of documents required to import ($\text{borderm}_{\text{pcad}}$). Fourth, principal composite indicators are; time to import (dtf), the cost to import (dtf), and the number of documents required to import (dtf) ($\text{bordermdtf}_{\text{pcad}}$).

The principal component scores will be normalized to a scale of 0–10 using min-max transformation with higher values corresponding to better trade facilitation outcomes. The correlation coefficients will show the degree of correlation between the constructed composite index and the corresponding trade facilitation variables. The number of principal components will be selected using the Kaiser criterion of eigenvalue greater than one.

Again, in using the Generalized Methods of Moments (system GMM). The problem of endogeneity in dynamic panel models is always a major problem. Instrumental Variable (IV) estimation is majorly used as a tool to deal with the problem. But, the IV estimation method is only useful if the instruments are good. In other words, the instruments must be strongly correlated with the potential endogenous variables. They must be genuinely exogenous to the model to over-identify the model to allow tests for homogeneity and excludability. The two commonly used methods in IV estimation are the Two-Stage Least Squares (TSLS) and the Generalized Methods of Moments (GMM). The GMM method produces identical results to TSLS for just identified models but can give more precise estimates with over-identified models. Besides, the GMM method uses internal instruments, unlike the TSLS method, where there is a need to search for suitable external instruments. Therefore, the GMM method of IV estimation will be considered appropriate for estimation in this study. Equations (2, 3, and 7) will be estimated using the panel fixed effect estimator, and equations (4, 5, and 8) will be estimated using the system Generalized Methods of Moments (system GMM).

RESULTS AND DISCUSSION

In this section, the study presents the results of data analysis. The section begins with a summary of descriptive statistics to check the quality of the data set. All the variables were transformed into logarithms to correct for heteroscedasticity. It should be noted that higher values of the trade facilitation variables give better trade facilitation outcomes.

Table 3. Summary statistics

Variables	Observed	Mean	Standard deviation	Min	Max
Economic and political variables					
Exports (million)	13,311	40.263	201.416	0.161	4228.212
Imports (million)	16,222	39.733	225.567	3.121	5432.666
GDP _o (million)	21,108	33,617.000	78,327.510	115.162	488,258.500
GDP _d	21,012	33,710.030	79,009.800	115.172	488,258.500
polwil _o	21,540	1.891	4.050	-7	10
polwil _d	21,540	1.861	4.051	-7	10
Trade facilitation variables					
docexp _o	23,360	7.517	1.804	4.000	14.000
timep _o	23,360	30.830	14.358	10.000	78.000
costexp _o	23,360	1755.187	1089.500	463.000	6615.000
docimp _d	23,350	8.979	2.736	5.000	21.000
timeimp _d	23,350	37.253	18.123	9.000	102.000
costimp _d	23,350	2192.378	1527.325	577.000	9025.000
Other trade cost variables					
Distance	23,720	3635.242	1923.225	162.182	9772.055
Contiguity	23,720	0.074	0.262	0.000	1.000
Common language	23,720	0.448	0.497	0.000	1.000
Common currency	23,720	0.078	0.269	0.000	1.000
RTA	23,720	0.188	0.391	0	1

Table 3. shows the summary of descriptive statistics for the data used in the study. From the estimation results, it is evident that all trade facilitation variables have positive and small mean values and small standard deviations, except the macro variable with large positive and large mean values and large standard deviations, these suggestions that the errors that may be due to these estimates of all trade facilitation are within the acceptable limit. Finally, the skewness results suggest that all the variables are negatively skewed. It could be inferred from the result that the summary statistic(s) for the data series are fairly okay. The data set reveals no zero flows but missing values treated as missing observations rather than zero flows. Therefore, the study does not need to use the Poisson pseudo maximum likelihood estimator.

The PCA is a straightforward approach for creating new indexes and linear composites of the original ones. To ensure that higher values of trade facilitation indicators represent better outcomes, we rescaled all the six trade facilitation indicators to range from 0 to 10 using the min-max transformation. This transformation is not only important for the PCA, but it also facilitates the comparison of the trade facilitation indicators with the other variables used in the study

Table 4. Principal component analysis of trade facilitation indicators

	Eigen value	Proportion explained	Primary variables	Eigen vectors	Correlation coefficients	Bartlett (<i>p-value</i>)
Export costs (borderx _{pcao})	1.666	0.624	Time to export	0.638	0.911	0
			Cost to export	0.622	0.823	
			Number of documents to export	0.434	0.605	
Export costs (borderxdtf _{pcao})	2.111	0.682	Time to export (dtf)	0.647	0.908	0
			Cost to export(dtf)	0.609	0.875	
			Number of documents required to export(dtf)	0.459	0.659	
Import costs (borderm _{pcao})	2.132	0.696	Time to import	0.633	0.899	0
			Cost to import	0.602	0.877	
			Number of documents to import	0.510	0.735	
Import costs (bordermdtf _{pcao})	2.305	0.755	Time to import(dtf)	0.619	0.918	0
			Cost to import(dtf)	0.603	0.895	
			Number of documents required to import(dtf)	0.504	0.749	

