Paperless custom clearance and business supply chains

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Abstract

Purpose – Seaports play an immeasurable role in the advancement of international trade. They have been the common avenue for the transportation of goods and services from one continent to another, and it has also been the linking transport of one mode of transport to another. The study sought to assess the effect of paperless information technology (IT)-based custom clearance at Ghana Seaports on businesses and industrial supply chains in Ghana.

Design/methodology/approach – The study conducted a survey with a sample size of 200 trading firms in Ghana.

Findings – The study discovered that IT-based port clearance has positive impact on customer order fulfillment, transaction cost reduction and supply chain relationships.

Practical implications – With the aim of making Ghana the transportation hub of businesses in the sub region, the paperless custom clearance has the potential to reduce delays at the port and improve their supply chain.

Originality/value – This paper provides researchers with a contemporary perspective toward understanding the effect of paperless custom clearance on the supply chain of businesses in the West African sub region.

Keywords Industrial supply chain, Businesses, Paperless, Custom clearance, Seaport

Paper type Research paper

Introduction

The increase in the level of globalization gives rise to increase in the volume of international trade. International trade has increased in volume significantly such that a judgment from the surface could lead one to believe that every nation is expanding its international trade borders (Arvis *et al.*, 2013). This is not the case in reality. The volume of trade has increased due to the fact that some countries have significantly improved their international trade and as long as there are exports and imports, the countries at the other end of the trade benefit from these improvements (Hausman *et al.*, 2005; Ashley, 2020). Seck (2017) has shown that a set of trade facilitation measures determine the growth of international trade. The author mentioned that border efficiency, the nature of the physical infrastructure, the laws and regulations, the level of information and communication technology, and logistics performance are some indicators of the growth of international trade. It is clear that Seck (2017) has clarified the reason why the volume and value of international trade were not rising uniformly by pinpointing the specific measures that facilitate the growth of international trade. The rate at which these factors are favorable in the country, the more it will promote the volume of international trade in the country. De Jong and Baas (2013) indicated that countries that are war prone are likely not to experience growth in international trade due to the adverse prevalence of the factors that determine the growth of international trade.

According to UNDP (2013), the general volume of trade in the sub-Saharan Africa region expanded greatly in the beginning of the 21st century. In the early decades of the 21st century, the volume of trade in sub-Sahara Africa increased by 5.9%, which was incredibly above the global growth trend of 3.8% (Seck, 2017). Consequently, the volume of international trade in Ghana consistently increased in the early part of the 21st century, and this can be explained from the political turmoil in the neighboring countries (De Jong and Baas, 2013). Nsiah (2014) has indicated that ports play an immeasurable role in the growth of international trade. Ports have been the common avenue for the transportation of goods and services from one continent to another, and it has also been the linking transport of one mode of transport to another (Carbone and Martino, 2003; Behdani *et al.*, 2020; Ashley, 2020). The study by this author indicated that ports are the point of loading and offloading goods. Considering the measures that determine the growth of international trade and the key role played by the sea ports in international trade, it is necessary for attention to be shifted to the improvement of port operations. According to Sourdin and Korinek (2011), what facilitates trade is the trade logistics. Sourdin and Korinek (2011) found out that improved trade logistical services enhance the competiveness of exports by lowering the cost involved in transiting the goods. The study by these authors showed that changes in the efficiency of trade logistics impact changes in the value and volume of international trade. Wilmsmeier *et al.* (2006) in their study also mentioned that transport costs constitute a great part of trade costs, and for this reason, there has been a growing interest of researchers on the factors that drive the increase in the transaction costs. This seemed all simple until Hornok and Koren (2014) came along to state that some trade costs have no relationship with the increase in the value and volume of international trade. The study by these authors showed that there are some transactional activities in the shipment process that increase costs, yet add no value, and an attempt to reduce such costs result in trade efficiency. For instance, the charge of a container is fixed whether it is full or not. In that case, an exporter would incur more cost to ship fewer items than when he or she sends a container full. In that case, the exporter would prefer to wait and load a full container for transport. The exporter has to make a tradeoff either by incurring higher cost to ship the product on time, or delay shipment of the product at a lower cost. The authors cited a number of transport costs that actually do not proportionate with the volume and value of trade. Some include inventory holding costs between shipment arrivals. Another operation in international trade that has the propensity to increase cost yet not add value to the trade is port clearance (Hornok and Koren, 2014).

