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Title: Transforming the Sudanese Economy: Leveraging trade facilitation, e-commerce and geographical indication protections through Distributed Ledger technology.

Author: Juan Felipe Rodrigo López
Supervisor: Craig Atkinson

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Abstract:

Blockchain technology is already bringing trust, transparency and security to different processes and commercial applications. This paper explores the potential for blockchain technology to address Sudan's long-standing economic challenge of export concentration given its current process of accession to the World Trade Organization (WTO). In tackling this situation, it is proposed that the protection and promotion of geographical indication (GI) products, the development of e-commerce and implementing the Trade Facilitation Agreement (TFA) provisions should be priorities in support of Sudan's economic development. Blockchain's potential in the context of these areas and implementation challenges is also explored. The paper concludes by suggesting the benefits that implementing blockchain technologies and an "Internet of Rules" could bring to the Sudanese economy and trade policy.

Key words: Blockchain, Internet of Rules, Trade Facilitation, Geographical indications, E-commerce, Sudan

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ABBREVIATIONS AND ACRONYMS

AFREXIMBANK African Export–Import Bank

AI Artificial Intelligence

ARIPO African Regional Intellectual Property Organization

EU European Union

FAO Food and Agriculture Organization of the United Nations

FDI Foreign Direct Investment

GDP Gross Domestic Product

GIs Geographical Indications

IMF International Monetary Fund

IBD Inter-American Bank of Development

IoR Internet of Rules

IPRs Intellectual Property Rights

LDCs Least Developed Countries

NGO Non-Governmental Organization

OECD Organization for Economic Cooperation and Development

PDO Protected Designation of Origin

PGI Protected Geographical Indication

TFA Trade Facilitation Agreement

TRIPS Trade-Related Aspects of Intellectual Property Rights

UNCTAD United Nations Conference on Trade and Development

UNECE United Nations Economic Commission for Europe

UNESCO United Nations Educational, Scientific and Cultural Organization

UNIDO United Nations Industrial Development Organization

USAID United States Agency for International Development

WCO World Customs Organization

WIPO World Intellectual Property Organization

WTO World Trade Organization

INTRODUCTION

Following the secession of South Sudan in 2011, Sudan has seen a slowdown in its economy and has lost 75 percent of its export earnings: 80 per cent of oil cumulative production and reserves are now geographically located in South Sudan (James, 2015). Since then, the country's economy has been struggling given rising inflation, economic sanctions imposed by the United States, the volatility of oil prices and institutional crises due to violence, poor governance, shortages of food and lack of opportunities for improvements to livelihoods (Burger, 2018). However, over the last five years Sudan started an integral institutional reform that is aimed to achieve integration with global markets through a policy of progressive economic liberalization. (Working Party on the Accession of Sudan, 2017). As part of this economic restructuring plan Sudan has not only adopted the Five-Year Economic Reform Program (2015-2019), designed to increase national production in order to enhance exports, but also has reactivated its accession process to the WTO.

According to the legal and economic literature, WTO accession encourages trade liberalization and this, in turn, stimulates economic growth and FDI through securing a stable and predictable legal environment (Alemi, De Melo and Haas, 2016). Aside from tariff reforms, WTO accession creates an obligation to bring national legislation into compliance with WTO rules. Article XVI: 4 of the WTO Agreement reads that *“each Member shall ensure the conformity of its laws, regulations and administrative procedures with its obligations as provided in the annexed Agreements”*

Sudan's Trade Marks Act of 1969 excluded geographical indications (GIs) from being protected as a trademark. The adoption of Trademarks and the Geographical Indications Act of 2018 is expected to provide a wider legal framework that attempts to comply with the WTO Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement's minimum protection requirements. Protection and promotion of Sudanese GI-products may result in increased profits for rural communities as a sign that expresses a known quality, helping to improve market access and for obtaining a greater remuneration from commercialization (UNCTAD, 2015).

However, in order to take advantage of the full economic benefits that WTO accession and trade liberalization are expected to bring to the Sudanese economy, Sudan should also focus on implementing reforms that improve logistical inefficiencies to simplify and facilitate the trade flows of goods and in building a strong digital economy. This is said as, according to WTO findings, trade costs in least developed countries (LDCs) such as Sudan are equivalent to applying a 219% ad valorem tariff. (WTO, 2015). Also, e-commerce has the potential to create business opportunities and new ways of distributing products (and services) and increase the access to customers from any geographical area without limitations in of expansion into new markets (Maamar, 2003). Digital markets have been experiencing rapid growth, coupled with an increase in Internet users. (Nogoev, et. al, 2011) With less than 3 million Internet users in 1991, the number hit 300 million by 1999. By 2021, over 2.14 billion people worldwide are expected to buy goods and services online (Statista, 2018)

For reasons that consider the relevance of the digitalized economy to international trade and the potential benefits that the implementation of trade facilitation measures could bring to Sudan, it is necessary to explore how disruptive technologies like blockchain and an “Internet of Rules” (Potvin, Forthcoming), (Xalgorithms Foundation, 2018) could contribute to help Sudan to diversify their exports, reduce transaction costs and take advantage of the access its economy into the world markets.

This paper explores whether and to what extent blockchain and bundles of disruptive technologies, such as an Internet of Rules, can potentialize the economic benefits of Sudan’s WTO accession in terms of protecting future GI products while improving the environment for e-commerce and its interface with trade facilitation reform. In order to achieve this objective, the paper is structured as follows: section I outlines the background Sudanese Economy, including a close look to the agricultural sector to identify opportunities for the development of GI products. In section II, the potential role of blockchain and an Internet of rules are discussed. Further practical issues involving blockchain and an IoR, such as the use of this technologies on certification and registration process for GI products, are described in section III along with the application of blockchain and an IoR to the development of e-commerce and Trade facilitation measures. In section IV, some of the challenges associated with the implementation of blockchain and an IoR are highlighted. Finally, paper concludes

with policy recommendations and general conclusions on the future role of technology in trade.

1. Background: Sudan's challenges and opportunities in trade

Sudan is a large country by geography with lower-middle income, according to the World Bank classification. It has experienced poor economic growth since the financial collapse of 2009 and the secession of South Sudan in 2011 (World Bank, 2018). After these events, the economic growth reached an average rate of 3.3 percent of real GDP, in contrast with real GDP growth between 2000 and 2010 that averaged 7.1 percent. With a population of 40.5 million and a GDP per capita of \$ 1,959.15 USD (2017)¹ Sudan is the second wealthiest country in East Africa².

Sudan is a rural country as 65.99 percent of its population lives in rural areas as reported by the World Bank. Agriculture has an important role in Sudan economy with 80 percent of its population employed in the agricultural sector (FAO, 2015) and as its share in Sudanese GDP represents 30.45 percent. However, the contribution of this sector has fallen since 1990s when agriculture contributed 45 percent to GDP, as a consequence of the expansion of the oil industry (World Bank, 2014). The contraction of the agricultural contribution to the Sudanese GDP is visible through this period with the decline of traditional exports, such as sesame, leather, cotton, arabic gum, and livestock. These key agricultural exports, that accounted for 60 percent of total exports in 1998, fell to 13 percent over the period 1999 to 2005 (World Bank, 2014).

