



Effects of Rwanda Electronic Single Window (RESW) on the Movement of Goods along the Rwandan Customs Posts

Nkundabaramye Vincent¹, Mom Aloysius Njong²

¹Kigali Independent University (ULK), Kigali, Rwanda

²University of Bamenda, Bamenda, Cameroon

Email: vincentnkundabaramye@gmail.com

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Abstract

The movement of goods is made complex and unpredictable by various factors. Some of the factors are formal while others are informal. In order to facilitate the movement of goods across the customs posts, Rwanda has introduced a customs centric single window, the Rwanda electronic single window (RESW). This study therefore assesses the effects of RESW on the movement of goods across the Rwandan customs posts using multi-level modelling. More specifically, this study focuses on determining the level of the implementation RESW; examining the level of trade facilitation; establishing the extent to which the movement of goods has been facilitated; and assessing the extent to which RESW affects the movement of goods across the Rwandan customs posts. Data were collected through questionnaire and analyzed using descriptive statistics and Multi-Level Model. The main findings reveal that the level of the implementation of RESW and trade facilitation have on average been improved whereas, the movement of goods has, to a large extent, been facilitated along the Rwandan customs posts. The implementation of RESW has to a large extent improved the level of trade facilitation and significantly and positively affected the movement of goods along the Rwandan customs posts, hence, streamlining and expediting the movement of goods by reducing the factors that make it more complex and unpredictable. More specifically, the results indicate that 1-unit increase in the level of trade facilitation as a result of the implementation of RESW is associated with 1.335 points reduction in the barriers to the movement of goods. However, there is a need for all border crossing agencies to work in a synergy to keep on improving the implementation of RESW.

Subject Areas

Economic System, Economics

Keywords

Single Window, Electronic Single Window, Rwanda Electronic Single Window (RESW), Movement of Goods and Customs Post

1. Introduction

Undoubtedly, cross-border trade and movement of goods face several challenges. At the first instance, the movement of goods is made complex by numerous agencies that intervene in cross-border trade and movement of goods. As such, if for instance, inspection of goods is undertaken separately by different border agencies, or if an importer has to present different documents (worse still, in paper form) to different agencies, it is clear that a lot of time and money is wasted in those procedures (Kafeero, 2008) [1]. Hence, the way customs function and different customs agencies collaborate and exchange trade data plays an important role in facilitating the movement of goods crossing the borders and customs posts. To this end, the adoption and the implementation of single window can lead to effective customs management, enhance collaboration of different customs agencies and eases the movement of goods.

This gives right to argue that the introduction of single window concept in the customs management would be desirable and made compulsory to facilitate the movement of goods. Accordingly, the article 10 (4) of the WTO trade facilitation agreement states that member states are required to use their best endeavours to establish or maintain a single window for submitting the documents and/or data requirements for import, export or transit, and to simplify procedures so that information that has already been supplied via the single window should not be asked for again by another border agency participating in the single window. Member states are also required, to the extent possible and where practical, to make their single windows electronic (International Trade Centre, 2013) [2].

At the East African Community (EAC) level, the partner states have agreed to implement Single Customs Territory (SCT). The agreement for the establishment of the EAC SCT entails the use of a destination model of goods clearance where assessment of goods and revenue collection is done at the first point of entry, thereby facilitating the free flow of goods in the common market (Shippers Council of Eastern Africa, 2015) [3]. Rwanda, as a partner state, adopted the use of Information and Communication Technology (ICT) along the customs posts to improve on transparency and communication and exchange of data among various agencies involved in cross-border trade. In 2011, with support of TradeMark East Africa (TMEA), Rwanda launched a customs centric single window—the Rwanda electronic single window (RESW).

RESW is a network of systems interlinked with the specific aim of reducing the cost of doing business and increasing e-governance in Rwanda (TradeMark East Africa [TMEA], 2017) [4]. This facility was introduced to improve coopera-

tion and sharing information through a single platform between the different agencies involved in cross-border trade and movement of goods. Accordingly, Nizeyimana and De Wulf (2015) [5] assert that RESW provides a system that allows for the submission of a single declaration containing all information required by the various agencies responsible for controlling trade into and out of Rwanda and enables these agencies to inform traders and their representatives of the progress of the release process, hence, saving time and costs as well as avoiding duplication of the processes.

Different studies throughout the literature have been conducted about the single window in general and RESW in particular. For instance, Tosevska-Trpcevska (2014) [6] conducted a study to analyse the effects of the implementation of single window and simplified customs procedures in the Republic of Macedonia and Nizeyimana and De Wulf (2015) [5] conducted a study to examine whether RESW supports trade facilitation amongst others. However, no study has specifically focused on the effects of RESW on the movement of goods. This paper therefore contributes to the existing literature by assessing the effects of RESW on the movement of goods along the Rwandan customs posts. More specifically, this paper is guided by four specific objectives: to determine the level of the implementation of RESW, to examine the level of trade facilitation along the Rwandan customs posts, to establish the extent to which the movement of goods has been facilitated and to assess the extent to which RESW affects the movement of goods across the Rwandan customs posts. More importantly, the paper used multi-level model as a comprehensive approach of methodology to analyze the effects of RESW on the movement of goods.

The rest of this paper is organized as follows: section 2 focuses on literature review, section 3 presents methodology, section 4 addresses results and discussions and section 5 concludes and draws recommendations.

2. Literature Review

2.1. Concept of (Electronic) Single Window

According to the recommendation 33 of United Nations Centre for Trade Facilitation and Electronic Business[UN/CEFACT] (2005) [7], the single window is a facility that allows parties involved in trade and transport to lodge standardised information and documents with a single entry point to fulfil all import, export and transit-related regulatory requirements. According to the African Alliance for E-Commerce (2013) [8], the single window for trade is a national or regional system mainly built on a computer platform initiated by a government or an ad-hoc entity to facilitate the performance of import, export or transit-related formalities, by offering a single point of submission of standardised data and documents in a bid to fulfil official requirements and facilitate logistics. As regard the definition of single window, the basic and common element is that single window is built on the principle of single point for submission of data and decision-making as well as payment.

The overall objective of single window is introducing ICT in border and customs management by promoting electronic submission and exchange of customs data between various trade operators and stakeholders. The United Nations Economic and Social Commission for Western Asia [UNESCWA] (2011) [9] shows that the purpose of a single window is to provide a platform and processes for a paperless (electronic) exchange of trade information between participants in the trade process. The introduction of single window is also considered a significant factor in the development of an integrated border management arrangement (United Nations Economic and Social Commission for Asia and the Pacific [UNESCAP], 2010) [10]. Single window system enables coordination and connection among different border government agencies ensuring that trade activities and transactions are safe, legitimate and seamless across trade and supply chains (Asia-Pacific Economic Cooperation [APEC], 2018) [11].