Traditional port clearance is characterized by manual operations, arbitrary decisions, corruption and unnecessary delays (Kesino, 2012; Agbozo, 2017; Osei-Owusu and Mahmood, 2020; Addo, 2020). The manual operations make it difficult for the clearance procedures to be executed on time and accurately, especially, in this era where there is rise in volume of transaction because of globalization. The arbitrary decisions allow custom officials to frustrate and delay the businesses in clearing their goods from the port. Corruption increases the cost of transportation for businesses due to extra cost borne due to corruption. The delays in the port clearance increase the inventory holding cost as they are kept in the bonded warehouses (Kahyarara, 2018). In a nutshell, the traditional port clearance increase transaction cost yet adds little or no value. Hoa and Haasis (2017) argued that port clearance is a logistical activity, and a logistical activity is to add value by ensuring that the right products are delivered to the "right customer" in their rightful quantity and condition at the right time to the right place for the right price. Comparing the function of a logistical activity stated by Hoa and Haasis (2017) and the function performed by the traditional port clearance in international trade, there is a gross mismatch.

This mismatch has aroused the interests of researchers and policy makers to seek for ways and means of making the port clearance efficient enough so as to deliver effectively as a logistical driver in international business. The efforts made by countries in enhancing port

clearance has been the adoption of information technology (Aliet, 2008). According to Tijan *et al.* (2012), information technology is an effective tool for achieving competitiveness and efficiency in sea port clearance. The justification for this argument is that information is a key resource in international trade. Therefore, to effectively carry out international trade, the information flow must be seamless. The adoption of information communication technology allows the port to handle the immense volume of demand and other information traffic.

In a "Port Efficiency Conference," organized by Ghana Institute of Freight Forwarders (GIFF) in 2017, the Vice President of the Republic of Ghana expressed the inefficiencies in the Ghanaian port clearance processes. In an effort to battle the inefficiencies, the government ordered the port operators to adopt total paperless operations in the clearance procedures. This is a great initiative but the problem associated with this reform is the limited research in the field. However, it cannot be said from face value that once the aim of the paperless port clearance adoption is to reduce clearing time, eliminate human intervention and streamline business process, firms and their supply chains are going to soar and will automatically be impacted positively (de Reuver *et al.*, 2018; Klein *et al.*, 2020). Nevertheless, there has been very limited literature in the context of Ghana that examines the impact of paperless IT clearance on businesses and their supply chains. For this reason, this study assesses the impact of paperless information technology-based custom clearance at Ghana port on businesses and industrial supply chains in Ghana. It is necessary for the government and policymakers in Ghana to understand the potential of the paperless port clearance system (Shepherd, 2014), from an objective point of view and to also guard against all the risks that may impede the flow of the benefits. This study provides an in-depth understanding into the paperless clearance process and related prospects of its adoption. This research work is a basis for the government to know which areas are risk prone to the paperless clearance adoption and how exactly the paperless clearance adoption impact businesses in Ghana. The paperless system and the challenges it pose to Ghana's port clearance procedure is presented under the overview. This is followed by the theoretical foundation of the study. The data and methodology then follow. The next section is the presentation of the results and is followed by the discussion section. The last section contains the conclusion of the study.

Theoretical foundation
Transaction cost economics theory (TCE)
The transaction cost economics is a theory that defines the various structures of organizations such as the market structures and government structures (Chen *et al.*, 2017). The author stated that in a more detailed explanation, the transaction economics theory refers to the determination of the level of transaction cost that is sufficient enough for firms to successfully manage and organize themselves in the competitive market. Williamson (1996) did a great job on explaining the theory some few decades after it was developed. The author explained that there are three dimensions to the transaction cost theory. These dimensions are asset specificity, frequency of transaction and supply uncertainty. The asset specificity dimension of this theory refers to the level at which the firm's assets used to carry out an activity can be re-used for alternative activities by other users without sacrificing its productive value (Chen *et al.*, 2017). The frequency of transaction also refers to the repetition of transaction activity carried out with customers in the market. Supply uncertainty also refers to the non-disclosure, disguising and distortion of information by the players in the market to take advantage of opportunities (Williamson, 1996). These three dimensions are interplays that determine the costs of a firm as it operates in a market. Willamsom (1996) explained that all these three dimensions have costs element and these costs emanate from production and coordination. The production costs arise from the flow of materials in the course of carrying out the transaction, whereas the coordination costs arise from the transfer

of information in the course of carrying out the transaction. Information technology comes to play to help improve the coordination costs incurred by firms.

The transaction cost economics theory is employed to examine the impact of investment in information technology on firm coordination costs. Since this research is focused on the influence of paperless port clearance on businesses and industrial supply chains, the transaction economics theory better explains the relationship between the constructs. According to Chen *et al.* (2017), IT-coordination costs are significant in external coordination. This makes the usage of the transaction cost economics theory plausible in the explanation of the impact that paperless port clearance has on businesses. As mentioned by Carbone and Martino (2003) ports are part of the supply chain and they are very instrumental in the coordination of the parties in the supply chains. Nsiah (2014) also disclosed that the ports play key role in the flow of materials across the supply chain. The author explained that the ports link all the other modes of transport employed by firms as long as international trade is concerned. This is very reasonable because international freights are transited on sea, due to the relatively lower cost of marine transport (Shepherd, 2014), before the freight are transported through other modes of transport such as road, rail and pipeline.