As the UNDP indicates, the economic impact of Southern Sudan secession reflects the loss in the oil revenues as more than 80% of oil reserves are now in South Sudan's territory (James, 2015). However, efforts aimed at reverting oil dependency have allowed

¹ Purchasing power parity of 2000.

² Considering East Africa as Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Seychelles, Somalia, Sudan, South Sudan, Tanzania and Uganda Source: African Bank of Development. However, Sudan is classified by some United Nations Institutions as a Sub-Saharan while others the United Nations Statistics Division classifies Sudan as North Africa.

Sudan to experience the fastest growth in non-oil exports as compared to countries of the region, such as Ethiopia, Tanzania, and Zambia. (World Bank, 2014).

Despite these efforts, and according to the AFREXIMBANK (2018), Sudan has an Export Concentration Index of 0.65 and an export's commodity concentration of 98 percent. This high export concentration evidences Sudan's reliance on fuels and gold as its primary source of foreign exchange income. The problem with this situation is that Acemoglu and Zilibotti (1997) and McIntyre et al (2018) provide evidence that, with trade openness, the lack of diversification makes economies more vulnerable to the trade shocks as commodity products tend to suffer from volatile market prices. Thus, Sudan should focus in diversifying its exports. As Hausmann and Klinger (2006) state, diversification leads to the production and exportation of goods that positively impact economic development.

It must be noted that the Sudanese export base (3.02 billion U.S. dollars) in oil and gold accounts for more than 70 percent of the total exports (WTO, 2018). Also, agricultural products such as cotton, gum Arabic, sesame, oily seeds and other goods as livestock and leather contribution significantly to the export base. Currently, Sudan is the number one producer and exporter of Gum Arabic, the second largest producer of Sesame Seeds and the ninth biggest gold producer (MIT, 2018).

Table 2: Leading Commodities exports different from Gold and Oil. (Thousand USD)

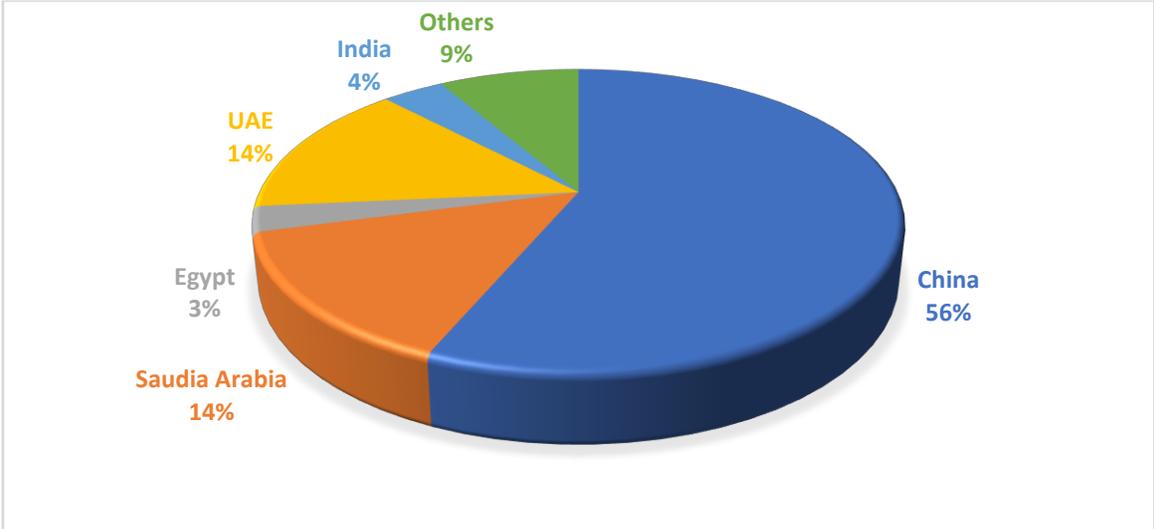
Commodities	2011	2012	2013	2014	2015
Cotton	27'030	11'769	102'736	34'028	39'365
Gum Arabic	81'780	67'102	134'773	96'976	111'687
Sesame	223'270	223'540	472'363	466'338	453'478
Groundnuts	990	3'400	42'837	6'123	2'994
Hibiscus Flower	17'300	14'090	17'280	18'485	18'740
Senna Pods	3'475	2'070	3'040	3'226	2'013
Livestock	294'402	371'493	593'959	792'958	804'300
Meat	7'010	38'106	15'500	19'840	70'081
Vegetables & Fruits	860	4'704	8'538	15'943	28'365
Hides & Skins	39'670	37'029	72'602	43'510	34'197

Source: Central Bank of Sudan

The main trading partner of Sudan is China, where Sudan exports 56.4 percent of the total amount of goods exported and where 22.8 percent of the total imports are originate. According to the World Bank (2014) the importance of the Chinese-Sudanese trade relations

is evidenced through figures that show that while 19 percent of Sudanese oil seed exports are consumed in China, 33 percent of Sudanese cotton is exported to China. Other key trading partners of Sudan are Saudi Arabia, United Arab Emirates, India and Egypt (WTO, 2018).³

Graph 1: Top Sudanese Exports Destinations (2015)



Source: WTO (2018)

The presence of natural resource deposits, including oil, gold, silver, zinc, copper among others has brought Foreign Direct Investment from Chinese, German, Qatari, Malaysian, Indian Egyptian, Indonesian, Lebanese and Saudi investors. In particular, 57 percent of total FDI is concentrated in China, Germany and Qatar (The Arab Investment & Export Credit Guarantee Corporation, 2016).⁴ Finally, estimations made by the African Bank of Development for this year calculate an expected growth of 3.7 percent, as consequence of the U.S. decision to permanently lift trade and economic sanctions on Sudan⁵, the rising gold