Historically, the single window evolved as a single physical office that was established to handle all formalities, compliance and payment processes (UNESCWA, 2011) [9]. The architecture of the single window also contains risk management tools which support customs and/or other agencies switch from a total physical examination and controlled system to trade facilitation leading to intervention by exceptions (UNESCAP, 2010) [10]. Besides, it is imperative to mention that the use and scope of single window vary across the countries. It is used to process all customs documentation, including documents pertaining to other government certifications, such as sanitary and phytosanitary standards in some countries and in other countries, it coexists alongside paper-based systems, diminishing the time and cost savings that the former provides (Peterson, 2017) [12].

The introduction of electronic single window is particularly important as it benefits both government agencies and trading communities in a number of ways. At the first instance, electronic single window provides trading agents with an opportunity to submit trade documents and information electronically. The UNESCAP (2010) [10] shows that when information is submitted in electronic form, individual data elements are only submitted once. Additionally, electronic single window helps all stakeholders involved in cross-border trade interchanging data through single submission and processing of data which, in turn, results into a single decision-making and boosts cost and time efficiency to all trading agents.

For governments, it can bring better risk management, improved levels of security and increased revenue yields with enhanced trader compliance. Trading communities benefit from transparent and predictable interpretation and application of rules, and better deployment of human and financial resources, resulting in appreciable gains in productivity and competitiveness (UN/CEFACT, 2005) [7]. This therefore calls for the implementation of single window facility across the borders and customs posts to facilitate cross-border trade and movement of goods.

It is also worth noting that there is no universal single window model for an aspiring economy to copy that guarantees success: each country will find its own route to the most appropriate national solution (UNESCWA, 2011) [9]. Thus, giving an impression that the choice of a given single window model varies from one country to another and its implementation depends greatly on a country's priorities and readiness amongst other factors. However, the UNESCWA (2011) [9] shows that the more effective the role of the single window, the more efficient the complete import/export process becomes, leading to national competitive advantages and corporate and government benefits, including employees and consumers.

In the context of Rwanda, it is worth noting that RESW is based on 3 key pillars: enhanced collaboration between government agencies involved in the regulation of international trade in Rwanda; strengthened government-business relationships; and the use of ICT to improve service delivery, communication and transparency in the trade environment for the benefit of all stakeholders (International Finance Corporation [IFC], 2017) [13]. Besides, the legal framework for the operation of RESW is based on the legislation pertaining to electronic messages, electronic signatures and electronic transactions (Nizeyimana and De Wulf, 2015) [5]. As such, traders submit standardised information to various agencies via a single, common electronic platform, and solicit a rapid response resulting in faster cargo release (TMEA, 2017) [4]. This, in turn, helps the trading community saving time and costs.

2.2. Concept of Movement of Goods

There is a noticeable shortage of literature about the conceptualisation of the concept movement of goods throughout the literature. According to Woudsma (2001) [14], this is because the elements of freight movement and the actors involved are much more complex, which makes it a difficult subject to research. However, movement of goods is generally realized through various means like air; rail; water; and road. In cross-border trade point of view, movement of goods can be defined as the process of moving goods in the country as imports or out of the country as exports and the goods in transit. The concept "movement of goods" has also been defined as the process by which goods are transferred from one place to another¹.

The cross-border movement of goods normally includes a number of steps. Grainger (2007) [15] holds that prior to export, this includes packing, storage, haulage to the port, port entry and customs clearance, and loading onto a vessel. And once arrived in the port of destination, operations include off-loading, storage, release from the port and customs clearance, delivery to the buyer, unpacking, after-sales services and more. All these factors make cross-border movement of goods complex.

¹Operation and Supply Chain Dictionary, <https://www.mbaskool.com/business-concepts/operations-logistics-supply-chain-terms/16288-movement-of-goods.html>, accessed on 26 May 2018.

The complexity of cross-border movement of goods calls for a wide range of intermediaries to intervene. Grainger (2007) [15] highlights that those intermediaries include amongst others: transport operators, trucking and haulage companies, freight forwarders, customs brokers, banks and finance companies, insurance companies, port operators and stevedores, and IT systems suppliers. Beyond this, coordination between those various intermediaries is needed to cope with several operational steps involved in cross-border movement of goods and to ensure compliance with various customs procedures and processes along the transit system.

Furthermore, there are numerous factors which affect cross-border movement of goods. Those factors include a transit system comprising various components like hard and soft infrastructure and institutions that enable the transit system to move goods and vehicles on the corridor (Arvis, Smith, and Carruthers, 2011) [16], all of which having, an impact on the movement of goods. Hence, all these components need to be regularly upgraded in order to ensure effective cross-border movement of goods within the region along the transit system.

Another factor affecting cross-border movement of goods is associated with costs for moving goods. According to Marteau, Raballand, and Arvis (2007) [17], since most developing countries rely heavily on tariff duties, they tend to develop redundant procedures to avoid fiscal loss. As a result, this gives rise to additional inventories, emergency shipments, suspended operations, and lost markets (Arvis, Smith and Carruthers, 2011) [16]. In addition, a low quality of road infrastructure directly increases variable costs, since bad roads mean more fuel consumption and increased maintenance (Arvis, Marteau, and Raballand, 2010) [18]. Moreover, there is an overdependence on unfriendly trade corridors. Accordingly, Arvis, Marteau, and Raballand (2010) [18] admit that the dependence on inputs imported through unfriendly trade corridors leads not only to additional transportation costs but also to exponentially rising costs of production inventories. All these factors therefore contribute to the increase of the costs associated with the movement of goods and have a far-reaching negative impact on cross-border movement of goods.

2.3. Linkage between Single Window and Movement of Goods

In terms of linkage between single window and movement of goods, existing literature shows that the implementation of single window has potential to enhance the level of trade facilitation and hence streamlines and expedites cross-border movement of goods. The introduction of single window system affects cross-border movement of goods in a number of ways. However, at the heart of the single window concept is the automation of the information exchanges that control the flow of goods across national borders (United Nations Economic Commission for Europe, 2013) [19]. This, therefore, has the potential to streamline and expedite the movement of goods by enhancing the efficiency as well as transparency of customs operations. On the other hand, in addition to improv-

ing the efficiency, speed, and transparency of customs processing, single windows streamline time-consuming and often redundant paperwork for customs approvals, as well as reduce the opportunity for corrupt practices among customs officials (Peterson, 2017) [12].

