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Digital readiness and business performance of Rwandan women entrepreneurs in cross-border trade under the African Continental Free Trade Area (AfCFTA)

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ABSTRACT

This study aims to examine the digital readiness of Rwandan women entrepreneurs and its effect on business performance within the context of AfCFTA. The study employed a mixed-methods approach, including a cross-sectional survey on 94 Rwandan women entrepreneurs in cross-border trade across various sectors at key border points, complemented by interviews with stakeholders from several government and trade organizations. The findings reveal a moderate awareness and usage of digital resources among women entrepreneurs, coupled with insufficient investment in new technologies. Key gaps exist in skills, confidence, and digital literacy essential for business operations. Most women entrepreneurs do not own websites and rarely utilize online tools for transactions or logistics. Awareness of the AfCFTA goals and regulations is limited, resulting in low participation in digital trade and a poor understanding of trade laws. The study highlights the need for digital readiness and awareness in enhancing business performance of women doing cross-border trade under AfCFTA framework. The study used cross-section data and Rwanda women doing cross-border trade hence making it difficult for replication. Therefore, future studies would use longitudinal study with large samples from all border posts and also should examine the gendered nature of digital readiness and entrepreneurial performance in Rwanda.

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1. Introduction

Digital readiness enhances female participation in opportunity-driven entrepreneurship by ensuring resource access, transparency, and empowerment, enabling business performance, success, and expansion into growing economic sectors (Moeini Gharagozloo et al., 2023). Digitalization contributes to influencing the firm's operation and innovation through its changing how services are developed, promoted, and delivered (Clarysse et al., 2022). Moeini Gharagozloo et al. (2023) note that highly digitalized economies enhance women entrepreneurial participation. Gergely et al. (2024) highlighted that digitalization helps in strengthening women entrepreneurship through enhancing women entrepreneurs' confidence and ability in expanding market access and improving operational efficiency.

Digital awareness involves understanding and effectively using digital technologies. For women entrepreneurs, it includes familiarity with e-commerce, digital marketing, cybersecurity, and data analytics (Nasution et al., 2018). The use of digital tool is considered as a resource for a business to achieve superior performance and, in turn, become a business's source of competitive advantage (Prakasa & Jumani, 2024). The application of those digital business process are essential for women doing cross-border trade for enhancing their business performance encompassing positive shift in sales, market entry, and effective business operation. Qi et al. (2023), highlighted that digitalization has a positive impact on both innovation and financial performance. Through digitalization, women in cross border trade could improve

its financial planning and projecting accuracy which leads to better financial results. Consequently, digitalizing women's cross border trade activities can lead to promotion of new product, services, and business models creation with the purpose of bringing differentiation in the market and in turn driving revenue growth (Rosyidiana & Narsa, 2024).

In many African countries, women significantly contribute to commerce as cross-border traders and managers; most operate in the micro and informal sectors (Goyal & Yadav, 2014). As key drivers of African trade, women entrepreneurs are the fastest-growing business group worldwide, vital to Africa's economic potential (Nziku et al., 2022; Ojong et al., 2021). African nations established the African Continental Free Trade Area (AfCFTA) as an essential tool for achieving African economic integration and economic development goals (Ogo, 2020). AfCFTA aims to promote and attain sustainable and inclusive socioeconomic development, gender equality, and structural transformation of the state parties (Thusi et al., 2022). Member states pledge gender parity and expand export opportunities for women and youth.

The agreement provides an important foundation for member states to boost their investments, build capacities of micro, small, and medium enterprises in different sectors especially those owned by women and youth, enables structural transformation across member states. To expedite this process, member countries are encouraged to adopt and use digital technologies and inter-operable digital cross-border technologies and implementing digital programs using emerging technologies (Michelle et al., 2024).

As the world is driven by technology, particularly with cross-border trade, the current study explores how technological awareness and readiness affect the performance of Rwandan women owned businesses operating in cross-border areas. Thus, this study investigates the linkages between digital awareness, digital readiness and business performance to gain insight into how technological preparedness manifests into concrete commercial earnings for women's doing cross border trade. In addition, we investigate whether Rwandan women entrepreneurs are benefiting from AfCFTA free trade agreement. Rwanda serves as an important contextual setting to study this phenomenon. Rwanda's entrepreneurship environment has had a remarkable improvement; that is to say, various entrepreneurship ecosystem enablers have been put in place, such as accelerators and incubation centers (Friederici, 2018). Women entrepreneurs in Rwanda face challenges such as limited loan collateral, high taxes, insufficient IT skills, elevated interest rates, high transport costs, and cultural and psychological barriers (Nsengimana, 2017). What is more, many women entrepreneurs acknowledge ICT's importance, but challenges like limited internet usage persist (World Bank, 2022). Much as women have managed to establish their entrepreneurial ventures, there is a need to ascertain the digital readiness of Rwandan women entrepreneurs, especially those dealing with exporting and importing. This is because digital innovation and innovative entrepreneurship are becoming essential in today's economy (Li et al., 2017; Taura et al., 2019). Therefore, integrating information and communication technology (ICT) into women-owned businesses is vital for enhancing performance, growth, and sustainability in Rwanda.

To achieve this, the current research is geared to answer the following research questions:

- What is the digital readiness of Rwandan women entrepreneurs to leap the benefit of the AfCFTA free trade agreement?
- How are Rwandan women entrepreneurs benefiting from Rwanda's ratification in AfCFTA free trade agreement?

A cross-sectional survey and interviews with policymakers revealed that Rwandan women entrepreneurs lack awareness and use of digital resources, face limited investment in new technologies, and possess gaps in essential digital skills and confidence. Consequently, most do not own websites or utilize online tools for transactions or logistics. Awareness of the AfCFTA goals and regulations is limited, resulting in low participation in digital trade and a poor understanding of trade laws. This study addresses this research gap by providing the link between digital awareness, digital operations and business performance of the women doing cross border trade in Rwanda under AfCFTA framework.

Our study is the first scholarly attempt in the African context and in Rwanda to link gender, technology, and trade performance. Previous studies on the African continent focused on women's entrepreneurship (Ajide & Osinubi, 2023) and the benefits of AfCFTA on women's trade (Geda & Yimer, 2023). Studies from other contexts have focused on digital readiness in apparel and fashion industries (Sun &

Ha-Brookshire, 2025) and as such, studies focusing on business organizations and entrepreneurial firms are very limited. Hawsawi (2023), notes that although digital technologies provide entrepreneurs with opportunities, the literature on digital technologies is very limited and scarce. Olsson and Bernhard (2021) call for more research on women entrepreneurs' adoption of ICT and digital tools. We follow calls by Liguori et al. (2024) to tap into unexplored areas of technological innovations and entrepreneurial ecosystems, particularly digital technologies and how they drive entrepreneurship so as to expand the field of entrepreneurship research. We add to this literature by providing a deeper understanding of how technology adoption influences trade performance among women entrepreneurs within the AfCFTA framework, to which Rwanda is a member state signatory.