Paperless IT-based port clearance

Ports have been the recognized site for the regular transshipment of consignments in order to transfer freights from one mode of transport to another mode of transport (Carbone, 2013). According to Rau and Aikaterini (2013), Customs Clearance, also known as Port Clearance is the act of passing freights through the customs unit of a country so that they can legally enter or leave the country. When the customs unit is satisfied with the certification, customs duty is paid by the importer or exporter, then a clearance document is issued to authorize the shipment of the goods. In the clearance procedure, the exporter is required to submit some documentation such as sales invoice, purchase order from the buyer, shipping bill, Bill of Lading or air waybill, Certificate of Origin for inspection (Rau and Aikaterini, 2013). The importer is also required to submit copies of the same documentation for inspection. Over time, information technology has been integrated into port clearance to enhance its efficiency. This has given rise to the concept of paperless trade or paperless port clearance. Paperless port clearance is a cross-border trade that takes place on the basis of absolute electronic communications, involving the transfer of trade-related data and documents purely through an electronic means (Shepherd, 2014). According to Duval and Mengjing (2017), paperless trade generally refers to the conduct of international business transactions through an electronic means, rather than using paper-based documents and data. Ports play significant roles in the management and coordination of the materials and information flow in supply chains (Carbone and Martino, 2013). Thus, UNIPASS will help to reduce the turnaround time of importers and exporters at the port (Mante–Kodjo, 2020).

Customer order fulfilment

Christopher (2011) defines order fulfillment as the processes undertaken by a firm to receive an order from a customer to the delivery of the product to the customer. It is commonly used to designate the process of shipping or distribution (logistics). It refers to the diverse ways through which firms respond to customer orders and the processes the firms follow to ensure that the product or service gets to the consumer. One of the crucial aspects of managing a business and being in business is to satisfy the customer successfully. It requires businesses to pay particular attention to client needs, order processing, time management and quality assurance efforts. The author further explains that unless businesses keenly take part in the

fulfillment process, they are possibly not going to be fully aware of the requirement of a successful Supply Chain delivery. Order fulfillment process of industries operate distinct from each other (Cannas *et al.*, 2020). However, the major common factor among the industries is the speed at which an order can be delivered, tells how excited a customer is going to be (Hishamuddin *et al.*, 2014). Hence, the benefits of order processing are many, irrespective of the means adopted by a supply chain in satisfying customer orders. The proliferation of the Internet and computers have greatly influenced the evolution of order fulfillment process. The new technology has created new processes of managing client information and orders. Now firms are able to rely on new order fulfillment tools to provide better organization of information and efficiency. Thanks to globalization and technology firms have access to unlimited opportunities and wide network of potential customers. In the new system, the supply chain is set in motion by the customers' order.

Conceptual framework and hypothesis
Some earlier studies have examined the impact of IT-based port clearance on several constructs. Yang and Wei (2013) examined the impact of IT based port clearance on security performance. Garstone (1995) looked at the effect of electronic data interchange on port operations. Strandenes and Marlow (2000) also examined the effect of IT-based port clearance on port pricing and competitiveness. Clark *et al.* (2004) examined the relationship between port efficiency, transport cost and international trade. Alavi (2004) also studied how ICT can be used in Port operations to facilitate trade. Schilima and Gikonyo (2017) examined the role of Kenya's electronic single window on global value chain. Tijan *et al.* (2012) also studied the essence of port community system implementation. All these are great works conducted on the impacts ICT-driven port clearance have on the various aspects of the global economy. A conceptual framework has been designed based on the review made on the literature above and some other literature. The study involves four main constructs: Paperless IT-based port clearance, transaction cost reduction, customer order fulfillment, and supply chain relationships. Below is a schematic diagram of the conceptual framework for the study (see Figure 1).
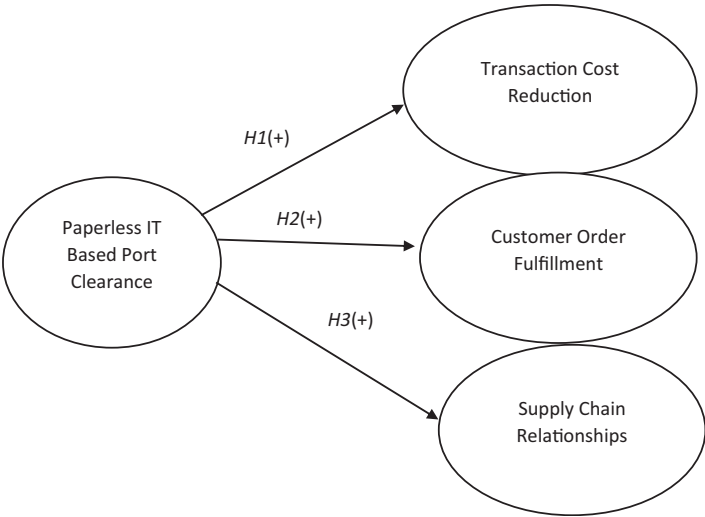