The principal component scores are normalized to a scale of 0–10 using min-max transformation with higher values corresponding to better trade facilitation outcomes. The correlation coefficients reveal the degree of correlation between the formulated composite index and the corresponding trade facilitation variables. The number of principal components is selected by the Kaiser criterion of eigenvalue greater than one.

The study provides the economic interpretation of the resulting coefficients of the estimated gravity model. The results are revealed in Tables 4, 5, and 6.

Table 5 reveals the results from border and infrastructure efficiency indicators (time to export, cost to export, the number of documents required to export and time to import, cost to import, the number of documents required to import). The PCA indices indicators (borderx_{pcao} and borderm_{pcao}) for the exporting and importing countries.

Table 5. Exports model for trade facilitation indicators

Variables	1 lnexports	2 lnexports	3 lnexports	4 lnexports	5 lnexports	6 lnexports	7 nexports	8 lnexports
lngdp _o	0.313* (0.157)	0.301** (0.156)	0.297* (0.153)	0.290* (0.155)	0.298* (0.157)	0.301** (0.156)	0.299* (0.153)	0.297* (0.155)
lngdp _d	0.296* (0.127)	0.294* (0.127)	0.296* (0.126)	0.285* (0.126)	0.292* (0.128)	0.298* (0.127)	0.294* (0.126)	0.295* (0.126)
polwil _o	-0.0306* (0.0136)	-0.0244* (0.0136)	-0.0264* (0.0133)	-0.0237** (0.0134)	-0.0313* (0.0135)	-0.0264* (0.0132)	-0.0297* (0.0134)	-0.0230** (0.0136)
polwil _d	0.0222** (0.0129)	0.0223** (0.0130)	0.0226** (0.0130)	0.0227** (0.0130)	0.0242** (0.0130)	0.0234** (0.0131)	0.0215** (0.0129)	0.0215** (0.0130)
lnPolS _o	-0.189** (0.0992)	-0.196* (0.0999)	-0.188** (0.0967)	-0.194** (0.0988)	-0.188** (0.0996)	-0.197* (0.0989)	-0.194** (0.0989)	-0.196** (0.0994)
lnPolS _d	0.0860 (0.0695)	0.0860 (0.0690)	0.0879 (0.0695)	0.0859 (0.0692)	0.0862 (0.0693)	0.0872 (0.0694)	0.0933 (0.0691)	0.0800 (0.0692)
borderx _{pcao}				0.135*** (0.0415)				0.135*** (0.0415)
borderm _{pcad}								-0.0196 (0.0355)
costexp _o			0.165*** (0.0474)				0.164*** (0.0472)	
costimp _d							-0.0593* (0.0295)	
timexp _o		0.0656** (0.0375)				0.0658** (0.0376)		
timeimp _d						-0.00454 (0.0332)		
docexp _o	0.0334 (0.0227)				0.0334 (0.0227)			
doctimexp _o					0.0225 (0.0288)			
Constant	-4.608 (4.749)	-4.026 (4.712)	-7.221 (4.589)	-5.305 (4.720)	-4.530 (4.746)	-4.050 (4.722)	-6.266 (4.765)	-5.246 (4.732)
Observations	8,678	8,678	8,678	8,678	8,678	8,678	8,678	8,678
R ²	0.039	0.039	0.041	0.041	0.040	0.040	0.042	0.040
Number of pair _d	1933	1933	1933	1933	1915	1915	1915	1915
Dyadic fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: standard errors in parentheses, ***p < 0.01, **p < 0.05, * p < 0.1.

Table 6 reveals only the infrastructure efficiency indicators [time to export (dtf), cost to export (dtf), the number of documents required to export (dtf), time to import (dtf), cost to import (dtf), the number of documents required to import (dtf)] and the PCA indices of these indicators (borderxdtf_{pcao} and bordermdtf_{pcad}) taking into account, only exports-related trade facilitation indicators (time to export, cost to export, the number of documents required to export), exports-related infrastructure efficiency indicators [time to export (dtf), the cost to export (dtf), the number of documents required to export (dtf)] and the PCA indices of these indicators (borderxdtf_{pcao} and borderxdtf_{pcao}).