Second, we contribute to studies on women entrepreneurship in AfCFTA context. Since its establishment, studies assessing the benefits and opportunities of AfCFTA have been limited to policy papers with limited empirical studies. We follow Liguori et al. (2024) who call for research that links gender and entrepreneurship from a contextual perspective.

The study is structured as follows: Chapter two reviews the existing literature on women's entrepreneurship, focusing on digital technologies and readiness as enablers of women's entrepreneurship. Chapter three pertains to research design, data collection, and instruments. Chapter four involves the presentation and discussion of results. The last chapter, Chapter 5, concludes with and provides future research and policy recommendations.

2. Review of literature

2.1. Digital readiness

Readiness in digital technology rises in the capacity of economies to exploit digital opportunities. Digital readiness has various meanings. First, it can be considered as the readiness of personnel, institutions, companies, industries, and even countries to maximize the benefits of digital technology (Nasution et al., 2018). Second, digital readiness is considered a measure of the industry's willingness to expand the exploitation of the opportunities provided by the digital economy (Queensland State of Innovation, 2021). Recently, Moeini Gharagozloo et al. (2023) asserted that digital readiness is a disruptive force changing the tone in many sectors and industries, such as media, transportation, and banking to exploit digital opportunities. Weiner (2020) argued that it is not encompassing access to digital tools such as digital materials, it also includes behavioral and psychosocial readiness to adapt to advanced technology.

Existing companies' readiness consists of analyzing the preparedness of the company both psychologically, behaviorally, and materially, as well as how knowledgeable it is in terms of taking action toward the change that happened (Weiner, 2020). Holt et al. (2007) add that readiness refers to the identification and assessment of opportunities, risks, and challenges that might result from a change process in an existing organizational context.

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Scholars developed different models to assess the company's readiness. Some focus on people's skills and knowledge as indicator of organizational readiness (Shea et al., 2014). A different approach is based on organization preparation for implementing Change, which is derived from Weiner's notion of organizational readiness for change (Shea et al., 2014). The Weiner model recognizes the organization's initiatives to improve worker preparedness by evaluating their dedication, efforts, competencies, and motivation in executing organization change. It is important to pin point that people's competence level in information technology is crucial when designing and implementing successful organization strategies due to their participation in both decision-making and execution procedures (Prifti et al., 2017). It is, however found that the assessment of technology readiness is linked to asset and technological resource analyses that facilitate the organization's embrace of new development (Tran & Daim, 2008). All in all, readiness assessment models involve a deeper analysis of the organization's strategy, technology, and

human resources. However, the models analyzed large enterprises with different departments, while women entrepreneur's own micro, small, and medium enterprises, which requires special consideration.

Analyzing an organization's digital readiness presents an essential contribution to its development. Gfrerer et al. (2021) in their banking industry survey, found that personal readiness, competencies, perception, and enabling environment to differ from organization to organization. The company's leaders create digital masters, enhancing the understanding of digital technology's importance and competitive advantages (Nasution et al., 2018). Digital readiness has various meanings. It can be considered the readiness of personnel, institutions, companies, industries, and even countries to maximize the benefits of technology from digital technology (Nasution et al., 2018).

It is evident that a lack of information and technology skills, their high cost, and internet reliability harm companies' digital readiness (Queensland State of Innovation, 2021). Nasution et al. (2018) added that secured digital infrastructure, commitment to digitalization, and investment in technology resources contribute to the digital readiness of a company. James (2011) also highlights the importance of technological skills in measuring a company's digital readiness. According to Nasution et al. (2018) to predict digital readiness, distinguish attitudinal readiness from action readiness. Whereas attitudinal readiness refers to the perception and implications of digital technology as an independent object, its perception and implications as a combined object are to as action readiness. Both attitude and action are considered significant antecedents to foresee an individual's digital readiness. These authors revealed that a lack of a positive attitude towards technology leads to slow adoption of new technologies, while digital readiness enhances entrepreneurship among national and international business collaborations.

2.2. The Africa Continental Free Trade Area (AfCFTA) and women entrepreneurship

The AfCFTA constitutes the largest free trade zone globally, designed to promote the unrestricted movement of individuals and commodities (Obeng-Odoom, 2020; Thusi et al., 2022). Notwithstanding its potential, obstacles remain, including antiquated trading models that impede intra-African trade (Pasara, 2020). Inadequate digital and physical infrastructure continues to impede industrial productivity and economic advancement (Fofack, 2020). Given that more than 30% of African states are landlocked, insufficient infrastructure may considerably hinder the effectiveness of the AfCFTA. Improving cross-border infrastructure is crucial for linking producers and consumers, while mitigating non-tariff barriers such as customs services and clearing procedures could provide significant advantages. Moreover, cultivating digital ecosystems is essential for capitalizing on the advantages of digitalization.

The AfCFTA represents the largest free trade area in the world (Geda & Yimer, 2023; Queensland State of Innovation, 2021). It offers trade and business prospects for women involved in regional trade in different sectors where they participate in such as agriculture and manufacturing (Agarwal et al., 2024). Obeng-Odoom (2020) claims that AfCFTA is expected to become different and dismisses the trade theories favoring non-aligned Pan-Africanism. The trade bloc envisages allowing free movement of people and goods. Vhumbunu (2022, p. 128) notes that although there are no stand-alone sections in AfCFTA Agreement on gender and entrepreneurship/trade, Article 3(e) of the framework agreement acknowledges gender and stipulates that the objective of the agreement is to foster and achieve sustainable and inclusive socio-economic growth, equal opportunity for women and men, and institutional change among the state parties, and also includes an article on trade and services in its Protocol (Article 27(2) (d)) where it aims to improve export capacity of informal service providers with particular attention to micro, small and medium size women and youth service providers. Recognizing the significance of context and the crucial contributions of women to business and Africa's socioeconomic advancement, Wamkele Mene, Secretary-General of the AfCFTA, vowed to put women and young people in the AfCFTA agreement that chiefly focuses on improving access to trade as well as supporting small and medium-sized businesses (Beleyi, 2022). The International Trade Centre (ITC) is a pivotal project designed to assist women-owned enterprises in seizing economic opportunities generated by the AfCFTA through capacity building, networking, and advocacy (Banga et al., 2021).

The implementation of the AfCFTA is projected to elevate intra-African trade volume by 81% by 2035 and augment total African exports by 29% (World Bank, 2020). The AfCFTA is anticipated to facilitate Africa's structural development by enhancing intra-African trade and promoting regional value chains

and industrial networks. The adoption of the AfCFTA is anticipated to elevate earnings by 10%, with more substantial benefits for unskilled laborers and women. Similarly, free trade could mitigate gender disparities in Africa by enhancing job opportunities for women and reducing gender-based wage disparity on the African continent (World Bank Group, 2019).

