



Assessment of the Impact of COVID-19 on Operations of Local Businesses and Level of Enforcement of Public Health Safety Measure within Business Premises: A Quantitative Study of Businesses in Huye-Rwanda

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Abstract: The impact of COVID-19 has been felt across all sectors, from transportation, education,

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Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). and public works to the daily operations of businesses like selling, retailing, and so forth. The business sector is among those badly affected, especially micro, small, and medium enterprises. The understanding of ground prevailing conditions is key in driving informed policies that would have meaningful impact on society with regard to overcoming the effects of the virus. Hence, this work is an attempt to report the real ground statistics and necessity of technological support with the goal of submitting a report of recommended policies to the concerned authorities. In this direction, this work presents the outcome of a survey conducted to assess the impact of COVID-19 on operations of micro, small, and medium enterprises and also to find out the interventions put in place around business environments so as to enforce adherence to COVID-19 health safety measures. The survey was part of a study to develop automated IoT-powered technological solutions that would help to enforce proper mask wearing in indoor environments and also observance of social distance requirements within business premises. A customized questionnaire was designed to capture data on various aspects central to the focus of the study. The study was carried out in the month of May 2021, in the Huye district of Rwanda. According to the survey findings, the major challenges faced by businesses due to COVID-19 include failure by clients to settle bills, reduced ability to expand investment, difficulty in accessing inputs domestically, lower domestic sales to consumers, and lower domestic sales to businesses. The results also reveal some positive points that most businesses were found to have: hand washing points, hand sanitizer dispensers, and mechanisms to enforce social distance between customer and customer and also customer and front desk worker. In a nutshell, this work is unique in terms of (1) the customized questionnaire about Rwanda's needs, (2) field visit-based data collection for accurate data, and (3) including an assessment of the importance of technological intervention for better handling of public safety, especially in the MSME business sector.

Keywords: COVID-19; MSMEs; businesses; Rwanda; social distance

1. Introduction

COVID-19 is a newly identified and named type of single-stranded, positive-sense RNA coronavirus that is believed to have jumped from an infected animal species to infect humans that in turn developed person-to-person transmission, resulting in respiratory problems [1,2]. Since its emergence, COVID-19 has caused massive disruption to societies, from separating family members due to restrictive self-quarantine measures that are required to limit its transmission, to bringing economies to a standstill as nations have taken

restrictive measures to control the virus's spread through the closure of all manufacturing industries, public and private offices, and local markets and public transportation systems. These restrictive measures have been necessitated by the fact that coming in close contact with an infected person or their nasal/mouth discharge remains the main risk factor for the spread of the virus [2,3].

The novel COVID-19 is related to SARS and MERS coronaviruses and its implications include high fever, severe cough, difficulty breathing, pneumonia, organ failure, and death [4,5]. The challenge in detecting people with COVID-19 can be attributed to the existence of too many respiratory infections, e.g., colds and flus, and also limited availability of test kits. COVID-19 is a lower respiratory tract infection, and as such most of its symptoms are likely to be felt in the chest and lungs. So far, fever is the most common symptom among people infected with the virus. This was substantiated by a study of patients at the Zhongnan Hospital of Wuhan University in China in which it was observed that about 99% of patients developed a high temperature [6]. Hence, across Africa, one of the precautionary measures being taken is the measuring of the body temperature of people either at the entrance to buildings or in designated places across cities. It is true that socialization is a matter of both culture and survival. Since people need to work to earn a living, in many African societies where more than half the populations survive on less than USD 1 per day, the enforcement of social distancing measures has had a negative impact on peoples' livelihood [7,8].