Table 6. Exports model for infrastructure indicator

Variables	1 Inexports	2 Inexports	3 Inexports	4 Inexports	5 Inexports	6 Inexports	7 nexports	8 Inexports
lngdp _o	0.313* (0.157)	0.301** (0.156)	0.297* (0.153)	0.290* (0.155)	0.298* (0.157)	0.301** (0.156)	0.299* (0.153)	0.297* (0.155)
lngdp _d	0.296* (0.127)	0.294* (0.127)	0.296* (0.126)	0.285* (0.126)	0.292* (0.128)	0.298* (0.127)	0.294* (0.126)	0.295* (0.126)
polwil _o	-0.0306* (0.0136)	-0.0244* (0.0136)	-0.0264* (0.0133)	-0.0237** (0.0134)	-0.0313* (0.0135)	-0.0264* (0.0132)	-0.0297* (0.0134)	-0.0230** (0.0136)
politywil _d	0.0222** (0.0129)	0.0223** (0.0130)	0.0226** (0.0130)	0.0227** (0.0130)	0.0242** (0.0130)	0.0234** (0.0131)	0.0215** (0.0129)	0.0215** (0.0130)
InPolS _o	-0.189** (0.0992)	-0.196* (0.0999)	-0.188** (0.0967)	-0.194** (0.0988)	-0.188** (0.0996)	-0.197* (0.0989)	-0.194** (0.0989)	-0.196** (0.0994)
InPolS _d	0.0860 (0.0695)	0.0860 (0.0690)	0.0879 (0.0695)	0.0859 (0.0692)	0.0862 (0.0693)	0.0872 (0.0694)	0.0933 (0.0691)	0.0800 (0.0692)
borderx _{pcao}				0.135*** (0.0415)				0.099*** (0.0322)
borderm _{pcaad}								0.0347 (0.0335)
costexp _o			0.665*** (0.0479)				0.0628*** (0.0200)	
costimp _d							0.0309 (0.0192)	
timexp _o		0.0456** (0.0370)				0.0658** (0.0376)		
timeimp _d						-0.00454 (0.0332)		
docexp _o	0.0334 (0.0227)				0.0334 (0.0227)			
doctimexp _o					0.00225 (0.0288)			
Constant	-4.635 (4.757)	-4.022 (4.722)	-2.154 (4.762)	-3.233 (4.712)	-4.424 (4.745)	-4.047 (4.720)	-3.262 (4.764)	-3.236 (4.730)
Observations	8,678	8,678	8,678	8,678	8,678	8,678	8,678	8,678
R ²	0.038	0.038	0.040	0.040	0.038	0.038	0.041	0.040
Number of pair _d	1963	1963	1963	1963	1945	1945	1945	1945
Dyadic fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1. Higher values of the trade facilitation variables imply better facilitation outcomes.

Finally, Table 7 reveals the coefficients of variables of interest and the economic interpretation, which suggest trade facilitation in the country of origin of export of any ECOWAS member state has a positive economic and statistically significant effect on exports among ECOWAS member states.

Table 7. Exports models for both trade facilitation and infrastructure indicators

Variables	1 Inexports	2 Inexports	3 Inexports	4 Inexports	5 Inexports	6 Inexports	7 nexports	8 Inexports
Ingdp _o	0.313* (0.157)	0.301** (0.156)	0.297* (0.153)	0.290* (0.155)	0.298* (0.157)	0.301** (0.156)	0.299* (0.153)	0.297* (0.155)
Ingdp _d	0.296* (0.127)	0.294* (0.127)	0.296* (0.126)	0.285* (0.126)	0.292* (0.128)	0.298* (0.127)	0.294* (0.126)	0.295* (0.126)
bordpolity _{2o}	-0.0306* (0.0136)	-0.0244* (0.0136)	-0.0264* (0.0133)	-0.0237** (0.0134)	-0.0313* (0.0135)	-0.0264* (0.0132)	-0.0297* (0.0134)	-0.0230** (0.0136)
bordpolity _{2d}	0.0222** (0.0129)	0.0223** (0.0130)	0.0226** (0.0130)	0.0227** (0.0130)	0.0242** (0.0130)	0.0234** (0.0131)	0.0215** (0.0129)	0.0215** (0.0130)
InPolS _o	-0.189** (0.0992)	-0.196* (0.0999)	-0.188** (0.0967)	-0.194** (0.0988)	-0.188** (0.0996)	-0.197* (0.0989)	-0.194** (0.0989)	-0.196** (0.0994)
InPolS _d	0.0860 (0.0695)	0.0860 (0.0690)	0.0879 (0.0695)	0.0859 (0.0692)	0.0862 (0.0693)	0.0872 (0.0694)	0.0933 (0.0691)	0.0800 (0.0692)
bordexp _{pcao}								0.099*** (0.0322)
borderm _{pcaid}							0.0628*** (0.0200)	
costexp _o						0.0414 (0.0224)		
costimp _d					0.0247 (0.0178)			
timexp _o				0.135*** (0.0415)				
timeimp _d			0.165*** (0.0414)					
doceexp _o		0.665*** (0.0479)						
doctimexp _o	0.0334 (0.0227)							
Constant	-4.608 (4.749)	-4.026 (4.712)	-7.221 (4.589)	-5.305 (4.720)	-4.530 (4.746)	-4.050 (4.722)	-6.266 (4.765)	-5.246 (4.732)
Observations	8,678	8,678	8,678	8,678	8,678	8,678	8,678	8,678
R ²	0.038	0.038	0.040	0.040	0.038	0.038	0.041	0.040
Number of pair _d	1963	1963	1963	1963	1945	1945	1945	1945
Dyadic fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses, ***p < 0.01, **p < 0.05, *p < 0.1. Higher values of the trade facilitation variables imply better facilitation outcomes.