In addition to women entrepreneurship across borders, the AU also initiated the Digital Transformation Strategy (DTS) which emphasizes the importance of creating an enabling environment for digital transformation in Africa with the AfCFTA expected to drive this initiative. Following the creation of the AfCFTA, it is evident that there is a significant increase of online efforts designed to link women throughout Africa to marketplace, as well as providing them with training and resources so that they can make it. Digitalization is a megatrend reshaping economic and state-society relations and presenting opportunities to boost trade. Even if the AfCFTA Agreement does not explicitly refer to the digital economy, it is readily evident that digital considerations cut across many aspects of trade in goods and services. E-commerce specifically will be negotiated under Phase 3 and plans are underway for a continental Protocol on E-commerce. The digital economy presents prospects for enhanced productivity, entrepreneurial spirit, innovation, job opportunities, and entry to fresh markets (Banga et al., 2021). Most African countries currently lack the infrastructure, to fully take advantage of these digital opportunities. Digital skills training is also needed to ensure that Africa's citizens are able to take advantage of digital trade opportunities. The matter of fact is that a large share of intra-African trade is informal, small-scale and unrecorded. Most traders are women, and they face substantial impediments when attempting to trade across borders, as well as abuse and harassment. Removing tariffs under the AfCFTA will enhance the affordability for informal cross-border traders to operate through formal channels, more needs to be done to support these marginalized and economically vulnerable actors (Apiko et al., 2020). Contextually, the AfCFTA plays an important role for creating trade opportunities for African female entrepreneurs. Under its e-trade protocol, the aim is to facilitate electronic transactions, boost investments in the digital infrastructure, and develop e-commerce (Beleyi, 2022). Researchers indicate that the growth of digital networks is essential. This enables African female entrepreneurs to access formal, peer support, mentorship, and opportunity to sell and present their products efficiently and effectively (Apiko et al., 2020).

2.3. Digital technologies, readiness, and women's entrepreneurship and performance

Ajide and Osinubi (2023) define digital technologies as electronic tools and devices that are used in generating, processing, and storing data and information and may include social media networks, mobile applications, and multimedia technology (p. 1). Paoloni et al. (2019) also highlight that digital technologies include artifacts, digital infrastructure, and digital platforms, which open new channels and connections to markets, users, and other stakeholders.

There is a consensus in the literature on external enablers of entrepreneurship that digital technologies help open new markets, business models, and the growth of firms and industries (Ajide & Osinubi, 2023; Hawsawi, 2023). With fast-growing digital technologies, actors in the economy, including women, are now able to interact, access information, and build business networks. This increases their alertness to opportunities for entrepreneurial ventures.

Considering the contribution of entrepreneurship to development, any cost can be paid if entrepreneurs are to be competitive. It is in this regard that Darley (2002) found that, in addition to the development of infrastructure like roads and ports, the introduction of new technology can contribute more. Among the benefits of adopting new technology in international trade are the considerable reduction of freight costs, the acquisition and application of the right international knowledge, as well as the removal of trade barriers. Digital entrepreneurship is one of the elements of entrepreneurship that is characterized by running businesses using digital technology (Li et al., 2017). Both entrepreneurial and digital skills are necessary for business owners to take advantage of the opportunities offered by technology use (Friederici, 2018). On the other hand, scholars highlight that women entrepreneurs continuously need technological skills so that they can be able to exploit digital entrepreneurial opportunities. Olsson and Bernhard (2021), found that women entrepreneurs face challenges like limited resources and a constant need for new digital skills, especially related to the use of social media, as well as work-life balance.

Digitalization among women entrepreneurs will enable African women to exploit different available opportunities presented in AfCFTA agreement, such as trading within 55 countries, eradicating tariffs, creating a single trade zone, opening up new trading companies with new businesses, new customers and new opportunities, as well as contributing in encouraging industrialization, which reduces Africa's reliance on foreign resources (Geda & Yimer, 2023). Digital technologies offer various benefits to women entrepreneurs, as follows: They can provide access to knowledge and information resources that help women access markets, customers, production methods, technologies, and business models. For instance, social media can help women entrepreneurs expand opportunities for communication, collaboration, and contacts with partners, customers, and potential customers (Tsukanova et al., 2024).

Though Women in Africa, particularly in Rwanda present great business potentials, frequently hindered gender related obstacles most importantly traditions values, regulations and access to finances (Brody, 2009; Shea et al., 2014). There is a high need of having a diversity strategy envisages digital literacy, regulatory framework and financial inclusions (Orrensalo et al., 2024; Skare et al., 2025) because women are falling behind women vis-à-vis electronic use and trading involvement (Valls Martínez et al., 2022).

2.4. Theoretical framework and hypothesis

This study applies Behavioral Leadership Theory (BLT) to examine Rwandan Women Entrepreneurs' Digital Readiness and Business Performance in the AfCFTA perspective. BLT offer a through framework for comprehending elements that affect women participation in cross border trading. According to Goff (2003), Behavioral Leadership Theory analyses influences of leadership decision on making decisions on result oriented activities. To the case of this study, leadership influence women in cross-borders trade decision on the adoption of digital tools to exploits AfCFTA opportunities. Hawsawi (2023) argued that mentorship, advocacy and trainings on digital literacy programs improve women entrepreneurial interaction with the digital platforms. Furthermore, female business in cross-border trade performance is a result of leaders advocating for digital readiness and digital skills enhancement which may diminish female gender-related obstacles (Hawsawi, 2023). El-Haddadeh (2020) assert that digital infrastructure, regulations, and people training—are pivotal elements in facilitating digital adoption within an organization.

Research shows that women in Africa are substantially restricted to financial capital, and digital resources (Kuada, 2023; Mukorera, 2020). It is, however, important to argue that digital literacy and business training courses can alleviate obstacles to access cross border trade and international market by improving female ability to effectively manage these digital platforms (Kuada, 2023). Therefore, without institutional support to women entrepreneurs in advancing their level of digital capabilities, digital adoption will remain a challenge to women entrepreneurs under AfCFTA (Amine & Staub, 2009). In Rwanda, the ability of women entrepreneurs to incorporate digital technology into their operations, helps in improving efficiency, market access, and overall competitiveness within the AfCFTA (Ajide & Osinubi, 2023). It is important to highlight that the Rwandan women entrepreneurs' abilities to take AfCFTA advantage is greatly influenced by access to technological tools, access to capital as well as literacy on trade. Given the emerging scholarship on the women entrepreneurship digital readiness, we posit that:

Proposition 1: Digital awareness, readiness and the availability of affordable user-friendly digital technologies impacts women entrepreneurs' business performance.

Proposition 2: Rwandan women entrepreneurs benefit from the AfCFTA free trade agreement.

3. Methods

3.1. Research design

This study employed a mixed-methods approach. A quantitative research design, specifically a survey design, was used to gather data about the digital readiness of Rwandan women entrepreneurs. This design was chosen for its efficient and structured approach to collecting information from many women entrepreneurs. It allows for a comprehensive understanding of their perceptions, behaviours, and

readiness levels regarding digital business conduct. In addition, Key informant interviews with representatives of the Private Sector Federation (PSF), the Ministry of Trade and Commerce, National Agricultural Export Development Board (NAEB), the Ministry of Information, Communication Technology and Innovation (MINICT) and well as Rwanda Development Board (BRD) were held so as gain insight on key policies, programs, and government initiatives, as well as constraints to the digital readiness and awareness of women entrepreneurs in Rwanda.