Figure 1.
Conceptual framework

Hypothesis
According to Sichilima and Gikonyo (2017), the implementation of the Kenyan National Electronic Single Window System led to great efficiency, transparency and effectiveness in the port operations that resulted in enhanced revenue collection for the government and reduced cost of doing business for both the public and private sector. Ghanaian ports can reduce costs in their chains through transportation cost savings, time savings and reduction in errors (Sichilima and Gikonyo, 2017). Costs incurred by exporting and importing firms in Ghana are caused by both internal factors and external factors within their port chain (Kholkin, 2017). Nordås and Piermartin (2004) explained that production in Ghanaian firms could be halted because a particular part needed for production was locked up at the Ghanaian Ports. This results in production interruptions which subsequently increases production costs within Ghanaian Port Chain. Therefore, costs of consignment at the Ghanaian Ports are escalated by the time goods are cleared. Sanchez *et al.* (2003) also stated that the cost of tariffs and duties paid on exports and imports passing through the Ghanaian Ports increased the cost of inventory and production costs. Moreover, travelling expenses and expenses related to documentations for the clearance of goods are added up to the administrative costs incurred by export and import firms in Ghana. United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP, 2013) explained that paperless port clearance makes business more efficient in their cost management. Based on this, it is hypothesized that:

H1. There exists a positive relationship between Paperless Port Clearance and Transaction Cost Reduction among firms in Ghana.

In a study by Sarathi (2006) on container security, the author mentioned that the greatest concern of supply chain executives is security of the in-transit inventory. It was discovered that the ports have greater stake in ensuring the safe delivery of transported goods. A non-smooth transport of the goods results in delays, increased holding costs, and production disruption. All these are factors that have the potency of affecting customer order fulfillment (Tengfei and Duval, 2013). Therefore, this study hypothesizes that

H2. Paperless IT-based port clearance positively influence customer order fulfillment in Ghana.

Ports are not external parties to supply chains. They are not third-party service providers, rather, they are part of the supply chain of every exporter or importer the port operates with. Not only are they part of the supply chain, but they are powerful actors in the supply chains (Carbone and Martino, 2003). Thus, a paperless port clearance is likely to increase supply chain visibility, shorten lead time, promote trust and collaborations, and this will eventually strengthen the relationships in the supply chains (Shepherd, 2014). Therefore, this study hypothesizes that

H3. Paperless IT-based port clearance positively relates to supply chain relationship development.

Data and methodology
In accordance with other studies (such as Latif *et al.*, 2021; Park and Baek, 2018; Meier and Schäfer, 2018) this study employed the survey method to evaluate the relationship between paperless custom clearance and business supply chains. The survey method is a quantitative technique used to examine the relationship between constructs (Latif *et al.*, 2021; Newsted *et al.*, 1998). Thus, a paper-based questionnaire was used to collected primary data from the respondents. The items used in the study were adapted from United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP, 2013). The items on the

questionnaire were measured with a five-point Likert scale (1 – Strongly Agree to 5 – Strongly Disagree). The respondents were purposively selected from import and export firms. They were deemed appropriate to provide the right kind of data needed to answer the research questions because they are very much involved in port operations. The respondents were briefed on the purpose of the survey and the researcher assured them that their identity will never be exposed. Also, the respondents were assured that participation in the survey is not compulsory. In other words, they have the right to opt-out at any time if they so wish. The main concepts in the survey were explained to the respondents before administering the questionnaire. This gave the researchers the opportunity to clarify all ambiguous issues. With regards to eligibility, only top managers of the selected firms were recruited to participate in the survey. 145 out of 200 questionnaires distributed were retrieved. However, 139 was used for analysis.