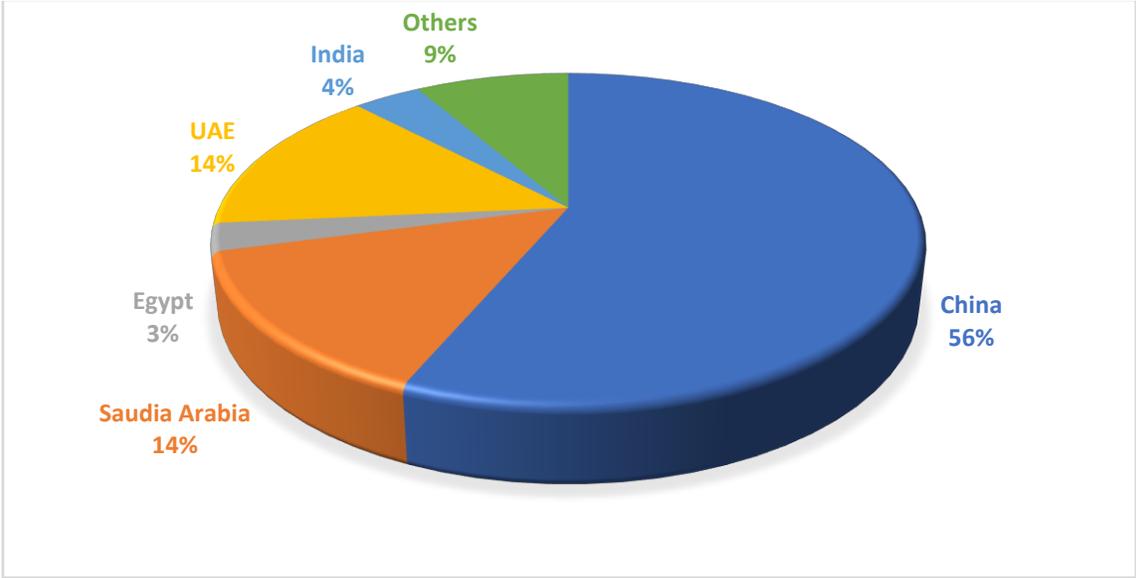
³ WTO (2018) Sudan Trade Profile. Retrieved from https://www.wto.org/english/res_e/statis_e/daily_update_e/trade_profiles/SD_e.pdf

⁴ The Arab Investment & Export Credit Guarantee Corporation (2016) Sudan Inward and Outward FDI <http://dhaman.net/wp-content/uploads/2016/02/Sudan.pdf>

⁵ U.S. DEPARTMENT OF STATE (2017) “Sanctions Revoked Following Sustained Positive Action by the Government of Sudan” available at: <https://sd.usembassy.gov/sanctions-revoked-following-sustained-positive-action-government-sudan/> last visited October 6, 2018

production and the expansion of the agricultural and service sectors that are projected to grow 6.5 percent and 4 percent, respectively.

Graph 2: Top 10 countries investing in Sudan (January 2003- May 2015)



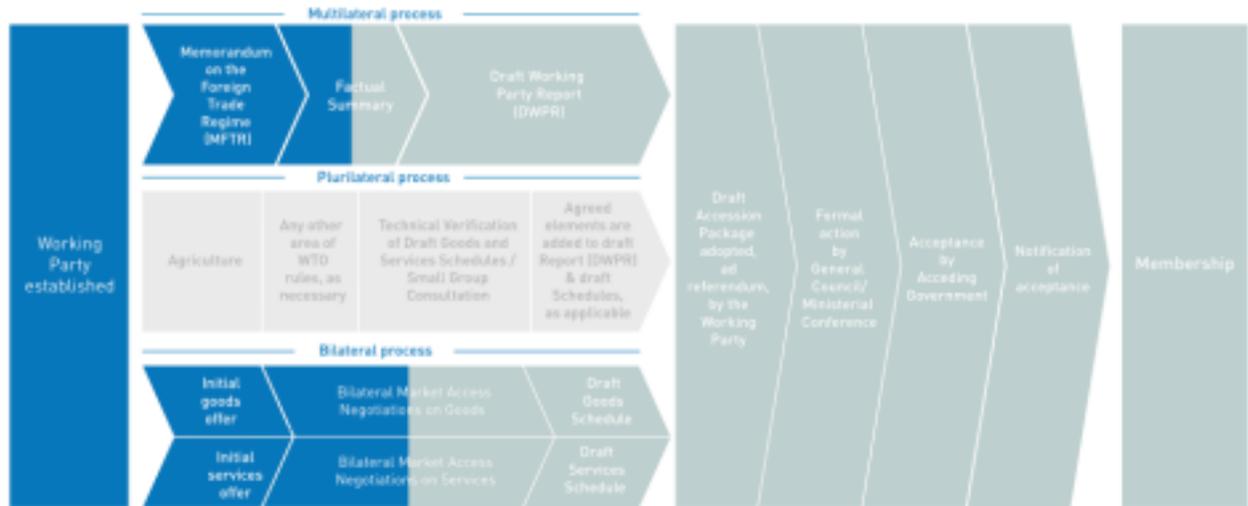
Source: UNCTAD (2016)

1.1 Sudan’s Accession process to the WTO

Sudan’s government applied for accession to the WTO on 24 October 1994. However, the process stagnated in 2004, six years after after Sudan submitted its first memorandum on its foreign trade regime (UNCTAD, 2005). In 2016, following the secession of South Sudan, the WTO accession process was considered an integral part of Sudanese economic reform and was reactivated. As figure 1 shows, Sudan is currently at the stage where the “Factual Summary” is discussed in order to identify if Sudanese laws, regulations and practices are relevant are in conformity with WTO requirements.⁶

⁶ WTO “The accession process — the procedures and how they have been applied” available at: https://www.wto.org/english/thewto_e/acc_e/cbt_course_e/c4s5p1_e.htm last visited October 6, 2018

Figure 2: Current Sudanese Accession Process



Source: WTO (2018)

Findings from Elsheikha, Elbushrab and Salih (2013) suggest that full liberalization will be harmful for the Sudanese economy as *“tariff is a main source of government income, thus its reduction will negatively affect government budget”* (2013, p.72). Also, it has been warned by Alemti et al. (2016) that by joining to the WTO, LDC governments will have less maneuverability in designing industrialization policies aimed to foster infant industries. However, bringing Sudanese laws, technical regulations, and administrative procedures in compliance with the WTO is expected to increase competitiveness and diversify the economy by improving market access and benefiting from most-favored-nation (MFN) treatment. (Siddig, 2010). Tang and Wei’s (2008) findings suggest that the economies of countries with poor governance become 20 percent larger after making a WTO accession commitment, as these commitment increase economic growth and investment for the five years following the accession (2008, p.26).

For these reasons, Sudan’s accession process should be understood as an opportunity to reform and improve the Sudanese investment and business climate. By acceding to the WTO, Sudanese exports of goods and services are expected to enjoy secure, stable, and non-discriminatory access while creating an opportunity to settle trade disputes when Sudanese

enterprises receive unfair treatment in the form of unjustifiable export restrictions in the markets of other WTO member countries.

Liberalization of the markets could help to not only increase FDI, but also to boost economic development, create new jobs and lead to transfer of technology as consequence of the arrival of investment. Losses in government revenues could be compensated with the increase in fiscal revenue as result of the increases in investment, economic activity, production, service-related activities, trade flows, and employment.

1.2 Sudan's WTO Commitments on GIs

After exposing the current status of Sudan's accession process and the benefits that implementation of the WTO's binding policies would bring to the economic development of Sudan, this section outlines the geographical indications provisions embodied in the draft of the country's Trade Marks Act of 2018 as well as multilateral trade facilitation obligations. The aim is to present weaknesses and limitations in these areas so as to propose, in the following sections of this paper, how the introduction of blockchain technology could contribute to Sudan's efforts of becoming an open, competitive and efficient economy.