3.2. Population, sample, and data collection

Rwandan women entrepreneurs engaged in cross-border trade (export and import) activities were considered as the population for this study. This group of traders represent subset of traders involved in trade across AfCFTA member states, which makes them a suitable and relevant for assessing their digital readiness within the AfCFTA context. The population included women-owned businesses across various sectors, such as manufacturing, agriculture, services, wholesalers and retailers. In each sector, businesses were categorized based on size, years of operation, and geographic location. The sample was randomly selected from each stratum to participate in the survey. Using figures from the Ministry of Trade and Industry (MINICOM) and the Rwanda National Institute of Statistics (NISR), an appropriate sample was purposively ascertained to achieve enough responses to ensure the reliability and validity of the findings. Ninety-four women doing cross-border trade were surveyed from the borders of Gatuna, Rubavu, Dubai Port, Magerwa, and Rusumo. Uganda and Rwanda share border entries of Gatuna. In contrast, Rubavu and Bugarama are shared by Rwanda and the Democratic Republic of Congo. In contrast, Rwanda and Tanzania share Rusumo. Regarding Key Informant Interviews, a representative sample was chosen purposefully.

3.3. Measures of constructs and sources

The survey questionnaire employed a 4-point Likert scale, ranging from 4 (strongly agree) to 1 (strongly disagree). The statements were developed based on existing literature related to digital awareness, digital technologies, and women entrepreneurs engaged in cross-border trade. Five items were used to assess digital awareness, adapted from UNCTAD (2014). Questions related to digital skills were developed using insights from prior studies (Kumar et al., 2025; Maji & Laha, 2023; Olsson, & Bernhard, 2021). Items assessing digital business operations were constructed drawing from various sources (Gergely et al., 2024; Olsson & Bernhard, 2021). Questions addressing digital technology adoption were informed by studies such as Mlambo et al. (2024) and Orser et al. (2019). Items related to cybersecurity and privacy were based on Michota (2013) and Foster and Azmeh (2019). Measures concerning resources and support were developed based on the work of Dominic et al. (2024).

Items evaluating support and opportunities under the AfCFTA were adapted from Banga et al. (2021) and Apiko et al. (2020). Additional questions addressing benefits, support mechanisms, collaboration, and networking drew upon Lemma et al. (2022), as well as Apiko et al. (2020). [Appendix 1](#) outlines the questionnaire components along with the corresponding sources used in their development.

3.4. Ethical approval and informed consent

For ethical purposes, a recommendation letter was obtained from the Directorate of Research and Innovation of the College of Business and Economics of the University of Rwanda. The letter was used to get access to the study respondents. The recommendation letter does not have the reference number, it shows the date (07/01/2024) and address of the signed authority (Director of Research and Innovation of the College of Business and Economics of the University of Rwanda).

Concerning informed consent, the research enumerators sought consent from respondents to participate in the research. Respondents were informed all about the research project, including its purpose, outcomes, and process. Respondents were also informed that the information/responses they provided were to be kept confidential and were only to be used for the research only and that their identity would be kept and used anonymously. The research team informed the respondents that their

participation was voluntary and that they were free to participate in or withdraw from the study any time without any negative consequences to them. Once they agreed to participate, they were given the consent form in both languages (Kinyarwanda and English) to sign without disclosing their identification.

3.5. Reliability and validity tests

For data quality control purposes, this study assessed reliability of the constructs for internal consistency. Table 1 reports factor loadings, Cronbach's alpha values and AVE validity test. According to Yadav and Tripathi (2024), a value of 0.5 factor loading is the minimum standard value recommended for survey studies. According to the results, most of the factor loadings are above 0.5. With regard to Cronbach's alpha, most of the constructs are above 0.7 implying strong internal consistency among the items used in the survey. Table 2 also provides scores for AVE validity tests. Most of the values are above 0.5 implying that they comply with AVE validity norms.

4. Results

4.1. Demographic results

The survey instrument was distributed to 150 women entrepreneurs engaged in cross-border trade and received 94 responses. This resulted in a high response rate of approximately 62%. Demographic analysis in Table 2 revealed that 40% of the women entrepreneurs were between the ages of 35 and 44. Additionally, 60% had a high school education or less, while 22% held a bachelor's degree. Furthermore, 24% of respondents were involved in trade activities, including retail and wholesale of various commodities. The majority of the sample (83%) consisted of sole trade business owners. Women exporters and importers were equally represented in the sample. Ultimately, a significant majority of women entrepreneurs (96%) engaged in trade with countries in East Africa.

4.2. Business description

Table 3 provides the summary statistics describing the firms surveyed. On average, these businesses have been in operation for nearly six years, with the longest running firm having been established 21 years ago. The typical firm employs an average of eight workers. In terms of financials, the average total assets for the surveyed businesses are valued at 13 million Rwandan Francs, while the average total turnover stands at 15 million Rwandan Francs.

These figures suggest that most businesses are relatively small compared to medium firms in the same line of business. Most of the women-owned firms surveyed are between the age of newer firms and relatively established companies. The average firm size (total assets) and turnover reflect different levels of growth and expansion, with large sized firms (in terms of total assets) showing greater potential for growth and expansion compared to small-sized firms.

4.3. Assessment of digital awareness and readiness

Tables 4 and Appendix 2 in the appendices summarize the average levels and variations in digital awareness and readiness among women entrepreneurs involved in cross-border trade. Several indicators are used to evaluate these aspects, such as digital awareness (DAR), digital skills (DS), digital business operations (DBO), digital technologies adaptability (DTA), cyber security and data privacy (CDP), and available resources and support (RS). Findings are presented in the form of means and standard deviation generated from Likert scales with 4 indicating the highest score and 1 the lowest.

In terms of digital awareness, respondents indicated moderate access to essential hardware, such as laptops and smartphones, as well as digital resources, software, tools, and high-speed internet that facilitate online business activities. However, they highlighted a lack of financial resources to invest in business technologies.

Table 1. Reliability and validity of constructs.