Results and discussion
Firms' background
The respondents were asked to disclose some background information about their respective firms and the responses are presented on Table 1: Two respondents representing 1.4% disclosed that their firm is less than a year old. 12 (8.6%) respondents indicated that their firms are between 1 and 3 years old. 21 (15.1%) respondents also responded that their firms have been in existence for a period of 4–6 years. 33 (23.7%) respondents also answered that their firms have been in existence for a period of 7–9 years now. 71 (51.1%) of the respondents also indicated that their firms have been in existence for 10 years and over. The researchers further probed to investigate the length of time for which these firms have been involved in international trade. 4 respondents (2.9%) answered that their firms started using the port clearance a year or less ago. 14 (10.1%) respondents also answered that their firms have been involved in the clearing process for a period of 1–3 years now. 29 (20.9%) respondents also responded that their firms have been involved in the port clearance process

Measures	Categories	Frequency	Percentage
Firms age (in years)	Less than 1	2	1.4
	1 to 3	12	8.6
	4 to 6	21	15.1
	7 to 9	33	23.7
	10 or more	71	51.1
Years in port clearing	Less than 1	4	2.9
	1 to 3	14	10.1
	4 to 6	29	20.9
	7 to 9	35	25.2
	10 and more	57	41
Firms' clearing status	Exporting	16	11.5
	Importing	99	71.2
	Both	24	17.3
Industry	Agriculture	12	8.6
	Automobile	7	5
	Building, mining and engineering	25	18
	Chemical and agrochemical	12	8.6
	Energy, electrical and electronic	22	15.8
	Food and beverage	37	26.6
	Pharmaceuticals	17	12.2
	Others	6	4.2

Table 1.
Background
information of firms

for a period of 4–6 years now. 35 (25.2%) respondents also indicated that their firms have been involved in the port clearance procedures for a period of 7–9 years now. 57 (41%) respondents also indicated that their firms have been involved in the port clearance procedures for 10 years and more. From the above information on the age of the firms and the length of time for which the firms engaged in international trading, it is evident enough that majority of the firms have been in existence for more than 10 years and they have been involved in the port operations for that long as well. 16 (11.5%) respondents indicated that their firms solely export goods, 99 (71.2%) respondents showed that their firm solely import goods, and 24 (17.3%) respondents indicated that their firms are into both exporting and importing of goods. It is very evident from the statistics above that majority of the firms in Ghana are involved in importing. This confirms the assertions that Ghana imports more goods than it exports. The respondents also provided the industry within which their firms fall. 8.6% of the firms fall within the agriculture industry, 5.7% fall within the automobile industry, 18% fall within the Building, Mining, and Construction Industry, 8.6% fall within the chemical and agrochemical industry. 15.6% fall within the Energy, Electrical and Electronics Energy, 27.3% fall within the food and beverage industry, 12.2% fall within the pharmaceutical industries and 2.8% fall within the other industries including forestry and industrial supplies.

Reliability test result
In order to ensure that the items used in measuring the constructs are reliable, a reliability test is conducted (Table 2). The Cronbach's alpha value is used to determine how reliable the items used to measure the variables in the study are. According to Hair *et al.* (2006), Cronbach's alpha values range from 0 to 1; however, 0.7 is the universally accepted lower limit. Nevertheless, in exploratory studies, this might decrease to 0.6 (Hair *et al.*, 2006). PPC measured the extent to which paperless port clearance practices are adopted: 6 items were used in measuring PPC and the test for reliability revealed a Cronbach's alpha value of 0.918, thus affirming that the items used to measure PPC are reliable and valid. 7 items were used to measure Customer Order Fulfillment, COF. The reliability test revealed a Cronbach's alpha value of 0.924, confirming that the 7 items used are effective and reliable. TCR representing Transaction Cost Reduction was also measured with 5 items. The reliability test indicates an alpha value of 0.873, again revealing that these 5 items are reliable indicators to measure TCR. 5 items were also used to measure Supply Chain Relationship (SCR) and the test for reliability showed a Cronbach's alpha value of 0.915. The Cronbach's alpha value of 0.915 confirms that these 5 items for measuring SCR are reliable. Because all the items were affirmed to be reliable for the measurement of the constructs in this study, no item was deleted.

Descriptive statistics on the extent of paperless port clearance
Table 3 shows the degree to which the IT-based paperless port clearance items presented above are adopted by the Ghanaian ports. The level of adoption indicates the extent to which the port operations are paperless. This result shows the current level at which IT-based port

Variable	No. of items	Cronbach alpha	Revised no. of items	Revised alpha
PPC	6	0.918	–	–
COF	7	0.924	–	–
TCR	5	0.873	–	–
SCR	5	0.915	–	–

Table 2.
Cronbach alpha
reliability result

clearance is adopted by the Ghanaian Ports. On a scale of 1–5, the respondents in the importing and exporting firms were asked to show the degree to which they agree or disagree to the IT-based port clearance system. The scale ranged from 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree to 5 = Strongly Agree. The average score obtained from the descriptive statistics for each item was compared to the Likert scale to determine the level of IT-based paperless clearance adoption in the Ghanaian ports. Generally, the extent to which paperless port clearance are practiced in the Ghanaian ports is minimal. The average item had a score between 3 and 4. This shows that there is minimal agreement to the adoption of paperless clearance in the Ghanaian ports. From Table 3, the presence of regulations to guide electronic transactions has relatively high mean score, followed by presence of certification authority, then electronic interchange of certificate of origin, before the electronic issuance of letters of credit by bankers with respective means of 3.87, 3.86, 3.79 and 3.75 and corresponding standard deviation of 1.055, 1.044, 0.996 and 1.064. The least adopted paperless port clearance practices are the use of electronic exchange of Sanitary and Phyto-Sanitary Certificates and Cross-Border Electronic Data Interchange usage with mean scores of 3.74, 0.958, 3.73, 0.990.