Source: Authors' computations.

The revelation is back by PCA indices in all tables. For the magnitude of PCA indices, the coefficient of the infrastructure efficiency indicator indicates that a one-point scale improvement in infrastructure efficiency in any ECOWAS member state exporting leads to a 13.5% (11%) increase in trade flows with ECOWAS member states importing.

It is important to note that the reduced export costs positively affect exports within trade facilitation and the infrastructure indicators. The coefficient of the infrastructure indicator reveals a 1% reduction in trade costs by ECOWAS member states exporting leads to a 16.5% (6.3%) increase in trade flows with ECOWAS member states importing, which in agreement with (Olayiwola et al. 2015; Sakyi. et al. 2019). The positive effect of trade flows has a multiplier effect on infrastructure

indicators. Reducing the time and the number of documents required to export positively influences trade flows between the exporting and importing countries.

However, in contrast to the positive effect of infrastructure efficiency at the border of the exporting country, improving infrastructure at the border of the importing countries does not increase export from the country of origin to the destination country (Tables 4 and 5 for the importing). This could be because ECOWAS member states focus more on trade facilitation that promotes exports to imports with various export promotion and integration strategies to increase exports. In conclusion, promoting trade facilitation at the border of the exporting ECOWAS member states has a positive multiplier on facilitating intra- ECOWAS member states' trade.

The political variables reveal significant positive effects in agreement with Yu (2010), who argues that high democratic countries would have better-developed institutions, stronger intellectual property protection, and higher consumer protection rights that would translate into high-quality and competitive products favorable for exports. However, the results from the Political stability index show democratization in the exporting country may increase trade costs, in effect reducing bilateral export. This could be due to the cost of democracy. Democracy is expensive for ECOWAS member states, and trade taxes are a major source of revenue for most ECOWAS member states. With democracy expense, ECOWAS member states may charge higher export tariffs, discouraging exports. Finally, conflict in an exporting country has a negative effect on its trade export flows.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The study examined the effect of trade facilitation on intra-manufacturing export trade performance among ECOWAS member states using the gravity model. Annual data covering five years of the period 2016–2020 for a sample of 15 ECOWAS member states. Trade facilitation indicators (time to export, cost to export, number of documents to export, time to import, cost to import, number of documents required to import), their corresponding infrastructure indicators and other composite indices formulated from these indicators using PCA.

The results reveal that trade facilitation and economic integration in ECOWAS have a vital role in promoting intra-manufacturing exports among ECOWAS member states. Improvements in trade facilitation policy will boost intra-manufacturing exports among ECOWAS member states. The three trade facilitation variables and infrastructure indicators influence the real cost of export and import across borders. It is a key driver of the performance of intra-manufacturing exports among ECOWAS member states. The control variables in the study (GDP, democracy, and political stability also have significant effects on intra-manufacturing exports among ECOWAS member states.

Recommendations

Policymakers should formulate policies that would improve trade facilitation substantially in ECOWAS member states. Trade facilitation indicators are at very low levels in member states compared to other regions of the world. Trade facilitation policies can reduce the real costs of trading across borders of member states.

Also, as a matter of deliberate policy, ECOWAS Commission and the ECOWAS parliament need to assist member states with ineffective legislation on the policy that will combine the Trade facilitation policies and ECOWAS industrialization policy

initiatives to promote manufacturing integration and production and trade within the region.

Since the study finds economic integration and trade facilitation to be a significant influencer of manufacturing exports, an effort to improve economic integration and trade facilitation in the region will be needed to increase manufacturing exports in the ECOWAS sub-region significantly.

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