Variable	Factor loadings	Number of items	α = Cronbach's alpha	
Digital awareness (dar) (dar1)	0.8186	5	RC = 0.883	AVE = 0.567
dar2	0.8454			
dar3	0.7715			
dar4	0.7567			
dar5	0.6615			
Digital skills (ds):	0.8248	7	RC = 0.923	AVE = 0.502
ds1				
ds2	0.841			
ds3	0.8104			
ds4	0.771			
ds5	0.8737			
ds6	0.797			
ds7	0.6315			
Digital business operations (dbo):	0.6513	7	RC = 0.889	AVE = 0.462
dbo1				
dbo2	0.8594			
dbo3	0.6251			
dbo4	0.6978			
dbo5	0.842			
dbo6	0.7757			
dbo7	0.709			
Digital technology adoptability (dta):	0.7964	5	RC = 0.9043	AVE = 0.571
dta1				
dta2	0.7952			
dta3	0.8235			
dta4	0.8132			
dta5	0.798			
Cyber security and data privacy (cdp):	0.71	5	RC = 0.879	AVE = 0.497
cdp1				
cdp2	0.7477			
cdp3	0.8506			
cdp4	0.8732			
cdp5	0.6709			
Resource and support (rs):	0.7626	5	RC = 0.869	AVE = 0.459
rs1				
rs2	0.7628			
rs3	0.8028			
rs4	0.7285			
rs5	0.6803			
Opportunities and benefits (ob):	0.3761	6	RC = 0.778	AVE = 0.299
ob1				
ob2	0.6283			
ob3	0.7555			
ob4	0.4815			
ob5	0.763			
ob6	0.6427			
Barriers and challenges (bc):	0.5727	4	RC = 0.547	AVE = 0.188
bc1				
bc2	0.3525			
bc3	0.3926			
bc4	0.5816			
Resource and support (ras)	0.4808	3	RC = 0.490	AVE = 0.182
ras1				
ras2	0.5951			
ras3	0.3368			
Collaboration and networking (cn):	0.6074	2	CR = 0.659	AVE = 0.2478
can1				
can2	0.6074			

Tables 4 and Appendix 2 also reveal findings on digital skills and literacy. Most of the respondents showed limited understanding, confidence, and proficiency in using digital tools and software for business operations. Furthermore, they seldom update their skills to keep pace with technological advancements and struggle to effectively navigate and use online business resources and platforms.

Insights from key informant interviews reveal that policymakers are aware of the limited digital awareness among women engaged in cross-border trade. They recognize the importance of digital knowledge

Table 2. Descriptive statistics for demographics variables.

Variable	Freq.	%	Cum.%
18–24	4	4.26	4.26
25–34	27	28.72	32.98
35–44	40	42.55	75.53
45–54	19	20.21	95.74
55+	4	4.26	100
Total	94	100	
High school or less	60	63.83	63.83
Diploma	11	11.7	75.53
Bachelors	21	22.34	97.87
Professional certificate	1	1.06	98.94
Masters	1	1.06	100
Total	94	100	
Agricultural sector	11	11.702	11.702
Arts and crafts	3	3.194	14.89
Flowers exportation	2	2.127	17.02
Food processing	17	18.08	35.106
Manufacturing	2	2.127	37.234
Manufacturing	2	2.127	37.234
Trading	59	62.76	100
Total	94	100	
Sole trader	78	82.98	82.98
Partnership	1	1.06	84.04
Company	15	15.96	100
Total	94	100	
Exporter	43	45.74	45.74
Importer	42	44.68	90.43
Both	9	9.57	100
Total	94	100	
EAC	91	96.81	96.81
Rest of Africa	3	3.19	100
Rest of the world	0	0	100
Total	94	100	

Table 3. Business description.

Variable	Obs	Mean	Std. dev.	Min	Max
Years in business	94	5.893	4.172	1	21
Number of employees	94	8.074	41.25	0	400
Log (total assets)	94	13.245	1.959	9.903	20.031
Log (turnover)	94	15.19	1.55	11.156	20.671

Table 4. Digital readiness and awareness.

Variable	Obs	Mean	Std. dev.	Min	Max
Digital awareness	94	2.315	0.801	1	4
Digital skills	94	2.365	0.738	1	4
Digital business operations	94	2.228	0.721	1	4
Digital technologies adaptability	94	2.736	0.795	1	4
Cyber security and data privacy	94	2.257	0.752	1	4
Resources and support	94	2.053	0.727	1	4

for these traders, noting that, like all business owners, women need to be digitally informed, especially as business becomes increasingly digital. One respondent explained: *'We provide training on digital business platforms with our partners to help women trade locally and internationally. For instance, the 50 million African Women Speak project focuses on networking, enabling women across COMESA, including Rwanda, to share business information and learn best practices for cross-border trade'*. (Private Sector Federation).

In terms of digital business operations, the findings reveal that most women entrepreneurs do not own a website, and those who do rarely keep them updated. Respondents also reported limited use of social media and online professional networks for cross-border trade. While some occasionally conduct transactions, manage finances, and handle cross-border logistics and supply chains online, their engagement remains moderate. They also infrequently update their business websites as well as social media for interaction with their customers

Tables 4 and Appendix 2 provides survey results on respondents' level of adaptability to digital technologies. Most of the respondents demonstrated moderate confidence in adopting new technologies. However, they on the other hand underscored the importance of digital tools in enhancing business operations. They showed the need to learn new digital skills to enhance their enterprises. Additionally, they voiced optimism about the potential for digital technologies to help expand their businesses across borders.

Findings on cyber security and data privacy indicate that respondents have a moderate understanding of online practices to protect their business data. They also reported being moderately aware of IT security threats, with limited use of cyber security measures. Table 4 reveals results on the level of resources and support that respondents have about digital technologies. Results show limited support in areas such as mentorship, coaching, and training on digital skills and tools. Additionally, respondents reported moderate access to online business communities for women but received limited assistance from governments, international organizations, and universities in terms of digital training and support.

4.4. Women's trade practices under the AfCFTA

Tables 5 and Appendix 3 outline the average scores for the opportunities, support, and challenges faced by women conducting business in AfCFTA member countries.

Respondents indicated limited familiarity with the AfCFTA, its objectives, and its importance as well as limited involvement in AfCFTA digital trade, but on the other hand, demonstrated willingness to engage in businesses under the AfCFTA context. They showed that support from government (policies), local and international NGOs can help them to use digital technologies in business operations. There are also significant knowledge gaps in understanding AfCFTA regulations and its trade opportunities. In addition, respondents revealed that some AfCFTA countries do impose trade restrictions which affect their businesses

Findings align with insights from key informant interviews. For instance, one RDB respondent highlighted that *'Women face logistical challenges and non-tariff barriers, such as border restrictions and security-related issues, including supply shortages. Many women lack awareness of the AfCFTA agreement and its benefits for cross-border trade. Trade barriers, such as differing packaging requirements between countries, also impede their efforts. Advocacy is needed at various levels to ensure women can successfully export their products'*. A PSF official added, *'Women are generally unaware of the AfCFTA agreement, including the barriers and specific requirements, such as packaging standards like paper bags'*. Another NAEB respondent noted, *'Most women engaged in cross-border trade operate informally, which is risky. Many cross borders without following formal procedures'*. A MINICT official pointed out challenges related to digital payments, stating, *'Women struggle with digital payment issues, compounded by foreign exchange rate fluctuations. We are advocating for governments to support payment system interoperability, which would simplify cross-border trade and payment processes for women. Additionally, women are often unaware of the benefits of conducting business online through e-commerce platforms. To address this, we have developed a national African e-commerce platform where traders can showcase their products to a broader market across Africa, supported by logistics services'*.

Respondents also reported limited support for conducting business in AfCFTA member countries, particularly training and mentorship that will help them to tap AfCFTA trade opportunities. They expressed a need for educational materials on AfCFTA trade laws. Furthermore, collaboration with women entrepreneurs outside Rwanda was reported to be low, limiting their ability to explore trade opportunities within the AfCFTA.