Correlation tests
A correlation test was used to investigate the degree of association between the dependent and the independent variables (see Table 4). According to Einspruch (2005), a correlation from 0.0 to 0.5 is considered a weak correlation whiles a correlation ranging from 0.5 to 1 is considered a strong correlation. Greasley (2008) further explained that the sign of the correlation explains the direction of the relationship in that a negative sign shows that a rise in one variable is associated with a reduction in the other whereas a positive sign indicates that as one variable increases, there is also an increase in the other variable. The correlation results indicate that there is strong positive association between PPC and COF ($r = 0.734$, sig < 0.05), TCR ($r = 0.617$, sig < 0.05) and SCR ($r = 0.625$, sig < 0.05). The results indicate that PPC strongly correlates with COF, TCR and SCR. However, the degree of association is stronger between PPC and COF than the two other relationships. The strong positive correlation between PPC and COF, TCR and SCR implies that a unit increase in Paperless IT-

Measures	Min	Max	Mean	S. D
There are regulations guiding the electronic transactions	1	5	3.87	1.055
There is a certification authority	1	5	3.86	1.044
Cross – Border Electronic Data Interchange is used	1	5	3.74	0.958
Certificate of origin are interchanged electronically	1	5	3.79	0.996
There is Electronic exchange of Sanitary and Phyto-Sanitary Certificates	1	5	3.73	0.990
Our bankers issue letters of credit electronically	1	5	3.75	1.064
Valid *N* (listwise)				

Table 3.
Descriptive statistics on the extent of paperless port clearance

Variables		PPC	COF	TCR	SCR
PPC_com	Pearson correlation	1	0.734**	0.617**	0.625**
	Sig. (1-tailed)		0.000	0.000	0.000
	N	139	139	139	138

Note(s): PPC-paperless port clearance; COF-Customer Order Fulfillment; TCR-Transaction Cost Reduction Variable; SCR-Supply Chain Relationships Variable; **Correlation is significant at the 0.01 level (1-tailed)

Table 4.
Correlation results

Based Port Clearance strongly improves cost reduction, customer order fulfilment and supply chain relationships.

Regression results
Even though the correlation result showed positive association between paperless IT-based port clearance and cost reduction, customer order fulfilment and SCRs, Table 5 provides regression analysis to further test how the paperless IT-based port clearance affects cost reduction, customer order fulfilment and SCRs. The table presents a summary of the results after conducting stepwise regression analysis for the key variables in the study. Greaseley (2008) explained that a regression analysis seeks to find a line that best predicts the linear association between one or more dependent variables and a set of explanatory variables by assessing the relationship between these dependent and independent variables. Pallant (2001) further explained that with regression analysis, values of a dependent variable can be estimated from values of an independent variable. Prior to the regression analysis, the study examined the presence of endogeneity by regressing the dependent variables against the independent variable, the outcome showed that the independent variable does not correlate with the error with the dependent variables. This indicates the endogeneity is not a problem in the context of this study. Using the univariate regression analysis, the result showed that the omitted variable does not confound with either the dependent or independent variables which indicates the absence of endogeneity (Johnston, 1972).

Therefore, a regression analysis was conducted to investigate the extent to which the variation in the dependent variables (customer order fulfillment, transaction cost reduction and supply chain relationships) are accounted for by the variations in the independent variable (IT-based paperless port clearance). Argyrous (2005), explained that a correlation of 0.6 is not twice as stronger as 0.3 as one may be tempted to think. The R^2 value also known as the coefficient of determination tells the extent to which the variations in the explanatory variables have been accounted for by the variations in the independent variable. The R^2 in this study measures the predictive accuracy of the independent variables explored in the study. According to Falk and Miller (1992), the R^2 should be greater than 0.10 for the acceptance of a model's predictive relevance. The regression output showed R^2-square values of 0.539, 0.381 and 0.390 toward customer order fulfillment, transaction cost reduction and supply chain reduction respectively. Though all the R^2 values are higher than the threshold recommended by Falk and Miller (1992), the result showed a higher predictive accuracy toward customer order fulfillment. This implies that paperless port clearance is able to account for approximately 54% of variation within customer order fulfillment. Kwan and Chan (2011) indicated that the standardized regression coefficients are comparable. Thus, comparatively, paperless port clearance has shown to be highly influential on customer order fulfillment. Specifically, the result as presented in Table 5 showed that paperless port clearance has statistically significant positive effect on customer order fulfillment ($\beta = 0.734$; $t = 12.650$) followed by Supply Chain Reduction ($\beta = 0.625$; $t = 4.873$) and Transaction Cost Reduction ($\beta = 0.617$; $t = 9.180$). The result provide evidence to conclude that paperless port clearance has statistically significant positive impact on customer order fulfillment, transaction cost reduction and supply chain reduction.