Like all other countries on the African continent and the globe at large, Rwanda is equally battling the outbreak of the COVID-19 pandemic. Almost all sectors in the country have been affected, ranging from transportation, education, and public works to the daily operations of businesses like selling, retailing, and so forth. Micro, small, and medium enterprises (MSMEs) form the backbone of many African economies. In Rwanda, MSMEs comprise 97.8% of the private sector and account for almost 36% of private sector employment [9]. Thus, there is dire need for this research, which helps key stakeholders understand the real ground truths, which vary based on geographical context, practices, and in fact the existing government policies. There are various factors that have to be studied regarding the impact of the COVID-19 pandemic, but since the scope is wide, this research work attempts to focus on the effect of the pandemic in the business sector in Rwanda. The results may be extrapolated to most of the African continent, as many similarities exist in the business policies and the functioning of regulatory bodies. Thus, this work is an attempt to capture real facts and statistics as to how the pandemic has impacted businesses and more importantly, to appreciate the level to which businesses are enforcing the public health measures within the business environments, and if any gap is identified, to suggest technological mitigation models appropriately. The next phase of our work will be to report the effect before and after the technological intervention in those same business sectors. This work will serve as the input data for the next phase of the work, which is deployment, another survey, and comparing and reporting the effect.

2. Literature Review

2.1. Theories

Similar surveys have been conducted by other researchers in the Sub-Saharan African context. For example, a survey was conducted by a few other researchers in the kingdom of Eswatini, which reported that females above 30 were more vulnerable and about 32% did not use protective gear [10]. However, their focus was not on business impact, which we tried to capture. Similarly, in the work reported in [11], they proposed various operations and supply chain perspectives for handling disruptions in demand and supply, especially in terms of demand for non-essential product and services. Our study, however, covers a wide range of aspects of how MSMEs have been impacted, going beyond the supply chain disruption. In this regard, a questionnaire was formulated where the questions were organized along three main themes to capture many aspects in which local businesses have been impacted by the COVID-19 pandemic.

2.2. Known Studies

This section presents a discussion of the literature related to this work. It is important to understand the COVID-19 coronavirus disease as much as possible. In [12], the authors provided a detailed study of COVID-19, its factors of spread, health impacts, and much more.

Like other emerging economic regions, the Sub-Saharan Africa region experienced COVID-19 impacts to a different level than developed economic regions. This can be attributed to factors including broken healthcare systems and others. Since the beginning of the COVID-19 pandemic, its impacts on the various aspects of societal life have been studied and documented by the research community [13–15]. Our discussion focuses on the impact of the pandemic on MSMEs. In a study conducted in Uganda [16], it was discovered that laying off employees and difficulty in accessing inputs and markets for output were mong the main impacts suffered by businesses. These effects were attributed to containment measures to curb the virus's spread and also inability of the MSMEs to implement preventative health measures such as provision of hand sanitzer and handwashing points within the business environment, which had a direct impact on operational costs. The enforcement of social distance through lockdowns was observed as a threat with potential to cause permanent closure of MSMEs in a study reported in [17]. Ref. [18] reported a study assessing the financial and operational impact of COVID-19 on women-led MSMEs in 13 Sub-Saharan African countries. Over 25% of the businesses surveyed suspended their operations due to the crisis. The study further found that there was a need for over 50% of the businesses to adapt their businesss models. These problems were experienced by MSMEs across the study catchment area.

Recently, guidelines have been released as how to prepare workplaces during COVID-19 [19,20]. In yet another research work by Ayyoob et al. [21], the impact caused by COVID-19 on urban areas is discussed and reveals the need for post-COVID-19 urban design and planning. This work discusses importance of resilience and sustainability. In Rwanda, several studies assessing the impact of COVID-19 have been reported. Some studies are similar but differ in some way either in approach or focus [22].

The impact of COVID-19 in urban and rural areas is elaborately discussed, specifcally the importance of policymaking in urban governanace [23]. In addition, the effect of COVID-19 on economically weaker sectors is worse. The educational sector has also not been spared, and the impact of online education has clearly indicated that the quality of education standards has come down. The reasons include remote examination evaluation metrics, less hands-on practice, etc. This was captured by [24].