Table 5. Assessment of AfCFTA opportunities, challenges, and benefits.

Variable	Obs	Mean	Std. dev.	Min	Max
Opportunities and benefits	94	2.365	0.619	1	4
Barriers and challenges	94	2.497	0.586	1	4
Resources and support	94	2.514	0.62	1	4
Collaboration and networking	94	1.979	0.613	1	4

Table 6. Cross-tabulation.

Education	Dar	ds	Dbo	Dta	Cdp	rs
High school	2.163	2.2381	2.1	2.597	2.237	1.96
Diploma	2.436	2.364	2.208	2.8	2.127	2.127
Bachelors	2.676	2.659	2.524	3.009	2.333	2.324
Professional cert.	2	3	2.571	3.4	2.6	1.8
Masters	2.8	3.143	3.571	4	3	1.4
Business type	dar	ds	dbo	dta	cdp	rs
Sole trader	2.238	2.287	2.097	2.644	2.221	2.003
Partnership	1	1.571	1.857	1.8	2	1.8
Company	2.315	2.829	2.933	3.28	2.467	2.333
Export/import	dar	ds	dbo	dta	cdp	rs
Exporter	2.442	2.449	2.352	2.758	2.353	2.242
Importer	2.162	2.245	2.082	2.686	2.148	1.852
Both	2.422	2.524	2.317	2.867	2.311	2.089

Table 7. Regression results.

	-1	-2	-3
	perf1	perf2	perf3
Digital awareness	-0.104 (-0.61)	-	-0.0849 (-0.74)
Digital skills	0.102 -0.55	-	0.00021 0
Digital business operations	-0.0888 (-0.57)	-	0.0239 -0.23
Digital technologies adaptability	0.193 -1.07	-	0.0214 -0.11
Cyber security and data privacy	0.560*** -3.75	-	0.348** -2.59
Resources and support	-0.101 (-0.89)	-	0.042 -0.43
Opportunities and benefits (AfCFTA)	-	0.368** -2.28	0.223 -0.98
Barriers and challenges (AfCFTA)	-	0.122 -1	0.0323 -0.26
Resources and support (AfCFTA)	-	0.474*** -2.91	0.426*** -2.69
Collaboration and networking (AfCFTA)	-	-0.184 (-1.60)	-0.267** (-2.26)
cons	1.818*** -8.07	1.204*** -3.57	1.268*** -3.61
N	94	94	94
R-squared	0.389	0.445	0.531

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ environment.

4.5. Cross tabulation of digital readiness with education, business type, and cross-border trade

Table 6 presents the digital awareness and readiness scores cross-tabulated with education level, type of business ownership, and cross-border trade (exporters versus importers). The findings indicate that women entrepreneurs holding master's and bachelor's degrees demonstrate significantly higher levels of digital awareness and skills compared to respondents with either high school certificates or professional qualifications. Respondents with masters and bachelor education are also more likely to use digital technologies in business operations compared to peers with lower education (high school and professional certifications). This equally also applies to technology adaptability and the understanding of cyber security and digital privacy concerns.

Findings in Table 6 also reveal that when compared to other business ownership types (incorporated companies), sole traders have modest awareness of and use of digital technologies. In contrast, partnership businesses exhibit particularly low levels of digital skills and technology usage. Among cross-border traders, exporters demonstrate notably higher levels of digital awareness, skills, adaptability, and use of technology compared to importers.

Table 8. Additional regression results.

	-1	-2
	Sole trader	Company
Digital awareness	-0.123 (-1.00)	1.177*** -5.29
Digital skills	-0.0124 (-0.08)	-0.127 (-0.54)
Digital business operations	0.0169 -0.12	0.415** -1.74
Digital technologies adaptability	-0.00461 (-0.02)	0.358 -0.99
Cyber security and data privacy	0.435*** -2.84	0.692** -2.52
Resources and support	0.0511 -0.4	0.466*** -4.88
Opportunities and benefits	0.146 -0.55	0.0301 -0.09
Barriers and challenges	-0.0665 (-0.54)	-0.29 (-1.20)
Resources and support (AfCFTA)	0.571*** -3.46	0.554*** -2.52
Collaboration and networking	-0.317*** (-2.68)	0.0635 -0.34
cons	1.403*** -4.03	2.438*** -4.77
N	78	15
R-squared	0.5457	0.9028

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.6. Digital awareness and women business performance: regression results

Table 7 presents baseline regression results, where the outcome variable is the digital performance of women entrepreneurs engaged in cross-border trade within the AfCFTA. Three models are outlined in Columns 1-3. In Column 1, regression results are based on firm-level digital awareness and readiness variables as predictors, utilizing linear cross-sectional regression (svy) for estimation. Column 2 provides results using AfCFTA-related variables as predictors, while Column 3 incorporates both firm-level and AfCFTA variables. The findings reveal that in Column 1, cyber security and data privacy significantly enhance firm performance, with digital technology adaptability and digital skills offering modest improvements. In Column 2, AfCFTA-related variables—such as opportunities, benefits, resources, and support—have a strong positive effect on firm performance. When both firm-level and AfCFTA variables are combined in Column 3, cyber security, along with AfCFTA resources and support, emerge as key determinants of firm performance in the baseline model. Counter intuitively, collaboration and networking negatively affect women business performance. This could be explained in part by the nascent AfCFTA implementation leading to a lower level of collaboration and networking among traders.

In other results reported in Table 8, business performance is assessed using different business types (sole proprietors, partnerships, and companies) as sample splits. Table 7 presents the regression results for sole traders and companies. Results on partnership businesses could not be fully incorporated due to model convergence issues. The results show that companies have a greater awareness of digital tools, software, and resources compared to sole trader owners. However, both groups exhibit a similar level of awareness about cyber-security, data privacy, resources and support. Furthermore, sole traders are less likely to collaborate and network with peers, which adversely affects their business performance.

Table 9 reports regression results for the sample splits between importers and exporters. The findings reveal that importers tend to experience a more negative impact from low digital awareness compared to exporters. However, as importers improve their digital skills, their business begins to increase and surpass those of exporters. Results also show that imports have a relatively strong awareness of cyber security and data privacy compared to exporters and significantly (and positively) contributes to enhanced business performance. Results reveal that in the initial stages importers face digital technologies and cyber security awareness which affects their business performance but this trend reverses as they gain more digital and cyber security awareness.

Table 9. Other results.

	-1	-2
	Exporter	Importer
Digital awareness	0.166 -0.77 (-1.86)	-0.384** (-2.60)
Digital skills	-0.259* (-1.86)	0.498** -2.5
Digital business operations	-0.0738 (-0.36)	0.241 -1.18
Digital technologies adaptability	-0.0144 (-0.06)	-0.562** (-2.62)
Cyber security and data privacy	0.464 -1.5	0.508*** -2.99
Resources and support	0.0545 -0.21	0.0853 -0.57
Opportunities and benefits	0.0466 -0.17	0.364** -2.24
Barriers and challenges	-0.0461 (-0.29)	0.465* -1.94
Resources and support	0.608*** -3.29	-0.114 (-0.64)
Collaboration and networking	-0.148 (-1.15)	-0.417** (-2.66)
cons	1.256*** -3.2	1.641** -2.59
N	43	42
R-squared	0.605	0.6811

t statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Under the AfCFTA framework, results reveal that importers are more likely to take advantage of the opportunities and benefits provided by the trade area than their exporting peers, making them well positioned to gain from those trade opportunities. In contrast, exporters are more likely to gain from the resources and support mechanisms offered by AfCFTA, implying the importance of their home countries' support mechanisms. These support mechanisms boost their business further.