1.2.1 GI Protection in the Trade Marks and Geographical Indications Bill 2018: Why does it matter?

According to the World Intellectual Property Organization (WIPO), a GI is a "sign" used for products that have a specific geographical origin and possess qualities or a reputation specifically derived from their place of origin (WIPO, 2018). Generally, a GI consists of the name of the place of origin of those products or also symbols that are associated with a place. GIs are not limited to agricultural products, as they can protect manufactured goods and handcrafts that have a quality derived from its place of production or from producer know-how such as selection techniques, traditional production methods or a connection to the local wisdom and heritage (Passeri, 2017).

During the current WTO accession process, Sudan started the process of aligning its intellectual property legislation and regulations in compliance with the provisions of the WTO Agreement on Trade-Related Aspects of Intellectual Property Right (TRIPS). It must be considered that Article 1 of the TRIPS agreement establishes the nature of the obligations

of the Members. For that reason, member States can, without being obliged to do so, grant more protection than that required by TRIPS, if it does not infringe dispositions. Also, member States can freely establish the method to apply the provisions of the TRIPS Agreement within the framework of its own legal practice.

Chapter 10 of Sudan's Trade Marks and Geographical Indications Bill covers Geographical Indicators (GI) and includes them to the Sudanese Intellectual Property Law protection. In the chapter, GIs are defined as:

“The geographical indications specifying the good's origin in an area or place of a member state in the international trade organization, or the treatment of a state in an equivalent treatment, whenever the quality or reputation, or the fame of this good and effecting its publicity, basically referred to its geographical origin”

Besides this, some conditions for registering GIs are imposed such as:

“Be produced continuously with the knowledge of the applicant of registration, in the geographical area of the special fame”

The bill articulates certain exclusions, such as those that are aimed to mislead the public on the origin of the product and trademarks that include a GI when the right had been acquired through a good faith practice before the GI was granted or the 2018 act entry into force. From this chapter it can be observed that Sudan has full compliance with the TRIPS Agreement except for Article 23 of TRIPS, as the commercialization of wines and spirits is forbidden in the territory.

The importance in protecting GI products is, that with the accession to the WTO, Sudan's enterprises would be able to export their products with lower restrictions. However, as international markets are open and competitive, competing with products from third countries where production costs are much lower than in Sudan could limit Sudanese producers' access to consumers. Also, Sudanese products could face the competition of large companies with bargaining power, economies of scale and highly demanded brand that allow them to be price competitive. With this in mind, by differentiating Sudanese products on the basis of quality and reputation, producers could satisfy certain consumers that opt for quality products, seeing the price as secondary (Quiñones Ruiz et al., 2015). This will allow Sudanese producers not only to accede to international markets but also to receive higher economic gains (UNCTAD, 2016).

According to authors as Van Ittersum et al. (2003) offering high quality and value is especially important for the viability of producers located in countries with higher cost structures, while companies in countries that bear lower cost structures could bet more decisively to develop competitive advantages in prices. In rural countries as Sudan, GI products have the potential to prevent rural exodus as the higher economic gains from the production of GI product contribute to the creation of rural employment (WIPO, 2017). Also, Passeri's (2017) findings suggest that GIs create considerable "spin-off effects" on promoting a region as a Gastronomic and Cultural Tourism Destination as evidenced through the increasing tourism campaigns using GI in Champagne, and in Espelette France and in the Colombian coffee Region. However, developing GIs would not automatically lead to consumers to buy these GI products and concentrating all efforts on an enforcement strategy is not viable. In order to make this happen, it is necessary to focus in two strategies:

The first are marketing strategies that make the quality or uniqueness of the GI product stand out and allow for consumers to differentiate between products with geographical origin-based characteristics and others without (WIPO, 2017). Marketing then, represents an important part of GI's success as suggested by Sharma and Kulhari (2015).

A second strategy should focus on gaining access for GI products in export markets. In doing so, Sudan should focus on taking advantage of the expansion of African cross-border e-commerce to allow the country's enterprises to reach a larger number of consumers. Also, Sudan Should put effort into making product distribution more efficient via streamlined customs and other procedures at the border to decrease costs and increase time savings (UNCTAD, 2016). For this reason, the next section presents the implications of developing a sound digital economy and adopting the WTO Trade Facilitation Agreement. Reduced transport-related costs and the decline of other transaction costs would contribute to the efforts of Sudan of diversifying its economy.

1.3 E-commerce in Sudan: Challenges and opportunities

The digital transformation of the economy and the increasing access to internet-enabled services has resulted in the exponential growth of e-commerce. The WTO (1998) defines E-commerce as "*as the production, distribution, marketing, sale or delivery of goods*

and services by electronic means". The OECD defines that an e-commerce transaction consists on *"the sale or purchase of goods or services, conducted over computer networks by methods specifically designed for the purpose of receiving or placing of orders"* (OECD, 2002)

The growing importance of e-commerce is evidenced through figures that estimate, by 2021, global e-commerce sales will reach \$4.5 trillion (Shopify, 2017) and that over 2.14 billion people worldwide are expected to buy goods and services online (Statista, 2018). Africa is no stranger to the digital economy. Despite, infrastructure problems that have limited the development of e-commerce in the region, KPMG finds that African e-commerce will continue growing at an annual rate of 40 percent until 2015 (Macleod, 2017). The sustained growth of the African e-commerce market may translate into a 75 billion dollar market by 2025 (Mckinsey, 2018).

While e-commerce is to a great extent domestic, its international relevance is increasing. By 2016, it was estimated that 12 percent of goods were sold through cross-border e-commerce (IADB, 2018). In Africa, cross border e-commerce is projected to grow by an annual rate of 25 percent, or twice the growth rate of domestic e-commerce (DHL, 2016). E-commerce could bring potential gains to LDC's MSME as e-commerce creates a new sales channel that has two additional advantages in comparison to the traditional commerce.

For instance, an e-commerce site is active 24 hours a day, seven days a week. It also has a geographical advantage in new markets, since it allows to reach potential consumers anywhere in the world (Landström, 2004). E-commerce has fewer overhead costs and related intermediation costs as it shortens the supply chain and leads to more competitive prices for goods and services (Nordin, 2013). As a result, e-commerce allows single sellers and micro, small and medium-sized enterprises (MSMEs) to access to foreign markets where access was previously limited to large enterprises (Manyika et al., 2014).

Several studies examine the impact of e-commerce on diversification of exports. For instance, Wang and Lee (2017) found that the development of e-commerce in Bangladesh and in Cambodia allowed these countries to expand and diversify their exports. The authors highlighted that the diversification of exports through e-commerce leads to a notable increase in exports of the same sector that represent higher value-added goods, as well as niche products and unique offerings. This was seen in Cambodia, where the goods demanded via

cross-border e-commerce were fresh mangoes and cashew nuts instead of the cereals that were traded offline.

Considering that e-commerce reduces intermediation, online consumers tend to demand higher value-added products and the closer relationships between producers and consumers, GI producers could use e-commerce as a distribution channel for expanding the reach of GI products (FAO, 2009). Sharma and Kulhari (2015) suggests that in order to take advantage of the benefits that e-commerce could bring to GI products, governments could create a portal linking each of the individual GI websites for one stop access to all GI products (or tie-in with online retail platforms). Also, fraudulent use of geographical indications could be addressed through public-private agreements such that between the Italian government and eBay / Alibaba for reporting and repressing counterfeit GI products (Qualivita, 2017).