Variables	B	T	R-Square	F-stat	Sig
PCP and COF	0.734	12.650	0.539	160.029	0.000
PCP and TCR	0.617	9.180	0.381	84.274	0.000
PCP and SCR	0.625	4.873	0.390	87.055	0.000

Table 5.
Standardized
regression result

Hypotheses testing

To begin with, this study envisaged that the paperless port clearance has a positive relationship with transaction cost reduction. The findings showed that paperless port clearance has a positive relationship with transaction cost reduction. Hence, Hypothesis one is confirmed (Table 6). The outcome of the current study is indifferent of Sichilima and Gikonyo (2017) who examined the benefit of the implementation of the Kenyan National Electronic Single Window System on the Kenyan Economy. The study reported that the implementation of the Paperless Port Clearance in Kenya led to great efficiency, transparency and effectiveness in the port operations which resulted in enhanced revenue collection for the government and reduced cost of doing business for both the public and private sector. UNESCAP (2013) also explained that paperless port clearance makes business more efficient in the context of cost management.

Again, the study confirmed that paperless port clearance significantly affects customer order fulfillment. This implies that the implementation of paperless port operations is capable of addressing the problem of delays and production disruptions. This improves customer order fulfillment. This confirms a study conducted by Sarathi (2006) on container security, the author mentioned that the greatest concern of supply chain executives is security of the in-transit inventory. It was discovered that the ports have greater stake in ensuring the safe delivery of transported goods. A non-smooth transport of the goods results in delays, increased holding costs, and production disruption. Tengfei and Duval (2013), also mentioned that delays, and production disruptions have the potency of affecting customer order fulfillment negatively.

Additionally, ports are not external parties to supply chains. They are not third-party service providers, rather, they are part of the supply chain of every exporter or importer who access the facilities of the port. Not only are they part of the supply chain, but they are powerful actors in the supply chains (Carbone and Martino, 2003). Shepherd (2014) explained that a paperless port clearance is likely to increase supply chain visibility, shorten lead time, promote trust and collaborations which will eventually strengthen the relationships in the supply chains. The outcome of this study showed that paperless port clearance positively relates to supply chain relationship development.

Discussion of results

High freight turnover at the ports, and the complex requirements of exporters and importers require sea ports to adopt complex services as well as adapt to the changing technologies and integration with the exporters and importers (Hoa and Haasis, 2017). Countries using modern IT-based infrastructure enhance their operations. For instance, Kenya has adopted the Kenya National Electronic Single Window System (KNESWS) to correct the inefficiencies and delays in their port system (Sichilima and Gikonyo, 2017). Berida (2008) stated that the introduction of information communication technology in port

Hypothesized paths	*B*-value ant *t*-value	Decision
H1: Paperless IT-Based Port Clearance positively influence cost reduction	$\beta = 0.617$; $t = 9.180$, $p < 0.05$	Supported
H2: Paperless IT- Based Port Clearance enhance customer order fulfillment	$B = 0.734$; $t = 12.650$, $p < 0.05$	Supported
H3: Paperless IT-Based Clearance strengthens Supply Chain Relationships	$B = 0.625$; $t = 4.873$, $p < 0.05$	Supported

Table 6.
Hypothesized paths and decision

Note(s): *t*-value are in the parenthesis; Paths evaluated at 5% (one tailed test) significant level; Critical value ≥ 1.645

operations and the implementation of automated clearance system lowers operational costs, lessens the import procedures, reduce cash outflows and reduce uncertainties. Duval and Mengjing (2017) also stated that paperless port clearance enhances regulatory control and compliance through the sharing of data by agencies. Due to the centralized database, all the regulatory agencies can access relevant information for their operations. The results indicate that the IT-based paperless port clearance at the Ghanaian ports has positive impact on the international trading firms in Ghana and their supply chains. It has been discovered that the adoption of IT-paperless port clearance in Ghana greatly influences customer order fulfillment. This confirms the arguments put forth by Berida (2008) that paperless clearance lessens the import procedures and reduce uncertainties. Because the import procedures are lessened, the responsiveness of firms are increased, thereby promoting their efficiency in fulfilling the orders presented by customers. The study found out that there is a strong positive relationship between paperless port clearance and customer order fulfillment. The study has revealed that in the Ghanaian context, the implementation of the paperless port clearance system accounts for approximately 54% variation in customer order fulfillment. It implies that approximately, 54% of the customer order fulfillment efficiency of the internationally trading firms in Ghana could be attributed to the implementation of the paperless port clearance system at the Ghanaian ports.