4.7. Discussion of results

This study assessed the digital readiness of Rwandan women entrepreneurs in taking advantage of the opportunities and benefits of AfCFTA. The results show that women entrepreneurs have moderate access to digital technologies and concepts, but on the other hand lack the financial resources to invest in new technologies for their businesses. These results agree with previous arguments in Ajide and Osinubi (2023) that financial assistance, particularly by empowering women to use digital technologies, promotes entrepreneurialism. Goyal and Yadav (2014) had earlier found that women entrepreneurs in developing economies face limited financial resources to invest in their businesses. The findings also showed that there is a limited level of training and support to use digital tools. The findings are in line with previous results in Olsson and Bernhard (2021), who reported that women entrepreneurs do not possess adequate training and support, which limits their full understanding and sense making of ICT use.

The findings also reveal that cybersecurity and data privacy significantly enhance firm performance, with adaptability to digital technology and digital skills offering modest improvements. In addition, AfCFTA-related variables, such as opportunities, benefits, resources, and support, have a strong positive effect on firm performance. The findings are in line with previous studies that investigate the effect of digital technologies on business performance (Yang et al., 2024). The findings also revealed that fewer companies were familiar with the AfCFTA, its benefits, and regulations. Previous studies such as Salamzadeh Dana et al. (2024) have also shown that women entrepreneurs are constrained by complex regulations, which makes it difficult to navigate and use digital technologies.

The regression results showed that digital technologies positively improve the business performance of women-owned enterprises, particularly driven by the benefits and opportunities of AfCFTA. These findings are explained in part by the policies and programs put up by the AfCFTA under the African Union (Apiko et al., 2020) such as the digital transformation agenda (2020–2030) that harnesses digital technologies and innovation to improve inclusive economic growth in Africa, the Smart Africa initiative that

aims to use ICT for socioeconomic development in Africa, the development of the Pan African Payment and Settlement System of the African Export-Import Bank. Apiko et al. (2020) also show that under the AfCFTA, digitalization offers opportunities that help increase productivity, entrepreneurship, innovation, job creation, and accessing new markets. Makoza (2023) had earlier emphasized that with the free movement of goods and services (under the AfCFTA), digital technologies are perceived as enablers of the free movement of people, goods, and services, the creation of services, promotion of investment and the establishment of new businesses

5. Conclusion

The main objective of this study is to explore the digital readiness of Rwandan women entrepreneurs to reap the opportunities and benefits resulting from Rwanda's ratification of the African Continental Free Trade Agreement. This study utilized a mixed-methods approach (survey and key informant interviews).

The findings from this study shows moderate levels of awareness and use of digital resources among women entrepreneurs, as well limited investment in new technologies. There are significant gaps in skills, confidence, proficiency, and digital literacy required for business operations. Most women entrepreneurs do not own websites and only occasionally use online tools for tasks such as business transactions, financial management, and cross-border logistics. Regarding the opportunities, support, and challenges for women operating in business in the AfCFTA member states, the results show very limited awareness of its goals, importance, and regulations. Additionally, their involvement in AfCFTA-enabled digital trade is low, and they have a poor understanding of trade laws and available opportunities. The women also receive minimal support for conducting business in member countries, particularly in areas such as mentorship and training programs.

5.1. Contributions to theory

The study contributes to existing literature on the nexus between link gender, technology, and women's involvement in business, particularly in Africa. A notable addition to previous studies is its focus on digital readiness, which is frequently neglected in discussions/regarding women entrepreneurs.

5.2. Managerial and practical implications

Findings from this study highlight low levels of digital literacy, limited use of digital tools as well as moderate awareness AfCFTA opportunities and benefits. These findings have implications for managers. Managers in these firms should put efforts into improving the digital skills of their employees, invest in digital technologies and boost awareness of the AfCFTA framework. Managers should also prioritize mentorship programs and train employees in cyber security.

5.3. Policy implications

The study offers policy recommendations for enhancing African women's involvement in tackling obstacles such as financial accessibility, digital readiness, digital technology readiness and regulatory intricacy. Regional interventions on financial support, digital literacy, and law enforcement campaigns as well as engaging women entrepreneurs in policy decision-making process are important in enhancing their involvement in AfCFTA enabled trade. In Africa, collaborative efforts across different stakeholders are crucial for promoting women entrepreneurs in Africa, but they are also radically engaged in exploiting the AfCFTA framework.

5.4. Study limitations and future scope

This study focused on women owned businesses operating across Rwandan borders. We had sample limitations and were also limited by the availability of longitudinal data on their performance. The study

used cross-section data and Rwanda women doing cross-border trade hence making it difficult for replication. Therefore, future studies would opt for a longitudinal study with large samples from all border posts. Further studies could explore the long-term impact of digital adoption on performance of women-led businesses in Rwanda. Future research could as well look at the gendered nature of digital readiness and entrepreneurial performance among Women and Men Entrepreneurs in Rwanda.

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Data availability statement

Data for this manuscript is available both in excel, transcripts, and in Stata forms. They can be available from the corresponding author [Josephine Mutesi – email: mutejose5@gmail.com], upon reasonable request.

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Appendix 1: Measures of constructs and their sources