2.4. Theoretical Review

This part focuses on the theoretical review. It reviews globalisation theory to shape the theoretical foundation of this study. Globalisation theory, seen to have started in about the 1980s, is said to have begun with strong accounts of the globalisation of economy, politics and culture and the sweeping away of the significance of territorial boundaries and national economies, states and cultures (Martell, 2007) [20]. However, Robinson (2007) [21] shows that there is not a single theory of globalization but many theoretical discourses which are grounded in broader theoretical traditions and perspectives. In that regard, we identify throughout the literature three broad schools of thoughts (Held *et al.*, 1999) [22] of globalisation theory which are also referred to as waves or perspectives in globalisation theory (Martell, 2007) [20] or stances within globalisation theory (Parjanadze, 2009) [23]. Those perspectives or waves include the hyperglobalists, the sceptics and the transformationalists.

Parjanadze (2009) [23] holds that complete understanding of these approaches will work towards thorough realization of global trends. However, the three waves are not absolutely clear-cut from one another. Some authors fit into more than one perspective (Martell, 2007). Among the three perspectives, there is a rich diversity of intellectual approaches and normative convictions; and yet, despite this diversity, each of the perspectives reflects a general set of arguments and conclusions about globalisation with respect to its conceptualisation, causal dynamics, socio-economic consequences, implications for state power and governance and historical trajectory (Held *et al.*, 1999) [22].

Globalisation waves are concerned with trade flows, trade liberalisation or trade facilitation among the countries. Baldwin and Martin (1999) [24] show that the 1st and 2nd waves of globalisation are superficially similar but fundamentally different in terms of trade flows. In addition to changes in transport and communication costs, the two waves witnessed important changes in trade policy. In general, the central argument in globalisation theory that this study embraces is networking, connecting and integrating all the economies across the world in the global market through the reduction or removal of the barriers to cross-border economic activities including trade and movement of goods. In that regard, Podestà (2003) [25] posits that the reasons that are usually mentioned to explain the contemporary cross-border barriers liberalization have to do with globalisation views. Muhammad *et al.* (2011) [26] also show that the removal of cross-border trade barriers has made formation of global markets more feasible. Equally important, Orga (2005) [27] argues that the removal of barriers to international trade by countries in the quest to operate within the

framework of the multilateral trading system was a major impetus for the acceleration of globalisation of trade.

According to Cetkovic and Zarkovic (2012) [28], globalisation is a phenomenon that has become reality affecting our lives and causing strong debates about whether it brings more benefits or *vice versa*. However, it is evident that globalisation has in general positive and negative effects, which also Orga (2005) [27] referred to as opportunities and challenges, respectively. Held *et al.* (1999) [22] posit that such effects may be visible over both the short and the long term in the ways in which states and societies accommodate themselves to global forces. Nevertheless, Cetkovic and Zarkovic (2012) [28] admit that globalisation has much stronger effect on small countries than on large ones in the sense that smaller countries are typically dependent on foreign trade than larger ones. To confirm the positive and negative sides of globalisation, Cetkovic and Zarkovic (2012) [28] argue that globalisation itself is neither good nor bad, neither fair, nor unfair, it is simply there, present in all spheres of our lives, whether we like it or not. Orga (2005) [27] further explains that globalisation penalizes countries that adopt the wrong macroeconomic and sectoral policies, while enhancing the growth potentials of those that apply sound policies.

Martell (2007) [20] argues that globalisation may have a differentiated effect depending on type (e.g. economic, cultural or political) or location where it is experienced, whilst still being a force. Hence, some groups and societies may be more vulnerable to globalisation than others (Held *et al.*, 1999) [22]. In the context of developing countries, UNCTAD (2008) [29] highlights that with globalization, the potential for developing countries to expand and diversify their economies through the increased development and trade in services is immense.

In terms of trade, Savrul and Insecara (2015) [30] highlight that the emergence and deepening of globalization contribute to world trade on a large scale. Consequently, Orga (2005) [27] shows that an important feature of globalisation is that, it enhances the volume of international trade and investment. Globalisation reduces or abolishes barriers to international economic exchange, by increasing economic integration among countries (Cetkovic and Zarkovic, 2012) [28]. Globalisation is also thought to improve trade relations among the nations and increase trade flows and the volume of international trade. As put it by Cetkovic and Zarkovic (2012) [28], globalisation is not an option (alternative), it is inevitable; and as an inevitable result of this process, the global trade flows benefited from this process substantially (Savrul and Insecara, 2015) [30].

However, the theory of globalisation has been criticised by different scholars in a number of ways. The main critiques view globalization as harmful and perceive it as a force that brings about increased domination and control by wealthier and overdeveloped nations over the poor and underdeveloped countries (Orga, 2005) [27]. According to Robinson (2007) [21], the notion of globalization is problematic given the multitude of partial, divergent and often contradictory claims surrounding the concept. Orga (2005) [27] went further to ex-

plain that though globalisation has been perceived as a force that enhances the volume of trade among nations, international trade continues to be largely concentrated in developed countries. The same point of view was raised by Savrul and Insecara (2015) [30] who showed that while the developed economies with sophisticated economic infrastructure were benefited from globalization process well enough, the status of developing and less developed ones varies from better to worse.

The applicability of globalisation theory in this study hinges on one of its central argument that globalisation theory is directly concerned with networking, connecting and integrating all the economies across the world in the global market. This is to be achieved by removing existing barriers across national boundaries, which, in one way or another, affect cross-border economic activities including trade and movement of goods. Globalisation theory also provides a better understanding of the interdependence between the trading countries and the role of implementing trade facilitation policies like electronic single window in abolishing the barriers to cross-border trade and movement of goods. Hence, enhancing the integration of the countries in global markets and promoting supra-territorial links.

2.5. Empirical Review

In general, the majority of empirical studies show that the introduction of single window has been found to be significantly gainful to all stakeholders involved in cross-border movement of goods. Available empirical studies reveal that the single window has effects on the number of trade documents, the time required for clearance, time for border crossing and trade costs. Hence, reducing delays encountered at the border and customs posts. A study by Tosevska-Trpcevska (2014) [6] which analysed the effects of the implementation of single window and simplified customs procedures in the Republic of Macedonia has revealed that the introduction of the single window has been viewed positively by companies due to savings in time and human resources. The average number of documents had decreased by almost 2 documents, the average number of signatures had decreased by almost 1 signature, the average time by 13.23 hours, and the average financial costs had dropped by almost 500 denars. Another study by English, McSharry and Ggombe (2016) [31] showed that the introduction of an electronic single window system at the border is a positive step.