Nevertheless, LDCs like Sudan face challenges that hinder the development of cross border e-commerce and digital trade (ICTSD, 2018). Among the obstacles that have limited the expansion of e-commerce in LDCs are factors such as low IT literacy and deficient service infrastructure that affects access to energy services and Internet connectivity. Also, given limited access to the financial sector, lack of e-payment methods and inefficient logistics systems hamper the inclusion of LDCs and developing countries in international digital markets.

For the Sudanese case, Mohamed, Wang and Elhadi (2014) describe that the development of e-commerce has been low in comparison to neighboring countries like Egypt and Kenya due to low penetration of internet (28 percent of the population⁷), high costs of access to bandwidth, lack of e-payment systems, poor purchasing power, low financial inclusion and IT illiteracy. Also, cultural factors such as Sudanese preference for the use of cash and distrust of e-commerce and e-transactions play a role. (Kardaras, 2009). However, Sudanese mobile phone penetration of 70.4 percent⁸ offers an opportunity to compensate for a limited fixed Internet penetration. In addition, the cash on arrival payment method could help in coping with deficient financial inclusion.

⁷ Freedom House “Freedom on the net 2017: Sudan Country Profile” Available at <https://freedomhouse.org/report/freedom-net/2017/sudan> Last Date of Access (Oct. 21, 2018)

⁸ Statista “Number of mobile cellular subscriptions in Sudan from 2000 to 2017 (in millions)” Retrieved from <https://www.statista.com/statistics/501131/number-of-mobile-cellular-subscriptions-in-sudan/> Last Date of access (Oct 19, 2018)

One of the biggest constraints for developing strong cross-border e-commerce, to improve market access for MSMEs, is high costs and lengthy delays with customs and border procedures (World Bank, 2018). The next section presents the inefficiencies in Sudanese border procedures to expose the way that simplified procedures, adoption of International Standards and e-payments, as stated on the TFA, could enable increased Sudanese cross-border e-commerce.

1.4 The present and future of Sudan’s Trade facilitation measures through the TFA.

By the World Bank’s indicator of “Trading across Borders” that refers to the time and costs associated with the logistical process of exporting and importing goods, Sudan ranks in 185 out of 190 countries. In comparison to the neighboring countries, Sudan performed worse than neighboring countries of Kenya, Egypt and Ethiopia. In fact, as evidenced in *Figure 2*, in every indicator of the Trading across Borders, it was found that exporting from and importing to Sudan is more expensive and takes longer in comparison to the average country in Sub-Saharan Africa.

Figure 3: Trading across Borders index - Sudan

Indicator	Sudan	Sub-Saharan Africa	OECD high income	Overall Best Performer
Time to export: Border compliance (hours)	162	100.1	12.7	0 (17 Economies)
Cost to export: Border compliance (USD)	950	592.1	149.9	0.00 (19 Economies)
Time to export: Documentary compliance (hours)	190	87.8	2.4	1.0 (25 Economies)
Cost to export: Documentary compliance (USD)	428	215.1	35.4	0.00 (19 Economies)
Time to import: Border compliance (hours)	144	136.4	8.7	0.00 (21 Economies)
Cost to import: Border compliance (USD)	1093	686.8	111.6	0.00 (27 Economies)
Time to import: Documentary compliance (hours)	132	103.0	3.5	1.0 (30 Economies)
Cost to import: Documentary compliance (USD)	420	300.1	25.6	0.00 (30 Economies)

Source: Doing Business (2018)

Also, considering the high average release time for clearance processes at Sudanese ports of entry (*explained in Figure 3*) it is evident that, as noted by UNCTAD (2016), repetitive and unproductive administrative processes that generate delays as well as burdensome document filling and checking explain why exporting in Sudan is twice more expensive than in the Sub-Saharan region.

Figure 4: Average release time of clearance in the Sudanese Entry Ports

Import entry point	Average release time
North Quay Port	14 days and 20 hours
South Quay Port	21 days
Swakin Port	11 days
Karthoum Airport	6 days, 15 hours and 35 min
Soba Container Depot (land port)	14 days, 16 hours and 8 min
Wadi Halafa (land port)	6 days, 15 hours, and 30 min
Awseif (land port)	2 days, 7 hours and 7 min
Galabat (land port)	6 hours

Source: Sudan Customs

Trade Facilitation is defined by the UNECE (2014) as “*the simplification, standardization and harmonization of procedures and associated information flows required to move goods from seller to buyer and to make payment*”. In addition, the IBD (2016) adds that trade facilitation is not limited to the reform and modernization of border institutions, but also is meant to make import and export processes more efficient and enterprises more effective by means that include the provision of training in the private sector.

For this reason, the implementation of a national policy in order to ensure that the border agency procedures are more transparent, direct and efficient, fostering better conditions of competitiveness of national products and services abroad is considered necessary for the Government of Sudan. This will not only facilitate the export of GI products, but may enable Sudanese enterprises to participate in global value chains (GVCs). As for participating in GVCs, it is required to have “*the ability to produce specialized goods or services at a demanding level of quality and quantity, and within tight timelines*” (UNCTAD, 2012).

In 2011, Sudan, with the cooperation of the UNCTAD’s Empowerment Program for National Trade Facilitation Committees, designed a “Roadmap for the implementation of

trade facilitation measures from 2017 to 2021” (UNCTAD, 2016). With this, the Government of Sudan decided to ratify and implement the WTO Trade Facilitation Agreement upon Sudan's accession (Working Party on the Accession of Sudan, 2017). The consequence of adopting the TFA implies that Sudan is required to implement key reforms to speed up the movement of goods, within a framework of reducing the costs of international trade. (WTO, 2018) In relation to the agreement, the TFA provides facilitation disciplines that are in line with the efforts being made by developed, developing and LDC countries to simplify and simplify foreign trade operations. These are reflected in the commitments Sudan has made in its roadmap for the implementation of the agreement.

The specific disciplines of the TFA in Section I refer to the publication and availability of information (Article 1), the opportunity to comment before the entry into force of new or amended laws and regulations (Article 2), advance rulings (Article 3), procedures' review (Article 4), non-discrimination and transparency (Article 5), duties and charges (Article 6), the release and rapid clearance of goods (Article 7), cooperation between agencies operating at the border (Article 8), movement of goods (Article 9), formalities relating to import, export and transit (Article 10), freedom of transit (Article 11) and customs cooperation (Article 12) (WTO, 2015).