Constructs	Items	Sources
DA	I own or have access to the necessary hardware (e.g. laptop, smartphone) for conducting business online I find accessing digital resources and tools required for my business operations easy My business software and tools are up-to-date and meet my professional needs I have reliable access to high-speed internet for my business activities	(UNCTAD, 2014)
DS	I have sufficient financial resources to invest in new technology for my business I have a good understanding of how to use digital tools and software for business purposes I am confident in using digital tools and software for business purposes I am proficient in using online communication platforms (e.g. email, video conferencing, I regularly update my digital skills to stay current with technology trends. I find it easy to navigate and utilize online business resources and platforms. I can troubleshoot basic technical issues related to digital tools on my own I know the importance of using digital tools in my business	(Kumar et al., 2025; Maji & Laha, 2023; Olsson, & Bernhard, 2021)
DBO	I have a website for my business. I actively use social media platforms to promote my business (e.g. Instagram, X, and Facebook locally and internationally. I conduct transactions and manage finances (financial reporting, e-banking, taxation) through secure online systems. Using digital tools, I manage cross-border logistics and supply chains (international trade documents). I regularly use online professional networks to expand my business internationally. I regularly use online professional networks to expand my business internationally. I regularly update my website and social media profiles to engage with customers. I sell products or services online.	(Gergely et al., 2024; Olsson & Bernhard, 2021)
DTA	I am confident in adapting to new digital business trends. I believe that digital tools significantly enhance my business operations. I am open to learning new digital skills to improve my business. I feel prepared to handle digital challenges in my business operations. I am optimistic about the potential of digital technology to grow my business across borders.	(Bouwman et al., 2018; Mlambo et al., 2024; Orser et al., 2019).
CDP	I know online security practices to protect my business data. I regularly update my passwords and use multi-factor authentication for my accounts. I feel confident in identifying and avoiding online security threats. I use secure methods to share sensitive business information online.	(Foster & Azmeh, 2019; Michota, 2013)
RS	I am aware of privacy regulations that affect my business operations across borders. I have access to online communities or support networks for women in business. I receive adequate support and training in digital skills (from my professional network, government, international bodies, universities).	(Dominic et al., 2024).
OB	I know where to find resources and information to improve my digital readiness. I benefit from mentorship or coaching on using digital tools for business. I participate in online courses or webinars to enhance my digital competencies. I am familiar with the AfCFTA and its goals and importance. I am very optimistic that AfCFTA will strengthen trade relations between African countries. I am well prepared to conduct business across AfCFTA. I am engaged in the AfCFTA-enabled digital global trade. I believe that government programs and policies promote Rwandan women entrepreneurs' ability to use digital technologies in conducting their businesses. I believe local and international non-government stakeholders are assisting Rwandan women entrepreneurs and owners in becoming digitally ready.	(Apiko et al., 2020; Banga et al., 2021).
BC	Country (ies) regulatory restrictions are a barrier to trade under the AfCFTA. I am aware of the trade laws with the AfCFTA. It is difficult to follow trade laws within the AfCFTA framework.	(Banga et al., 2021).
RAS	I believe there are major knowledge gaps regarding AfCFTA trade opportunities. . There are sufficient training and mentoring programs to assist your preparedness for the AfCFTA. The government regularly provides incentives to women entrepreneurs who trade in AfCFTA-related cross-border trade. I think there is a need for easily understandable educational materials on AfCFTA trade laws.	(Lemma et al., 2022; Apiko et al., 2020)
CN	I regularly network with other Rwandan women entrepreneurs in search of possible AfCFTA collaborations. I very often cooperate with other women entrepreneurs in Rwanda to explore AfCFTA opportunities.	(Apiko et al., 2020; Lemma et al., 2022)

Appendix 2: Assessment of digital awareness and readiness

Variable	Means	Std. dev
Digital awareness and readiness:		
I own or have access to the necessary hardware (e.g. laptop, smartphone) for conducting business online	2.617	1.089
I find accessing digital resources and tools required for my business operations easy	2.306	1.016
My business software and tools are up-to-date and meet my professional needs	2.266	0.997
I have reliable access to high-speed internet for my business activities	2.319	0.941
I have sufficient financial resources to invest in new technology for my business	2.064	0.787
Digital skills and literacy:		
I have a good understanding of how to use digital tools and software for business purposes	2.309	0.916
I am confident in using digital tools and software for business purposes	2.415	0.909
I am proficient in using online communication platforms (e.g. email, video conferencing,)	2.36	0.957
I regularly update my digital skills to stay current with technology trends.	2.181	0.903
I find it easy to navigate and utilize online business resources and platforms.	2.298	0.878
I can troubleshoot basic technical issues related to digital tools on my own	2.064	0.853
I know the importance of using digital tools in my business	2.851	0.829
Digital business operations:		
I have a website for my business.	1.851	0.938
I actively use social media platforms to promote my business (e.g. Instagram, X, and Facebook locally and internationally.	2.329	0.932
I conduct transactions and manage finances (financial reporting, e-banking, taxation) through secure online systems.	2.511	0.959
Using digital tools, I manage cross-border logistics and supply chains (international trade documents).	2.329	0.909
I regularly use online professional networks to expand my business internationally.	2.234	0.860
I regularly use online professional networks to expand my business internationally.	2.234	0.860
I regularly update my website and social media profiles to engage with customers.	1.894	0.873
I sell products or services online.	2.447	1.033
Digital technologies adaptability:		
I am confident in adapting to new digital business trends.	2.436	0.911
I believe that digital tools significantly enhance my business operations.	2.766	0.989
continued		
Variable	Descriptions	Source
I am open to learning new digital skills to improve my business.	3.085	0.888
I feel prepared to handle digital challenges in my business operations.	2.478	0.981
I am optimistic about the potential of digital technology to grow my business across borders.	2.915	0.899
Cyber security and data privacy:		
I know online security practices to protect my business data.	2.223	0.918
I regularly update my passwords and use multi-factor authentication for my accounts.	2.234	0.897
I feel confident in identifying and avoiding online security threats.	2.298	0.914
I use secure methods to share sensitive business information online.	2.245	0.924
I am aware of privacy regulations that affect my business operations across borders.	2.287	0.923
Resources and support:		
I have access to online communities or support networks for women in business.	2.265	0.929

Variable	Means	Std. dev
I receive adequate support and training in digital skills (from my professional network, government, international bodies, universities).	2.021	0.842
I know where to find resources and information to improve my digital readiness.	2.287	0.875
I benefit from mentorship or coaching on using digital tools for business.	1.946	0.896
I participate in online courses or webinars to enhance my digital competencies.	1.745	0.938

Appendix 3: African continental free trade area (AfCFTA) aware-ness and engagement AfCFTA concepts and goals

Variable	Means	Std. dev
Opportunities and benefits:		
I am familiar with the AfCFTA and its goals and importance.	1.777	0.832
I am very optimistic that AfCFTA will strengthen trade relations between African countries.	2.500	1.013
I am well prepared to conduct business across AfCFTA.	2.511	0.959
I am engaged in the AfCFTA-enabled digital global trade.	2.000	0.880
I believe that government programs and policies promote Rwandan women entrepreneurs' ability to use digital technologies in conducting their businesses.	2.830	0.863
I believe local and international non-government stakeholders are assisting Rwandan women entrepreneurs and owners in becoming digitally ready.	2.574	0.836
Barriers and challenges:		
Country (ies) regulatory restrictions are a barrier to trade under the AfCFTA.	2.851	0.950
I am aware of the trade laws with the AfCFTA.	1.926	0.737
It is difficult to follow trade laws within the AfCFTA framework.	2.181	0.867
I believe there are major knowledge gaps regarding AfCFTA trade opportunities. .	3.032	1.021
Resources and support:		
There are sufficient training and mentoring programs to assist your preparedness for the AfCFTA.	1.883	0.774
The government regularly provides incentives to women entrepreneurs who trade in AfCFTA-related cross-border trade.	2.426	0.836
I think there is a need for easily understandable educational materials on AfCFTA trade laws.	3.234	0.977
Collaboration and networking:		
I regularly network with other Rwandan women entrepreneurs in search of possible AfCFTA collaborations.	2.011	0.740
I very often cooperate with other women entrepreneurs in Rwanda to explore AfCFTA opportunities.	1.947	0.678