In the context of Rwanda, Nizeyimana and De Wulf (2015) [5] studied whether RESW supports trade facilitation and their findings show that RESW has made a major contribution to the trade facilitation agenda of Rwanda. Time needed to import and export has been substantially reduced. Another study by the International Finance Corporation (IFC) showed that RESW has reduced time for clearance goods moving across the Rwandan customs posts. The same study revealed that the introduction of RESW resulted into a reduction in the average time to clear imported goods through customs from 264 hours (11 days) in 2012 to 34

hours (1.5 days) in 2014. Export clearance times dropped from 67 hours (about 3 days) to 34 hours (about 1.5 days) (IFC, 2017) [13].

Furthermore, the implementation of RESW affected the time for clearance and the cost of doing business. The TMEA (2017) [4], for instance, reveals that the average time to clear goods from customs has reduced by 46% from 11 days and 1 hour in 2011 to 1 day and 9 hours in 2015. While before the introduction RESW, it took traders 4 days to get their exemptions and phytosanitary certificates approved, with the introduction of RESW, exemption processing and phytosanitary certification times decreased to 2 hours with the cost of each transaction reduced from USD60 to USD10. The IFC (2017) [13] also shows that the implementation of RESW marked the first successful collaboration among Rwanda's numerous agencies that oversee the country's cross-border trade.

Moreover, the Single Window Information for Trade (SWIFT) portals initiative has improved efficiency. For instance, the Rwandan Livestock Inspection Services Department and the National Agricultural Export Board (NAEB) have reduced the average time to issue import and export trade permits from 24 hours to 6 hours and from 24 hours to 4 hours respectively (TMEA, 2016) [32]. Automation of processing of key trade documents along the EAC corridors has contributed to reducing average document clearance times by 3.2 days (77 hours): from 3.3 days (79 hours) to just 2 hours. The average cost per transaction for key trade processes has also fallen by US\$62, from US\$72 to US\$10. This saved US\$6.6 million in 2016 on the total cost of doing business (TMEA, 2017) [4].

3. Methodology

3.1. Study Area, Research Design, Population and Sampling Techniques

The study was conducted in Rwanda, one of the six partner states of the EAC sharing the borders with Tanzania in the East, Uganda in the North, Democratic Republic of Congo in the West and Burundi in the South. The study adopted descriptive research design with mixed approach (qualitative and quantitative). Target population is composed of different trading agents: traders; transporters; freight forwarders; and clearing agents. Based on the nature of the population, the study adopted stratified sampling technique, whereby the population elements were grouped into 4 groups of trading agents that are individually more homogeneous than the total population. Thereafter, purposive sampling technique was applied to select the representative sample from each group. A sample size of 139 respondents comprising 49 traders; 30 transporters; 30 freight forwarders; and 30 clearing agents was determined using a formula suggested by Daniel and Cross (2013) [33]. Uneven number of respondents across the groups of trading agents is explained by the fact that the size of population across the groups of trading agents from which the respondents were sampled was also not equal. The group of traders composed of importers, exporters and both is estimated to have a large size of population.

$$n = \frac{Z^2 pq}{d^2}$$

Whereby, n = sample size; Z = the value on the Z Table at 95% confidence level = 1.96; d = desired level of precision or sampling error = 5% or 0.05; p = Variability of the population estimated at 10% or 0.1; and $q = 1 - p = 0.9$

$$n = \frac{(1.96)^2 (0.1)(0.9)}{(0.05)^2}$$

$$= 138.29 \approx 139 \text{ respondents}$$

3.2. Data Collection Methods, Reliability and Normality

As far as data collection is concerned, a survey questionnaire made of five-point Likert scale items was developed and administered to the respondents. This was arranged into four sections. The first section collected demographic characteristics of participants, the second section gathered data on the level of the implementation of RESW, the third section collected data on the level of trade facilitation and the fourth section collected data on the movement of goods. Thereafter, data collected were tested for internal consistency reliability using Cronbach's Alpha which was found to be 0.784 (see **Table 1**), thus acceptable as recommended by George and Mallery (2003) [34].

To ensure validity, factor analysis scoring for items in the questionnaire was performed. The purpose of this test was to determine the scores of different items in the questionnaire. The items which got the score below the acceptable score or value of 0.3 were then deleted from the questionnaire to restructure it in order to ensure validity. As regard normality of data, Shapiro-Wilk and Kolmogorov-Smirnov tests were performed and their results revealed that data were approximately normally distributed, as they were all greater than 0.05.

Table 1. Test for internal consistency reliability.

Items	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
Items capturing the extent to which the movement of goods has been facilitated along the Rwandan customs posts	0.788	0.792	10
Items capturing the level of trade facilitation across the Rwandan Customs posts in the framework of RESW	0.789	0.802	16
Overall Survey Questionnaire Cronbach's Alpha	0.784	0.789	26

Source: Compiled from Field Data, 2018784.

3.3. Data Analysis and Estimation Methods

Before the analysis, raw data were organised, edited, coded and entered into Statistical Package for Social Sciences (SPSS). Concerning data analysis, while there are different techniques for data analysis, this study adopted descriptive statistics (mean, standard deviation, 95% confidence interval for mean and minimum as well as maximum means) and multi-level model for estimations. These were applied to determine the level of the implementation of RESW, to examine the level of trade facilitation and to establish the extent to which the movement of goods has been facilitated along the Rwandan customs posts. It is also worth noting that before the analysis, data collected were quantified by computing the average scores of the relevant items using SPSS.

In order to estimate the extent to which RESW affects the movement of goods across the Rwandan customs posts Multi-Level Model was applied. As such, null hypothesis that “RESW has no effect on the movement of goods across the Rwandan customs posts” and the alternative hypothesis that “RESW has significant positive effects on the movement of goods across the Rwandan customs posts” were tested given that the relationship between RESW (X) and the movement of goods (Y) would be moderated by the level of trade facilitation (W). In that regard, the following models were employed: null model (1), random intercept and fixed slope model (2), random intercept and slope model (3), and cross-level interaction model (4).

$$y_{ij} = \gamma_{00} + u_{0j} + e_{ij} \quad (1)$$

$$y_{ij} = \gamma_{00} + \gamma_{10}(X_{ij} - \bar{X}_j) + \gamma_{01}(W_j - \bar{W}) + u_{0j} + e_{ij} \quad (2)$$

$$y_{ij} = \gamma_{00} + \gamma_{01}(W_j - \bar{W}) + \gamma_{10}(X_{ij} - \bar{X}_j) + u_{0j} + u_{1j}(X_{ij} - \bar{X}_j) + e_{ij} \quad (3)$$

$$y_{ij} = \gamma_{00} + \gamma_{01}(W_j - \bar{W}) + \gamma_{10}(X_{ij} - \bar{X}_j) + \gamma_{11}(X_{ij} - \bar{X}_j)(W_j - \bar{W}) + u_{0j} + u_{1j}(X_{ij} - \bar{X}_j) + e_{ij} \quad (4)$$

Whereby,

y_{ij} : Response variable (movement of goods) score for the i^{th} trading agent in group j ;

γ_{00} : Grand mean movement of goods across the groups of trading agents

u_{0j} : Group level (level 2) residual term

e_{ij} : Individual level (level 1) residual term (randomly distributed error).