It is important to understand a few other geographic locations apart from Rwanda, Africa, if one needs a better understanding of the blow of COVID-19. The paper by [25] potrays how COVID-19 has impacted mobility and therefore the livelihood of people from all walks of life. Planning for post-COVID-19 scenarios is very important. This includes working spaces, businesss models, operation modes, and many more. In [26], the author tries to give an insight of how post-pandemic society will be and highlights hidden challenges that will have to be addressed. There is also an interesting study that explored the impact of COVID-19 in terms of environmental factors as well. This is not directly related to business, but there is a clear indication of the improvement of health metrics of people and increased work productivity compared to normal times. There are some pros and cons for every effect, but this is no exception. This is captured in the work reported in [27].

There are some interesting studies on environmental impact, which on initial glance, looks like there is no relevance to business and their ecosystem, e.g., [28]. However, the drugs consumed in some countries that are believed to curb COVID-19 ae leading to polluted water bodies through improper drug preparation methods. AntiRetroViral (ARV) drugs are heavily used in the Sub-Saharan African region to curb HIV and were also rumored to curb COVID-19. ARV preparation involves wastewater discharge as part of the preparation, which is not properly treated and is fed back into fresh water, which in turn

is consumed by people and used by MSMEs. There is a possibility that this may bring in serious threats to the economies of countries through deteriorating health, standards of living, decrease in productivity, and many more as part of the ecosystem chain [29]. In [30], the authors investigated the impact of COVID-19 on migration and the reasons thereof, including job opportunities and business opportunities.

There are many critical questions that need to be addressed in terms of the perceptions around the pandemic and plans to mitigate the challenges [31]. Technology is always a two-sided coin. Some technologies have really contributed in terms of prevention, protection, and mitigation techniques. Some authors [32] have captured it through their contributions, which highlights that these mechanisms can improve conditions prevailing in business spaces for improving the productivity and, of course, the safety of working crews.

3. Materials and Methodology

To facilitate the execution of the survey, study authorization was obtained from the responsible district council offices together with the list of businesses registered to operate within the district. Upon obtaining these necessary documents, a questionnaire was developed and enumerators were recruited and trained in line with the needs of the study. The survey was conducted in line with the existing COVID-19 preventive measures. The collected survey data were analyzed using relevant statistical packages, and based on the analysis, an extensive report was produced that has been shared with the funders of the study. The overall study methodology is summarized in Figure 1. Below we briefly discuss each of these steps.



Figure 1. Preliminary data collection process.

3.1. The Questionnaire

The survey was conducted using a questionnaire that had 24 general questions to capture many aspects in which the local businesses have been impacted by the COVID-19 pandemic.

The survey design was based on the authors' insights that were seen fit for the study's geographical location, business, and social governance landscapes. The questionnaire was not based on any specific previous work, but basic reference of mandatory ingredients of any survey questionnaire were adopted to maintain survey standards. Before embarking on the study, the developed questionnaire was piloted, after which necessary changes were made to the questions and responses to make sure there was no ambiguity in the intended responses to the questions. In general, the questions were organized along three main themes as highlighted below.

Specific impacts of COVID-19 on business operations

The questions in this section focused on capturing information on how business operations have been affected since the emergence of the COVID-19 pandemic and also the level of the impact. Some of the aspects focused on include the risk of permanently closing the business, the ability of the business to purchase inputs and/or sell outputs, and strategies adopted to cope with effects of the pandemic.

Enforcement of the public health safety measures

The questions in this section assessed whether and/or how the businesses enforce the recommended public health safety measures to curb the spread of the virus, including social distance and checking for fever within the business premises.

Perception towards automated public health safety measure enforcement systems

Under this theme, the questions focused on assessing the challenges the businesses face in enforcing the COVID-19 public health safety measures and finding out the people's perception of automated technology-based system(s) that can enforce these safety measures.

The questionnaire combined multiple-choice questions and open-ended questions. The multiple-choice questions had predefined answers, giving the respondents the possibility to choose and rank among several options or possibilities. Where necessary, an optional space was provided to offer the respondents an opportunity to elaborate on their answers. Such comments from respondents were found to be insightful in that in some instances they revealed the respondents' feelings and provided elaborate justification to some options selected in the multiple-choice questions. All such information provided valuable material that improved the interpretation of the overall survey results.