In the agreement, developing countries and LDCs have the flexibility to implement each provision according to three categories of their own choice, thus determining when they will implement each measure and which measures they will implement only after receiving capacity-building assistance. There are three categories of obligations:

- A.** Upon entry into force of the Agreement, 22 February 2017.
- B.** After a transitional period of time following the entry into force of the TFA
- C.** After the entry into force of the TFA and after receiving assistance for build capacity

With this in mind, Sudan's roadmap designated 16 obligations in category A that will be implemented upon accession, while 7 obligations of category B and another 15 obligations of the category C will be implemented according to Article 16 of TFA and Sudan's roadmap. Among the fully implemented measures of the TFA, Sudan has implemented procedures for appeal and review, notifications for enhanced controls or inspections, use of international standards, and pre-shipment inspections. Some measures that are partially implemented

include electronic payment, the establishment and publication of average release times and measures for fees and charges imposed on or in connection with import and export. Obligations that are not yet implemented include the “Single Window”⁹, the advance ruling and the interval between publication and entry into force.

Figure 4: Proposed Notification of TFA obligations for Sudan

Country	Category A (%)	Category B (%)	Category C (%)	N/A
Sudan	40%	17.5%	37.5%	5%

Source: Authors own using Roadmap for the implementation of trade facilitation measures from 2017 to 2021” (UNCTAD, 2016).

According to Sudan's roadmap, within a five year period, the Sudanese government could achieve full compliance of all measures with the exception of freedom of transit. Also, it was estimated that the impact of the TFA on Sudan would be such that, for 2021, the country will reduce the time of import and export by 40 percent and the volume of exports will rise by 25 percent after the removals of unnecessary procedures that create costs for exporters (UNCTAD, 2016).

Aside from this, the WTO (2015) has found that African LDCs could benefit the most: these countries tend to export time-sensitive goods. The results obtained by the WTO show that a full implementation of the TFA could decrease the time and cost to export by 91 percent and 10.4 percent, respectively (WTO, 2015). Also, government revenues are expected to

⁹ The WCO and UNCENE define single window as “a facility that allows parties involved in trade and transport to lodge standardized information and documents with a single entry point to fulfill all import, export, and transit related-related regulatory requirements”. See, the United Nations Economic Commission for Europe Recommendation on Establishing a Single Window (Recommendation 33, ECE/TRADE/352). (http://www.unece.org/cefact/recommendations/rec33/rec33_ecetrd352_e.pdf)

grow as consequence of the increase in trade and the improved fraud and corruption detection.

In particular for the Sudanese case, the implementation of the TFA has considerable relevance as the WTO (2015) found that the implementation of the agreement creates the possibility to increase traditional exports of LDCs between 13 percent and 36 percent. The agreement also promotes export diversification for developing countries, as producers that were not able to export due to the high export costs would be encouraged to export if profitability is attainable. In addition, evidence from Nordås et al. (2006) and Dennis and Shepherd (2011) found that a more efficient export process would encourage exporters of non-durable goods to export their products.

Despite the benefits that TFA implementation could bring to LDC like Sudan, the implementation costs that LDCs face could delay the full implementation of the TFA. This is said as UNCTAD's calculations estimate that in order to achieve the implementation of all TFA measures, developing countries must spend between \$5 million and \$15 million USD (UNCTAD, 2016b). Thus, given the limited budgets of LDC and developing country governments, the WTO (2015) states that implementation could suffer due to lack of political and public support. Also, structural problems like deficient infrastructure and limited internet stability could keep enterprises in LDCs and developing countries from participating in the global value chain beyond providing raw materials.

The next section explores how blockchain technology and an "Internet of Rules" can help Sudan to overcome challenges in implementing the TFA to achieve more efficient cross-border trade that allow for diversification of exports and development of Sudanese GI products.

2. Blockchain technology and an Internet of Rules: disrupting the international trading system

Findings from Kumar et al. (1998) suggest that trust between trading partners is essential: trust has the potential to reduce trust transaction costs as trust increases cooperation among parties, leading to less asymmetries of information. (Ratnasingham & Kumar, 1999). In the paper “Cross-border trade: fuelling conflict or building peace?” Carrington (2009) describes that a virtuous circle exists between trust and trade, as building trust boosts cross-border trade and that growing cross-border commerce tends to also strengthen trust between traders.

Building trust can be costly, as both trading partners have incentives to not trust each other due to existing information asymmetries (Kumar, 1996). Trustless middlemen emerged to charge transacting parties for establishing trust amongst them. This is described by the World Economic Forum:

“Currently, most people use a trusted middleman such as a bank to make a transaction. But blockchain allows consumers and suppliers to connect directly, removing the need for a third party”¹⁰.

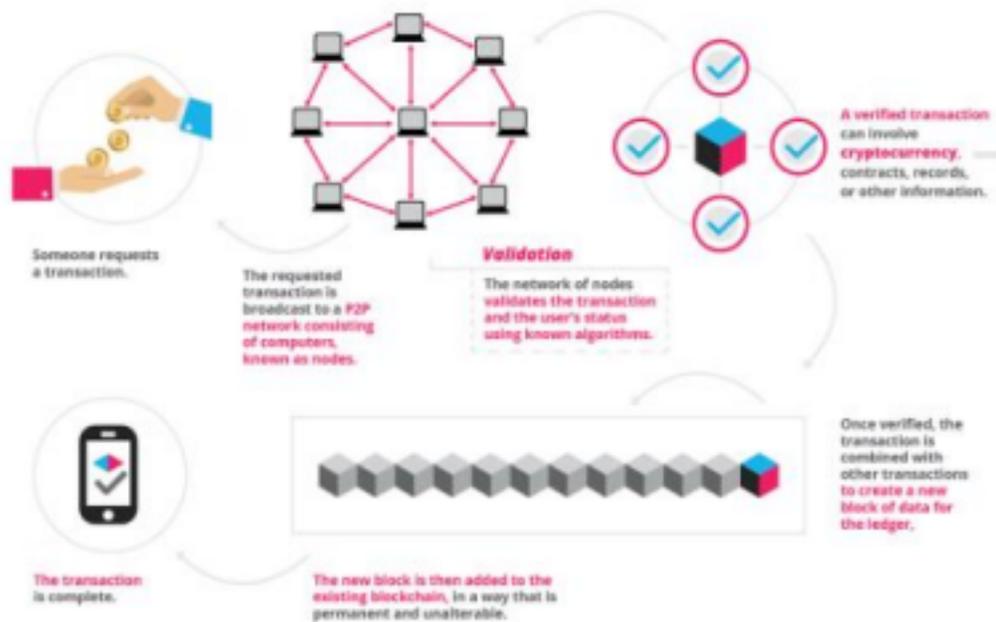
Blockchain technology represents a distributed, constantly updated, database that works as a large "general ledger" where transactions and documents are recorded or published, in blocks, to which any person, duly authorized, can access and is shared among all participants in the system so as to achieve traceability of operations (Cong & He, 2017). The blockchain uses cryptography protocols in order to transaction data secure. As Thompson (2018) notes that this allows separate parties to have shared trust in a transaction because the ledger cannot be easily falsified or manipulated.