X_{ij} : Individual RESW score for the i^{th} trading agent in group j

\bar{X}_j : Group average RESW score

W_j : Group j level of trade facilitation score

\bar{W} : Average group level of trade facilitation score

γ_{10} : Predicted slope regressing RESW on the movement of goods

γ_{01} : The amount of change in the scores of the movement of goods associated with a 1-unit increase in the level of trade facilitation

γ_{11} : Cross-level interaction effects: moderating effects of the level of trade facilitation on the relationship between RESW and the movement of goods.

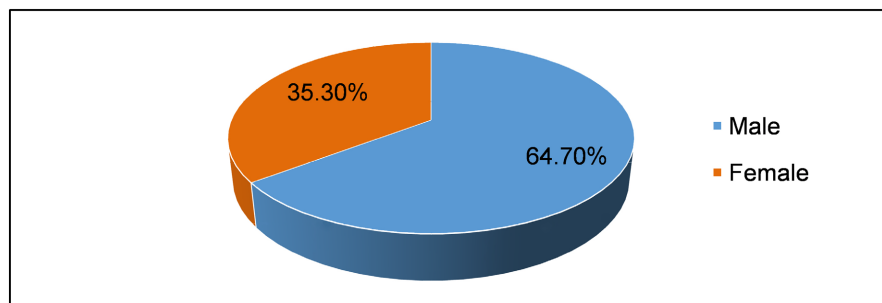
4. Results and Discussions

4.1. Demographic Characteristics of Respondents

This part presents demographic characteristics of the respondents. The study engaged a total number of 139 respondents comprising the various groups of trading agents such as traders, transporters, freight forwarders and clearing agents using a survey questionnaire to collect necessary data on the aspects of trade facilitation and movement of goods along the Rwandan customs posts. However, demographic characteristics of the respondents are defined in terms of gender, age group, experience, cross-border trading activity and transit corridor used. This part starts by defining gender characteristics as shown in **Figure 1**.

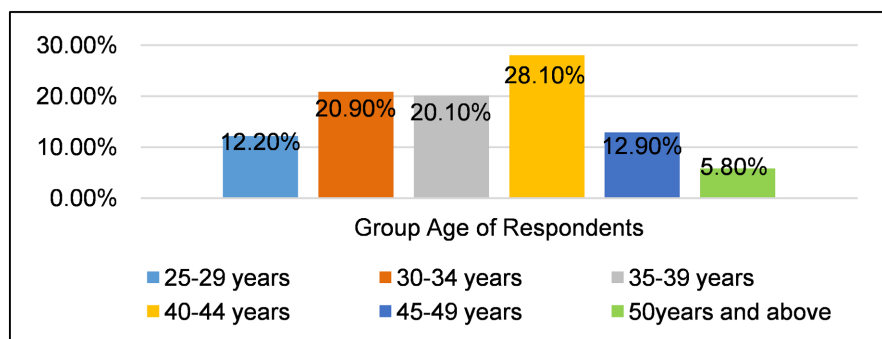
In terms of gender characteristics, the results in **Figure 1** show that both male and female trading agents participated in this study. However, male trading agents dominated the study as the majority of the respondents were male with a proportion of 64.70% compared to female respondents who constitute 35.30% of the total respondents. Furthermore, the respondents were described in terms of their age group in order to understand their age composition. A summary of the results of age characteristics of the respondents is presented in **Figure 2**.

According to **Figure 2**, respondents from different age groups participated in this study. However, a large proportion of the respondents totaling up to 28.1 percent were aged 40 - 44, followed by those aged 30 - 34 and 35 - 39 with the



Source: Compiled from Field Data, 2018.

Figure 1. Gender of the participants.



Source: Compiled from Field Data, 2018.

Figure 2. Age of the Participants.

proportion of 20.9% and 20.1% respectively. Those aged 25 - 29; 45 - 49; and 50 years and above were 12.20%, 12.90% and 5.8% respectively. Hence, these results indicate that the majority of the trading agents (respondents) were in their early adulthood. The respondents also use either of the Northern or Central Logistics Corridor or both in their cross-border trading activities. Hence, **Table 2** provides the statistics of respondents for each group of trading agents according to the transit corridor used.

Referring to **Table 2**, the group of traders has the highest number of respondents (35.25%) while, the groups of transporters, freight forwarders and clearing agents have the same number of respondents, each constituting 21.58%. This implies that the respondents who participated in this study are engaged in different cross-border trading activities such as trading, transporting, freight forwarding and clearing activities. However, the majority are engaged in trade activities (importing, exporting and both of them).

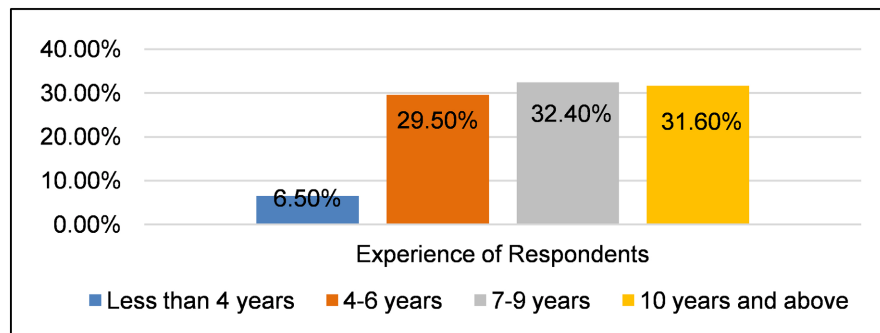
In addition, while some trading agents across the different groups use either of the Northern or Central Logistics Corridor, others use both corridors for moving goods to or from Rwanda. More specifically, **Table 2** shows that 30.22% use the Northern Logistics Corridor, 23.74% use the Central Logistics Corridor, and 46.04% use both corridors. The results indicate that the majority of trading agents use both Mombasa and Dar es Salam ports to move their goods to or from Rwanda.

As regard the experience (duration) of trading agents in cross-border trading activities, **Figure 3** reveals that the largest proportion equivalent to 32.40% of the respondents have been engaged in cross-border trading activities for a period of 7 - 9 years. This is followed by those who have been engaged in cross-border trading activities for 10 years and above and those in the range of 4 - 6 years, each forming a proportion of 31.60% and 29.50% respectively. However, the respondents engaged in cross-border trading activities for less than 4 years

Table 2. Activity of the participants according to the transit corridor used.