3.2. Survey Sample

The sampling procedure included (1) hard copies of the questionnaires made available, (2) formulation of a data collection team, (3) capturing a list of all registered businesses, (4) using this information to calculate the target sample size of respondents using Equation (1) below, (5) field visits by the teams, and (6) keying in the data, consolidating, analyzing, and inferring based on the results. Equation (1) below is the formula utilized for computing the representational sample size.

$$n = \frac{(z)^2 p(1-p)}{d^2}$$
(1)

where n is the sample size, z is the level of confidence as per the standard normal distribution, p is the estimated proportion of the population that possesses the characteristic of interest, and d is the tolerated margin of error. As per the accessed list, the number of registered businesses operating in Huye at the time of the survey was 6138.

The prevalence of the factor under study (p) was set to 0.5. The margin of error d and z-score were set to 0.05 and 1.96, respectively. The z-score of 1.96 represented a confident level of 95%. After applying the formula, the results suggested that the sample size should be 384 for Huye; however, a sample of 403 was considered for this study.

3.3. Data Analysis

To analyze the survey data, two applications were used: Microsoft Excel and IBM SPSS Statistics 23. Microsoft Excel was used to analyze structured survey data, whereas IBM SPSS was used to analyze unstructured data, i.e., questions with multiple response sets and open-ended question responses. To analyze the questions with multiple response sets, the multiple column scheme was adopted. A numeric code was assigned for the options selected, and for those not selected, it was left blank. Specifically, if a person selected that option, they were assigned a 1 for that variable; if they did not select that option, their data value was left blank.

4. Results and Discussion

Our analysis focused on the assessment of the various ways in which businesses have been impacted by the pandemic. We divided the impacts into themes, as reported below. The results reported herein are not exhaustive of the analyzed data. The data are publicly available via https://aceiot.ur.ac.rw/HUYE_Data_For_Public_Sharing.xlsx (accessed on 18 November 2021) to allow for validation of the results and also in case of interest in other variables not reported in this research.

4.1. The COVID-19 Pandemic Has Impacted the Turnover of Businesses

Figure 2 summarizes the ways in which most businesses have been impacted by COVID-19. Figure 2 is a graphical interpretation of the data on this aspect. As can be seen from the figure, 57.3% of the businesses cited failure by clients to pay their bills, whereas 67.5% pointed to reduced investment as some of the ways in which they have been impacted. We can clearly see that businesses cannot invest if they are not making a profit, which in this case was partly due to failure by clients to settle their bills, which may be attributed to disruption caused by the pandemic.



Figure 2. Some ways in which COVID-19 has impacted businesses.

4.2. There Is a Need for Temporary Measures by the Government to Help Businesses Cope

Figure 3 summarizes the finding in terms of the temporary measures that business owners wish the government would facilitate and believe would improve their uprightness during this pandemic period. Most businesses expressed the need for assistance in terms of financial programs (e.g., low-interest credit or credit guarantees) (57.6%), tax waiver or temporary tax breaks (82.8%), rent reductions on rented business facilities or offices spaces (45.9%), social cash transfers (32.9%), support for the self-employed (38.2%), and a consideration of the extension of operating hours (38.9%).



Figure 3. Government measures that can help businesses cope with the impact of COVID-19.

4.3. Businesses Are Experiencing Challenges to Accessing Inputs and Selling Outputs

Figure 4 presents a graphical interpretation of the analysis concerning how the pandemic has affected the ability of businesses to purchase inputs and/or sell outputs. Most businesses pointed out that, since the emergence of the pandemic, it has been difficult to access inputs domestically (49.1%). As regards sales, 94.5% pointed out that, since the pandemic, they have experienced lower domestic sales to consumers, whereas 39.5% indicated that they are experiencing lower domestic sales to businesses.



Figure 4. Some ways in which business have been impacted by COVID-19.