The study has equally confirmed that IT-based paperless port clearance helps reduce transactional costs in firms. The study's findings clearly suit the presentations of the transaction cost economics theory. According to Chen *et al.* (2017), IT coordination costs are significant costs in external coordination. This made the usage of the transaction cost economics theory plausible in the explanation of the impact that paperless port clearance has on transaction cost reduction in businesses. The usage of information and communication technology in the port clearance is a medium for cost reduction in the businesses. Thus, the study confirms the transaction economics theory. The study discovered that IT-based paperless port clearance at the Ghanaian ports has a strong positive relationship with transaction cost reduction. The outcome of the regression analysis showed that 38.1% variation in transaction cost reduction could be traced to paperless port clearance system. Thus, the study has confirmed that firms can achieve cost reduction when the paperless port clearance is enhanced at the Ghanaian ports. Nevertheless, among the three outcome variables studied, paperless port clearance has the least impact on cost reduction. The reasons for its relatively minimal impact can be investigated by future researchers.

The study has also confirmed that IT-based port clearance enhances SCRs. The study found out that IT-based paperless port clearance positively relates with SCRs. One of the findings made in the study is that IT-based paperless port clearance facilitates and promote supply chain relationship development. The regression model run in the study estimated that a variation in the paperless port clearance accounts for 39% variation in supply chain relationships. This implies that 39% of the variations in the supply chain relationships in the import and export industry is accounted for by paperless port clearance system.

Shepherd (2014) explained that the IT-based port clearance is a process and so countries are not expected to have all of them at a go. In the quest to examine the extent to which IT-based paperless port clearance has been adopted in the Ghanaian context, it was discovered that Ghana has not fully operationalized the IT-based paperless port clearance system. This lends itself to the conclusion that the benefits that arise from paperless port clearance is not fully deployed by the Ghana ports. The study revealed four main findings: The Ghanaian ports have adopted paperless port clearance but they have not fully integrated the IT-based paperless port clearance practices into their operations: paperless port clearance at the Ghanaian ports positively influences customer order fulfillment by the international trade

firms in Ghana: paperless port clearance at the Ghanaian ports positively impact transaction cost reduction at the ports in Ghana and IT-based paperless port clearance at the Ghanaian ports strengthens SCRs in the supply chains of the import and export industry (Agyemang, 2016; Agbozo, 2017; Ashley, 2020).

This study is among the first few attempts in sub-Saharan Africa that attempts to examine the link between paperless clearance system and business supply chains. This study adds to the literature on seaport operations. Also, the application of transaction cost in this context (Seaport Operations in sub-Saharan Africa) is also unique. With regards to policy interventions, the most effective measure will be to improve and promote the use of the paperless clearance system by all stakeholders. Such a move will have a positive influence on the business supply chains. This means delays at the port, transaction cost and order fulfilment will be positively enhanced to facilitate international trade and put Ghana on the maritime map as the best transportation hub.

Conclusion

The transaction cost economics theory is employed to help explain the impact of paperless port clearance on supply chain performances which were measured along transaction cost reduction, customer order fulfillment, and SCRs. As mentioned by Carbone and Martino (2003), ports are parts of the supply chains and they are very instrumental in the coordination of the parties in the supply chains. Therefore, earlier literatures have emphasized the impact that the adoption of paperless port clearance has on the efficiency in the performance of firms and their supply chains. In the study, it was discovered that paperless port clearance Practices have positive impact on customer order fulfillment, supply chain relationships, and transaction cost reduction. This supports the transaction cost economics theory and affirms the earlier literatures. Even though there is a positive and significant correlation between paperless port clearance and these three performance dimensions, the level to which paperless clearance practices are adopted by the Ghanaian ports is minimal. This indicates that the optimal level of performance that is to be obtained from the full utilization of paperless custom clearance is not achieved by businesses in their supply chains. The study revealed that the paperless port clearance has the greatest impact on customer order fulfillment, and has the least impact on transaction cost reduction. The outcome of the study provides information for managers to enhance their operations by effectively utilizing the benefits that are presented by the paperless port clearance. Since the development of the paperless clearance is dependent on the stakeholders, it implies that firms and their supply chains must collaborate with the port authorities to improve the state of the paperless port clearance at the Ghanaian ports.

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