Activity	Corridor			Total	Percent
	Northern Corridor	Central Corridor	Both of them		
Traders	17	7	25	49	35.25
Transporting	12	2	16	30	21.58
Freight forwarding	4	18	8	30	21.58
Clearing Agents	9	6	15	30	21.58
Total	42	33	64	139	100.0
Percent	30.22	23.74	46.04	100.0	

Source: Compiled from Field Data, 2018.



Source: Compiled from Field Data, 201.

Figure 3. Experience of respondents in cross-border trading activities.

constitute the least proportion of 6.50%. Generally, these results imply that the respondents had good knowledge about trade and movement of goods across the Rwandan borders and customs posts as well as the operations of borders and customs posts.

Next, we analyze data according to the objectives of the study. However, it is worth noting that qualitative data collected across the groups of trading agents using a questionnaire made of five-point Likert scale items were quantified by computing average scores using the Statistical Package for Social Sciences (SPSS) before their analysis. Thereafter, descriptive statistics including means were applied to examine the implementation level of RESW, to determine the level of trade facilitation and to establish the extent to which the movement of goods has been facilitated. In that regard, statistical ranges of mean and corresponding descriptive rating were adopted in order to facilitate the interpretation of the results. A mean of 1.00 - 1.80 indicates a very poor/low level/extent; a mean of 1.81 - 2.60 indicates a poor/low level/extent; a mean of 2.61 - 3.40 indicates moderate level/extent; a mean of 3.41 - 4.20 indicates a good/high level/extent; and a mean of 4.21 - 5.00 indicates a very good/high level/extent (Parilla, 2013 [35]; Saduak *et al.*, 2017 [36]).

4.2. Level of the Implementation of RESW

The level of the implementation of RESW across the Rwandan customs posts was determined using descriptive statistics like mean, standard deviation, 95% confidence interval for mean and minimum and maximum mean as summarised **Table 3**.

According to **Table 3**, the level of the implementation of RESW is scored differently across the groups of trading agents. It is scored 3.7143 by traders; 4.2333 by transporters; 4.00 by freight forwarders; and 3.7667 by clearing agents. The results also reveal that the minimum mean score of the level of the implementation of RESW is 2.0 for the groups of traders, freight forwarders and clearing agents and 3.0 for the group of transporters while the maximum mean score for either of the groups of trading agents is 5.0. However, the level of the implementation of RESW is on average scored 3.8993.

The results of this study indicate that the level of the implementation of RESW along the Rwandan customs posts is on average rated good across the groups of trading agents and in general. This gives an impression that the implementation of RESW has been successful and to a large extent benefited trading community by simplifying and harmonising customs clearance procedures and documents and promoting collaboration among different trading agents. These findings are in accordance with the findings of IFC (2017) [13] which show that the implementation of RESW marked the first successful collaboration among Rwanda's numerous agencies that oversee the country's cross-border trade.

4.3. Level of Trade Facilitation

The purpose of this part is to determine the level of trade facilitation along the Rwandan customs posts. This was done using descriptive statistics such as mean, standard deviation, 95% confidence interval for mean and minimum and maximum mean as presented in **Table 4**.

Table 3. Level of the implementation of RESW across the groups of trading agents.

Trading Agents Group	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Min	Max
				Lower Bound	Upper Bound		
Traders	49	3.7143	0.86603	3.4655	3.9630	2.00	5.00
Transporters	30	4.2333	0.62606	3.9996	4.4671	3.00	5.00
Freight Forwarders	30	4.0000	0.74278	3.7226	4.2774	2.00	5.00
Clearing Agents	30	3.7667	0.93526	3.4174	4.1159	2.00	5.00
Total	139	3.8993	0.82791	3.7604	4.0381	2.00	5.00

Source: Compiled from Field Data, 2018.

Table 4. Level of trade facilitation across the groups of trading agents.

Trading Agents Group	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Min	Max
				Lower Bound	Upper Bound		
Traders	49	4.2129	0.23039	4.1467	4.2791	3.74	4.63
Transporters	30	4.3281	0.25796	4.2318	4.4245	3.85	4.79
Freight Forwarders	30	4.3433	0.19646	4.2700	4.4167	3.93	4.67
Clearing Agents	30	4.3131	0.20183	4.2378	4.3885	3.83	4.78
Total	139	4.2875	0.22864	4.2492	4.3259	3.74	4.79

Source: Compiled from Field Data, 2018.

Referring to **Table 4**, the level of trade facilitation along the Rwandan customs posts is slightly different perceived across the groups of trading agents. It is scored 4.2129 by traders; 4.3281 by transporters; 4.3433 freight forwarders; and 4.131 by clearing agents. On the other hand, the minimum mean scores for the groups of traders, transporters, freight forwarders and clearing agents are 3.74; 3.85; 3.93; and 3.83 respectively, while the maximum mean scores are 4.63 for traders, 4.79 for transporters, 4.67 for freight forwarders and 4.78 for clearing agents. However, the level of trade facilitation along the Rwandan customs posts is on average scored 4.2875.

These results suggest that the level of trade facilitation along the Rwanda customs posts is rated very high in general and across the groups of trading agents as the result of the implementation of RESW. These results suggest that the implementation of RESW improves trade facilitation along the Rwandan customs posts. This means that the implementation of RESW simplifies and reduces to a large extent the customs clearance procedures, trade documents and formalities for moving goods. It also streamlines cooperation and exchange of customs data through the single window as well as other customs practices. The results of this study support the literature that the introduction of single window has been viewed positively (Tosevska-Trpcevska, 2014) [6]. More specifically, a study by Nizeyimana and De Wulf (2015) [5] confirmed that the implementation of RESW has made a major contribution to the trade facilitation agenda of Rwanda.

4.4. Extent to Which the Movement of Goods Has Been Facilitated

In order to establish the extent to which the movement of goods has been facilitated along the Rwandan customs posts, descriptive statistics were applied to analyze data collected across the different groups of trading agents. A summary of the results is presented in **Table 5**.

According to **Table 5**, the extent to which the movement of goods has been facilitated along the Rwandan customs posts is scored differently across the groups of trading agents. It is scored 3.7816 by traders; 4.0167 by transporters;

Table 5. Extent to which the movement of goods has been facilitated.

Trading Agents Group	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Min	Max
				Lower Bound	Upper Bound		
Traders	49	3.7816	0.34198	3.6834	3.8799	3.10	4.50
Transporters	30	4.0167	0.41447	3.8619	4.1714	3.20	4.80
Freight Forwarders	30	4.0033	0.31126	3.8871	4.1196	3.30	4.60
Clearing Agents	30	3.9033	0.30567	3.7892	4.0175	3.50	4.80
Total	139	3.9065	0.35635	3.8467	3.9662	3.10	4.80

Source: Compiled from Field Data, 2018.