4.4. Businesses Have Adopted Some Strategies to Cope with the Effects of the Pandemic

Figure 5 summarizes some of the strategies that businesses have adopted to cope with the impact of the COVID-19 pandemic. It was noted that most business had either temporarily reduced the work force (37.0%) or had laid off employees (30.8%). A total of 23.1% had adopted a teleworking approach, whereas 22.0% had ventured into selling a new product or providing a new service.



Figure 5. Some measures to counter the cushion effects of COVID-19.

4.5. Most Businesses Have Put in Place Interventions to Enforce Public Health Safety and Meaasures to Safeguard Employees and Clients/Customers

When asked about which measures they had put in place within the business environment to enforce health safety measures, about 62.3% of the businesses indicated that they have hand washing points, 86.8% of the businesses indicated that they have hand sanitizer dispensers, and 63.3% pointed out that they have put mechanisms to enforce social distance within the business environment. Figure 6 presents the analysis results of this aspect.



Figure 6. Interventions to enforce COVID–19 health measures.

4.6. Many Businesses Have Put in Place Measures to Enforce Social Distance Requirement within the Business Premises

The responses given when asked about how they enforce social distance within the business premises are summarized in Figure 7.



Figure 7. Methods used to enforce social distance.

5. Comparison Discussion and Study Limitations

The results of this study confirm the findings of similar studies from different geographical locations that focus on a central theme: that MSMEs have faced far more negative impacts due to the pandemic [13,33–35]. This study confirms that MSMEs experienced disruption to their usual business operations and a reduction in revenue. Reduced revenue led to a weak financial muscle to sustain the work force, forcing them to downsize their workforce. In [34], the authors reported that MSMEs faced difficulties accessing credit and had low ability to service outstanding debts. Similar sentiments were expressed by the respondents in our study. As pointed out above, all of these are consequences of reduced revenue, which was caused by the prolonged lockdown. However, our research is different from the cited studies in that our study further assessed the level of enforcement of health safety measures, including social distance, mask wearing, and placement of handwashing points within the business environment. We find our study more impactful in that it is more informative for the local law enforcement authorities, as it reveals which measures are being obeyed. Hence, they can know what to do to enhance citizen appreciation of the need to obey the regulations. Among the limitations of this study is the overreliance on quantitative research methodology. We believe the findings could have been more informative if a mixed research approach had been adopted. The qualitative methods such as key informant interviews and focus group discussions would have shed light on the emotional impact of the pandemic, a variable that could not be captured by the questionnaire.

6. Conclusions and Future Work

This paper presents an assessment of our theoretical claim that COVID-19 pandemic impacts vary, taking into consideration various factors including geographical context, and political, social, and economical backgrounds. The claim is validated through a study that involved capturing real field-level data, and after being analyzed, the results show that the assertion is a fact. The prepared questionnaire captured all the attributes, namely, type of business, practices in place and how many are really followed, the reason for them, opinions on the need for technological support, awareness, impacted business, specific impacts, expectations from the public, possible countermeasures, etc., as well as being able to convincingly prove the impact of COVID-19 on the operation of businesses in Rwanda. This is made vivid through the graphical representations and inferences in the above sections. In addition, all the results presented in this paper are based on the analysis of real field survey data and not any publicly available dataset, which adds unique value and accountability to this piece of work. As already mentioned, this research work is part of a bigger project supported by the National Research and Innovation Fund (NRIF) through the National Council of Science and Technology of Rwanda to arrive at technological support to curb and mitigate the COVID-19 pandemic, preferably keeping post-COVID-19 in mind as well so as to be resilient and sustainable for a longer span and also to scale to any similar situation that may arise in the near future. Furthermore, the analysis of the data revealed several ways in which the pandemic has changed the business environment for MSMEs in particular. Moreover, the data also revealed some of the interventions that businesses are implementing so as to cushion the negative impacts of the pandemic. However, it is apparent from the data that there is need for further deliberate efforts from the government to widen access to the business recovery fund and other measures to ease the recovery process of businesses. As part of future work, more such surveys can be conducted in various sectors, including education, transport, etc., so as to get a holistic view of the impact apart from business.

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