Blockchains offer transparency and security because they cannot be altered without the intervention or knowledge of others. This preserves the integrity of the information as all participants have a full copy of the ledger. The shared character results in decentralized control, as all the participants in the network should agree to validate each record. This is

¹⁰ World Economic Forum (2016) all you need to know about blockchain, explained simply 17 June 2016. Retrieved from: <https://www.weforum.org/agenda/2016/06/blockchain-explained-simply/> Last Date of access (Oct 22. 2018)

relevant to centralized formulas, such as for single windows, where transactions and administrative procedures flow through single entry points hosted on platforms managed by a third-party (Cong & He, 2017). Once a transaction is verified, a block that contains information of the transaction is stored in a shared ledger across the network as explained *in figure 5* displays.

Figure 5: How Blockchain works



Source: Ammer Rosic for Blockgeeks¹¹

As described by the World Economic Forum:

“The technology can work for almost every type of transaction involving value, including money, goods and property. Its potential uses are almost limitless: from collecting taxes to enabling migrants to send money back to family in countries where banking is difficult. Blockchain could also help to reduce fraud because every transaction would be recorded and distributed on a public ledger for anyone to see.”

¹¹ Ameer Rosic, Blockgeeks: What is blockchain technology, Available at <https://blockgeeks.com/guides/what-is-blockchain-technology/> (accessed on October 12, 2018)

The influence of blockchain technology on global transactions is on the rise, with incorporation and use of this technology by private and public actors. According to UNITE (2017), 15 UN entities were carrying out Blockchain initiatives in programs as diverse as transferring donations to Syrian refugees¹² and using blockchain platform for promoting the development of ecommerce in developing countries and LDCs.

The private sector has embraced incorporation of this technology. For instance, the Spanish Bank BBVA carried out a transaction involving 25 tons of tuna between Spain and Mexico that took 2.5 hours for the document approval and processing time, a process that normally takes 7 to 10 days.¹³ The rising interest of the public and private sector responds to the way blockchain can strengthen the security and transparency of commercial operations. Still, the lack of interoperability between different blockchain platforms as well as scalability have hindered the expansion of blockchains, as they are often unable to interact and integrate with each other and different systems.

2.1 Smart Contracts

One of the main futures of blockchain technology is that it is programmable. This means that a blockchain can store conditional “*logic, allowing contractual scenarios and terms to be coded*” (EY, 2018) in order to trigger the recording and transactions on which the blockchain participants reach consensus once a condition is met (Cong & He, 2017). These blockchain-based scripts, or computer programs that are automatically and autonomously executed based on defined events, are defined as “smart contracts” (Cram-Martos, 2018). The main economic objectives of developing smart contracts is to reduce contract frictions, the risks of fraud and the cost associated to enforcement as arbitration and time delays (Tapscott, 2016)

¹² World food Program (2017) Blockchain Against Hunger: Harnessing Technology In Support Of Syrian Refugees (Published on 30 May 2017). Retrieved from: <https://www.wfp.org/news/news-release/blockchain-against-hunger-harnessing-technology-support-syrian-refugees> Last Date of Access: (Oct 22, 2018)

¹³ BBVA (2017) BBVA and Wave carry out the first blockchain-based international trade transaction between Europe and Latin America. November 27, 2017. Retrieved from: <https://www.bbva.com/en/bbva-and-wave-carry-first-blockchain-based-international-trade-transaction-europe-and-latin-america/> Last Date of Access: (Oct 22, 2018)

For its tamper-proof nature and automated execution that minimizes the risk for breach, Smart contracts are considered the most valuable application of blockchain for trade (Cram-Martos, 2018). Deloitte (2016) highlights that smart contracts could benefit trade by offering high accuracy and precision in comparison to existing forms of contracts when expressing the will of the parties as well as cost savings, as they involve fewer intermediaries, and speed given the use of automated transactions and less time spent on paperwork. However, despite the efficiencies and benefits that smart contracts could potentially bring, it must be considered that the reach of smart contracts could be limited given their early stage of development and its intrinsic characteristics related to breach of contract.

2.2 Internet of Rules

The development of blockchain has highlighted what Lawrence Lessig (2000) and Hassan and Filippi (2017) refer to as “code is law”: a form of regulation whereby technology is used to communicate, and if required, enforce existing rules. The concept of an “Internet of Rules” (IoR) represents an evolution of the architecture of “code as law”, as it implies not only the enforcement and provision of options but also the design of executable, digital, versions of laws that are published on the internet in a standard way (Atkinson, 2018b). In this sense, an IoR is defined by Xalgorithms Foundation, based on work by Potvin (Forthcoming) as follows: “An “Internet of Rules” (IoR) is created when computational algorithms can be readily transmitted from any independent source repositories within which they are maintained, to any applications that would use them.” (Xalgorithms Foundation, 2018) Atkinson (2018a) describes it as “a networked repository of executable forms of rules written in computer language”.

An IoR has an advantage over the use of smart contracts alone, as blockchain-based contracts only take into account rules negotiated between private parties. Atkinson (2018c) mentions that an IoR could use cellular networks in order to reach users that do not have access to the Internet or a device that allows them to connect to it, a situation that is common in LDCs. Users could consult and apply rules through SMS and mobile phone connected to a cellular network “*via back-end systems connected to the Internet*” (Atkinson, 2018). Also, an IoR does not have the interoperability problems that blockchains face, as these rules are accessible with almost any computer system. Finally, Atkinson (2018c) comments that an

IoR is appealing to LDCs because it does not require a physical infrastructure and the service considered to be “cloud native”.

3. Implementing Blockchain, Smart contracts and an IoR for a diversified Sudanese economy

After presenting how the emergence of disruptive technologies like blockchain, smart contracts and an IoR have the potential to transform the dynamics of commerce and economic transaction at the global level, this section discusses how these technologies can contribute to promote and increase the volume of exports and competitiveness of Sudan. In particular, this section explores how these disruptive technologies could boost the benefits that GI product protection and development, e-commerce and TFA provisions can serve Sudan in its efforts to diversify its economy.

3.1 Enhancing Trade Facilitation through the implementation of blockchain, smart contracts and an IoR

The international transport logistics chain offers an ideal environment to test blockchains, smart contracts and an IoR because it is a complex and interconnected ecosystem with variety and volume of actors, transactions, operations, jurisdictions and rules.

This is said as transactions and services are composed of administrative procedures, commercial contracts and cross-border information transfer, with an extensive network of actors and private relations. For instance, there are relations between crafts and ports, maritime agents and ports, exporters and importers. Also, there is necessary intragovernmental coordination, including the procedure of reception and dispatch of ships in which several public entities converge to authorize their entry, stay and departure. Port systems precisely attempt to organize this environment through the connection of actors and processes as well as the simplification of information.

Blockchains could promote an intelligent logistics chain that provides solutions in this complex ecosystem. The technology allows for the development of digital document transfer mechanisms that facilitate the traceability of the cargo, thus facilitating document management. It can also bring advantages for authorities given that transactions are observed

in real time, improving the quality of information for the exercise of risk management. Cram-Martos (2018) finds that having transactions recorded in a blockchain contributes to the digitization of transactions and reduces the amount of physical documents, printed certificates, and reports for its purely digital version.