4.0033 by freight forwarders; and 3.9033 by clearing agents. Both minimum and maximum mean scores are slightly different across the groups of trading agents. The minimum mean scores ranges between 3.10 and 3.50 and the maximum mean scores ranges between 4.5 and 4.8. On average, the extent to which the movement of goods has been facilitated along the Rwandan customs posts is scored 3.9065.

These results, therefore, suggest that the extent to which the movement of goods has been facilitated along the Rwandan customs posts is rated high across the groups of trading agents and in general. This indicates that the factors that make the movement of goods complex and unpredictable were in general removed or to a large extent simplified. More specifically, the results of this study give an impression that time taken for clearance, controls and post-clearance audits as well as number of documents required for moving goods have considerably been reduced. Equivalently, formalities for moving goods have been simplified and uncertainties for moving goods as well as roadblocks have been removed. Moreover, the quality of infrastructure facilities for moving goods and warehouse facilities were improved.

The findings of this study are consistent with existing literature that the implementation of single window has on average reduced number of documents, time and financial costs for moving goods (Tosevska-Trpcevska, 2014) [6]. More specifically, RESW has significantly reduced the time to move or transport goods (Ombudo *et al.*, 2014) [37]; time to clear imported goods (IFC, 2017) [13] and time needed to import and export (Nizeyimana and De Wulf, 2015) [5].

4.5. Extent to Which RESW Affects the Movement of Goods

The extent to which RESW affects the movement of goods across the Rwandan customs posts was assessed using multi-level model. The choice of this model was influenced by the nested nature of data. A summary of the results of multi-level model analysis is presented in **Table 6**.

According to **Table 6**—null model, the overall mean movement of goods across the Rwandan customs posts across the groups of trading agents is estimated at 3.920; the within-trading agents group variance is $\sigma^2 = 0.119182$; and the across-trading agents group variance in individual movement of goods is $\tau_{00} = 0.006335$. Hence, the total variance is $0.119182 + 0.006335 = 0.125517$. As such, we can estimate the proportion of the total variation in the movement of goods across the Rwandan customs posts accounted for by group differences. To do so, the intra-class correlation (ICC) coefficient (ρ) was computed as follows:

$$\rho = \tau_{00} / (\tau_{00} + \sigma^2)$$

The ICC was found to be equal to 0.05047. This, therefore, indicates that 5.04% of the variation or differences is between-groups and 94.96% is within-group. With regard to this, Peugh (2010) [38] reveals that the ICC values between 0.05 and 0.20 is common in cross-sectional multi-level modelling applications in social research studies. Hence, the ICC found provides an evidence for applying multi-level model rather than single level analysis.

Next, we test the significance of trading agents' group level effects on the movement of goods. To this end, the likelihood ratio test (LRT) is carried out by comparing null multi-level model to null single-level model. The results of null multi-level model are presented in **Table 6** whereas those of null single-level model are summarized in **Table 7**.

Table 6. Results of multi-level modelling analysis.

Level and Variable	Model			
	Null	Random Intercept and Fixed Slope	Random Intercept and Random Slope	Cross-Level Interaction
Level 1 Effects				
Intercept (γ_{00})	3.920* (0.04968)	-1.882* (0.282)	-1.834* (0.348)	-0.427 (1.345)
The predicted slope regressing RESW on the movement of goods (γ_{10})	-	-0.017 (0.018)	-0.024 (0.162)	0.355 (0.347)
Level 2 Effects				
The level of change in the movement of goods associated with a 1-unit increase in the level of trade facilitation (γ_{01})	-	1.335* (.067)	1.316* (0.067)	0.988* (0.315)
Cross-Level Interaction				
Cross-level interaction effects (γ_{11})	-	-	-	0.088 (0.081)
Variance Components				
Residuals/the within-group (L1) variance (σ^2)	0.119182	0.031	0.029	0.030
Intercept/the between-group (L2) variance (τ_{00})	0.006335	0.0001	0.155	0.009
Slope (L2) variance (τ_{11})	-	-	0.104	0.0009
Intercept-slope (L2) variance (τ_{01})	-	-	-0.074	-0.003
Intra-class Correlation (ICC)	0.05047	-	-	-
-2*log likelihood	102.940	-88.47	-61.951	92.031

Source: Field Data, 2018. Values in parentheses are standard errors; *Significant at $p < 0.01$.

Table 7. Results of null single-level model.

Level	Variable	Estimate	Std. Err.	Stat. TestZ	P > Z
Level 1 Effects	Intercept (γ_{00})	3.906475*	0.0301165	129.71	0.000
Variance Components	Residuals/the within-group (L1) variance (σ^2)	0.1260732	-	-	-
	-2*log likelihood	106.611	-	-	-

Source: Field Data, 2018. *Significant at $P < 0.01$.

The LRT is determined as the difference in the $-2 \times \text{likelihood}$ values for the two models. Hence, $LRT = 106.611 - 102.940 = 3.67$ on 1 d.f. as there is only one parameter difference between the models. The five-percent point of chi-squared distribution on 1 d.f. is 3.84. As such, comparing this critical p-value with likelihood ratio value, it is noticed that there is strong evidence that there is no group effects on the movement of goods. Multi-level model with no group effects is therefore preferred. In that regard, in order to estimate the effects of RESW on the movement of goods, Null Multi-Level Model was extended to Random Intercept and Fixed Slope Model. This was done by allowing the intercept of regression of the extent of trade facilitation to vary randomly across the groups of trading agents in order to estimate the factors that explain the variances σ^2 and τ_{00} .

According to **Table 6**, random intercept and fixed slope model, the mean movement of goods γ_{00} across the Rwandan customs posts for a group of trading agents is -1.882 . On the other hand, the predicted slope regressing the movement of goods on RESW γ_{10} is -0.017 ; and this indicates that the implementation of RESW affects the movement of goods across the Rwandan customs posts.

We have further moderated the relationship between the implementation of RESW and the movement of goods with the level of trade facilitation to determine the extent to which the implementation of RESW affects the movement of goods across the Rwandan customs posts. Accordingly, the results in **Table 6**—random intercept and fixed slope model indicate that the amount of change in the average score of the movement of goods along the Rwandan customs posts γ_{01} is 1.335. This has an implication that 1-unit increase in the level of trade facilitation is associated with 1.335 points of the improvement in the level of the movement of goods across the Rwandan customs posts. Additionally, the results indicate that the effects of RESW on the movement of goods are significantly positive, hence providing an evidence to reject a null hypothesis and to accept an alternative hypothesis that RESW has significant positive effects on the movement of goods across the Rwandan customs posts.

Comparing the results for random intercepts and fixed slope model and those for null multi-level model as shown in **Table 6**, we notice that the addition of the scores of the implementation level of RESW in the model has reduced the amount of variance at both levels, the group of trading agents and individual trading agents. The within-group variance has reduced from 0.119 to 0.031 and the between-group variance has reduced from 0.006 to 0.0001. Besides, comparing both variances, we notice that between-group variances reduction is large. A large reduction in the between-group variances, therefore, suggests that the distribution of trading agents by RESW scores differs from group to group.

Furthermore, in the random intercept and fixed slope model, the intercept of the regression of the level of trade facilitation was allowed to vary randomly across the groups of trading agents. However, in the random intercept and random slope model, both the intercept and slope are allowed to vary randomly

across the groups of trading agents. Consequently, it is important to carry out the LRT in order to test whether the effects of RESW vary across the groups of trading agents. Hence, using $-2 \times \log$ -likelihood ratio for null single-level model (Table 7) and $-2 \times \log$ -likelihood ratio for random intercept and random slope model, the $LRT = 106.611 - (-61.951) = 168.562$. This, therefore, provides a strong evidence that the group effect differs across the groups of trading agents.

Referring to Table 6—random intercept and random slope model, the effects of RESW on the movement of goods across the Rwandan customs posts for group j is estimated at $-0.024 + u_{1j}$ and between-group variance in the slopes is estimated at 0.104. Thus for the average group, a decrease of 0.024 points in the factors that make the movement of goods complex and unpredictable across the Rwandan customs posts is predicted for each increase in the level of trade facilitation across the Rwandan customs posts. Additionally, a 95% coverage interval for the group slopes is estimated at $-0.024 \pm 1.96\sqrt{0.104} = -0.656$ to 0.608. Hence, assuming a normal distribution, it is expected that the middle 95% of groups to have a slope between -0.656 and 0.608.

The results also reveal that the off-diagonal term (covariance between the groups of trading agents' intercepts and slopes) τ_{01} is -0.074 . This off-diagonal term therefore suggests a weak relationship between RESW and the movement of goods across the Rwandan customs posts. On the other hand, negative covariate suggests that the two variables (RESW and movement of goods) move in opposite directions. This means that the implementation of RESW along the Rwandan customs posts negatively affects the factors deterring the movement of goods. An increase in the level of the implementation of RESW will necessarily streamline and expedite the movement of goods along the Rwandan customs posts and make it more predictable by lowering the barriers to the movement of goods. More specifically, it is estimated that 1-unit increase in the level of the implementation of RESW will decrease the factors deterring the movement of goods across the Rwandan customs posts by 0.024 point or 2.4%.

Lastly, using cross-level interaction model the relationship between the implementation of RESW and the movement of goods was moderated by the level of trade facilitation across the Rwandan customs posts. Accordingly, Table 6—cross-level interaction model reveals that the cross-level interaction effects (interaction term between the level of the implementation of RESW and the level of trade facilitation) γ_{11} is estimated at 0.088. This interaction term between the level of the implementation of RESW and the level of trade facilitation is found to be positively related to the movement of goods along the Rwandan customs posts. More specifically, a positive amount of the cross-level interaction term suggests that the relationship between RESW and the movement of goods across the Rwandan customs posts will become stronger if the level of trade facilitation is increased by 1 unit. In addition, a positive amount of the cross-level interaction term suggests that the greater the level of trade facilitation, the stronger the relationship between the level of the implementation of RESW and the move-

ment of goods across the Rwandan customs posts.

In general, the implication of the results of this study is that the improvements in the level of the implementation of RESW will necessarily improve the level of trade facilitation along the Rwandan customs posts. This will, in turn, lead to a considerable reduction in the factors that make the movement of goods along the Rwandan customs posts more complex and unpredictable. In line with the results of this study, existing empirical literature reveals that the introduction of RESW was a positive step (English, McSharry and Ggombe, 2016). Accordingly, it has resulted into a significant reduction in the average time for clearance of goods (IFC, 2017 [13]; TMEA, 2017) and in transaction cost (TMEA, 2017) [4]. Additionally, existing literature reveals that, as a result of the introduction of RESW, time needed to import and export has been substantially reduced, thus increasing the external competitiveness of the country (Nizeyimana and De Wulf, 2015) [5]. Equally important, Chimilila, Sabuni, and Benjamin (2014) [39] showed that these ICT systems have improved efficiency in clearance procedures and contributed a lot, for instance, by reducing the time for clearance and release.

5. Conclusion and Recommendations

5.1. Conclusion

This paper assessed the extent to which RESW affects the movement of goods across the Rwandan customs posts. However, it was guided by 4 specific objectives as indicated in the introduction. As regard the first objective, this paper concludes that the level of the implementation of RESW was rated good and it has streamlined and expedited the movement of goods along the Rwandan customs posts. In terms of the second objective, the findings indicate that the level of trade facilitation was rated very high, which implies that the implementation of RESW has to a large extent improved the level of trade facilitation along the Rwandan customs posts. Concerning the third objective, the results suggest that a high extent to which the movement of goods has been facilitated along the Rwandan customs posts. In line with the fourth objective, the findings indicate significant and positive effects of RESW on the movement of goods along the Rwandan customs posts. Briefly, the results of this study imply that the implementation of RESW significantly contributes to the improvements in trade facilitation. This, in turn, streamlines and expedites the movement of goods by removing the factors that make the movement of goods complex and unpredictable.

5.2. Recommendations

On the basis of the findings, the following recommendations are made. The responsible bodies, border crossing agencies and stakeholders must work in synergy to continue streamlining the way RESW is implemented and get involved in the implementation and consultations. Equally important, the customs man-

agement has to improve on existing mechanisms by which customs laws and procedures are disseminated to the customs users. Finally, this study used primary data collected across the different groups of trading agents. Thus, further study is recommended to diversify the findings and develop common trends using secondary data and the same methodology.

This study contributes to the stock of knowledge by engaging various trading agents to generate fresh data on the implementation of RESW and the extent to which the movement of goods has been facilitated along the Rwandan customs posts. The findings stemming from this study provide a better understanding of the role and the effects of the implementation of electronic single window in promoting trade by alleviating the barriers to cross-border trade and movement of goods. The findings also provide important insights to policy makers and practitioners as well as other stakeholders and development partners involving in the formulation of policies.

In terms of limitations, the study used primary data collected at one point in time on the perception of different trading agents operating across the Rwandan customs posts due to shortage of quantitative secondary data on the level of trade facilitation, RESW and movement of goods along the Rwandan customs posts. To this end, the researcher recommends a longitudinal study with repeated observations over time.

Conflicts of Interest

The authors declare no conflicts of interest.

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