This could have a considerable impact on trade as Groenfeldt (2017) and Popper & Lohr (2017) findings suggest: the cost of the trade-related paperwork processing is estimated to be between 15 percent and 50 percent of the costs of physical transport. Paperless trade, referring to the digitization of information flows required to support goods and services crossing borders, is not specifically a part of the TFA and the introduction of electronic/automated customs systems would support the implementation of many of the general trade facilitation measures (UNECE, 2017).

The implementation of blockchain for reducing trade barriers and improve processing times at borders, is not limited to public bodies. Private initiatives as *Tradelens*, led by Maersk and IBM, have implemented a blockchain solution for the handling of digital documents that support the load and link to the different operators that require this information in order to reduce errors and provide transparency and traceability to the movement of cargo. Maersk and IBM have piloted the system with customs authorities to test the advantages of blockchain in the capture of information and subsequent application of controls (Hacckius & Petersen, 2017).

One of the key aspects of the TFA is the obligation found in Article 10.4 and related to the creation of a “single window”. A single window is a facility that channels foreign trade procedures in order to exchange information, eliminate procedural redundancy, implement efficient controls and promote transparent administrative actions. The importance of implementing a single window facility is evidenced in Senegal, where the implementation reduced border preclearance and clearance processing time from an average of two weeks to just one day (World Economic Forum, 2018). For that reason, in the opinion of Okazaki, governments could, “*leverage the power of blockchain technology to open up new possibilities to share information and resources, particularly in a Single Window environment and for cross-border data exchange purposes*” (2018, p.17). Lastly, Article 7.2 of the TFA forces parties to implement electronic payment facilities. With this in mind,

blockchain could also enable real-time and cross-currency e-payments while minimizing the costs associated with these transactions (Okazaki, 2018).

Although the blockchain is already operating in different business environments, it cannot anticipate a rapid expansion and reception in Sudan due to the heterogeneous levels of development among actors involved in the logistics chain, as well as the caution that Sudan could show when involving itself. But it is not necessary to wait for the application of these disruptive technologies to meet current needs: many of the main problems are already identified and must be corrected.

The IoR could contribute to comply with the full compliance of measure of Publication and Availability of Information obligation found on Article 1 of the TFA. An IoR could encourage Sudan to publish relevant tariff and trade related laws and regulations in Arabic, English and in an executable, algorithmic, form. Following what Atkinson (2018c) describes about an IoR, the codified rules will encourage MSMEs to engage in cross-border commerce as they could calculate *ex-ante* the tariffs and other costs they may assume in the case they export. Thus, the automated, algorithmic, version of laws would be a functional way for Sudan to comply with the obligation to publish tariff and regulatory trade information in an “easily accessible manner”.

3.2 Implementing blockchain, smart contracts and an IoR for GIs

As discussed by Fink and Maskus (2006), GIs try to solve the market failures of information asymmetry: the producer of the GI knows the real properties, method of production or cultural value of the product while the consumer may not. With agricultural products this information asymmetry is accentuated. As Fernández and González (2001) suggest, attributes are perceived after the products are consumed. For this reason, GIs are important instruments to limit information asymmetry to generate trust in the buyers and assure that the product meets the attributed properties of the GI product.

However, as Abeyratne and Monfared mention (2018), GIs do not offer consumers the possibility to verify for themselves that the products they are buying comply with the codes of practice or regulations of use of the GI. Also, the lack of traceability leads consumers

to buy counterfeit GI products. For instance, EUIPO found that 9 percent of the GI products in the EU market have been falsified in the last 3 years, representing a 4.3-billion Euro loss.¹⁴

As a response, integrating blockchains for tracing, verifying and controlling GIs in attribution and the right to use the indication could result in offering transparency as blockchain is a secure way of holding information, the enhanced traceability and transparency of GI products would enable enforcement of the intellectual rights of these products and empower rural producers (Tripoli, 2018).

3.3 Implementing blockchain, smart contracts and an IoR for development led by e-commerce

The use of blockchain in Sudanese electronic commerce could facilitate domestic and cross-border commerce and help MSMEs move from the domestic to international markets. As e-Commerce based MSMEs have less fixed costs than traditional retail, the cost reduction that blockchain can bring to transport and logistics costs would make businesses more competitive and prone to export. UNCTAD (2012) espouses that, “*participation in global value chains, however, requires an ability to produce goods, and within tight timelines*”, blockchains may reduce the time for delays on the border and in delivering products, allowing MSMEs to export time sensitive products as agricultural products. Yet, as Atkinson (2018c) states, a lack of clarity of tariffs and cross-border related regulation hinders MSMEs in effectively connect into local and global value chains. Thus, MSMEs could rely on an IoR in order to estimate *ex ante* costs of export, in order to determine whether trade would be financially feasible or not.

Behind this, the development of a decentralized system for the safe management of digital asset transactions is one of the most widely used applications and the natural scope of blockchain platforms. This is how "payment and e-commerce systems" ensure the unique expense, transfer consistency and immutability of transactions to facilitate payment and transfer systems at the international level. For that reason, through blockchain, MSMEs engaged in e-commerce might better access credit, as they can be linked into a wider investor ecosystem and also accept blockchain-based payment systems. Also, smart contracts can

¹⁴ Cosmovici “EU counterfeit GI worth € 4.3 billion” February 7, 2018. Retrieved From: <https://cosmovici-ip.com/news/eu-counterfeit-gi-worth-e-4-3-billion/> Last Date of Access (Oct 18, 2018)

support the development of e-commerce by reducing the risk of fraud and sellers could be paid automatically after goods have arrived at a specified location, instead of via traditional payment methods that take weeks to finalize (Fleming, and Assefa 2017).

4. Concluding Remarks and Policy Recommendations

The current WTO accession process is an opportune moment for Sudan to integrate e-commerce, GI protection and trade facilitation in its trade and development agenda. The world is gradually becoming more digital and by strengthening the economy with programs and policies that promote digitally-enabled markets it will be possible to increase the productivity and competitiveness of the Sudanese economy.

For this reason, the synergy of policies aimed at protecting and promoting traditional Sudanese products through GIs, developing a sound environment for e-commerce and achieving reduction in delays and costs through predictable and efficient movement cross-border procedures and logistic could help to transform the economy, achieve economic diversification and allow Sudan's enterprises to integrate with GVCs.

Despite the early stage of development, embracing blockchain and smart contracts could amplify the benefits of this tri-dimensional policy: its diverse applications could help tracking of counterfeit GI products while ensuring traceability, implementation of a single window, guaranteed access to credit and e-payments for exporters and improved trust in transactions.

However, while Sudan and many other LDCs may face some constraints in the implementation of blockchain technologies given limited internet penetration, the rapid increase in mobile penetration is as a gateway to these new and disruptive technologies. Given the Sudan's mobile development, the automated mobile friendly and algorithm version of trade rules offered by an IoR could enable exporters to better understand regulations and apply the rules if they seek to engage in international trade.

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