



Article

Do Digital Technologies Influence the Relationship between the COVID-19 Crisis and SMEs' Resilience in Developing Countries?

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Abstract: The COVID-19 pandemic is not only a medical emergency but also a business emergency that has created the need for organizations to be resilient and versatile in managing the impact of the pandemic on their business operations. At this time, small- and medium-sized enterprises (SMEs) are the most vulnerable to the economic disaster caused by the recent crisis, because these companies do not have the necessary resources to absorb losses. This research reviewed the impact of digital technologies on SMEs' resilience during the pandemic, focusing on companies in developing countries. Based on the 96 SMEs surveyed across six developing countries, the study shows that digital technology has helped SMEs to survive the pandemic, assisting SMEs in becoming more robust and ensuring their survival. This research fills a significant research gap in the literature, highlighting the inherent challenges of SMEs in developing countries and their digital transformation strategies. This study also offers practical recommendations for SMEs, tech developers, and policymakers to invest more effort in putting new procedures in place to ensure the efficacy of digital technology.

Keywords: COVID-19; developing countries; digital technology; resilience; small- and medium-sized enterprises



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1. Introduction

The global health catastrophe caused by the COVID-19 pandemic justified the establishment of a containment procedure in many nations, resulting in border closures, a sharp slowdown in trade, and a global economic depression [1–6]. COVID-19, according to [7], is the most severe epidemic since the 1918 Spanish Influenza pandemic. [8] claim that the economic crisis has had adverse effects on mental health, rising suicide, and hospitalization. Ref. [7] add that the epidemic and the government's response (social distancing measures, for example) intensified economic disparities and damaged socio-demographic groups. Ref. [9] argues that the COVID-19 pandemic presents a severe challenge to economic development worldwide and is predicted to cover the planet. According to an Organization for Economic Cooperation and Development (OECD) assessment, 20% of enterprises experienced liquidity problems one month after the lockdown, which grew to 30% after two months and reached around 38% after three months [10]. In 2021, the International Monetary Funds (IMF) forecasted a 5% economic growth rate, lower than the pace recorded during the financial crisis of 2008.

Small- and medium-sized enterprises (SMEs) would be the most vulnerable to the economic catastrophe caused by COVID-19 because these companies rely on the velocity of money generated by the sale of commodities [11]. Ref. [11] adds that SMEs are the most insecure because they lack the resources to survive during a crisis. A survey of UK SMEs found that 61% had severe financial concerns and that 81% had insufficient government

support [12]. A study of more than 5800 small businesses in the USA found that 43% of the companies had closed due to COVID-19 [2]. Using firm-level data in seventeen countries, [13] found that many small businesses have failed amid the severity of the pandemic and the uncertainty surrounding economic growth and limited government support.

SMEs play an essential role in a country's economy. Their survival is critical; for example, there are six million SMEs in the UK, accounting for over 99% of all businesses and 33% of employment. In many developing countries and emerging economies, more than 60% of SMEs are in the informal economy, lacking social protection and decent working conditions [14]. Failures of SMEs due to the pandemic will have serious economic consequences due to unemployed staff, defaulted loans, and a greater risk of financial crisis, highlighting the need for the government and policymakers to develop measures to support this sector of the economy.

The pandemic has provided a springboard for many innovations as businesses cope with the impact despite these challenges. Ref. [15] argue that digital technologies adequately address the COVID-19 pandemic's disruptive changes. The pandemic's disruption effect is different and more severe than the traditional disruption, in which human innovation drives change. Ref. [16] found that many SMEs, enterprises, and executives have explored new possibilities and implemented emergent strategies for long-term economic development to mitigate the COVID-19 crisis's negative impacts. Adopting digital technologies improves the company's competitiveness, productivity, and profitability while also ensuring its survival [16]. Digital technologies comprise such categories as the Internet of Things (IoT), artificial intelligence, big data analytics, advanced tracking and tracing technologies, wearables, and additive manufacturing [17–19].

Ref. [11] has also shown that digital technologies help SMEs be more resilient, developing their ability to withstand the effects of a business interruption and focusing their activities on continuing to provide the necessary services. Refs. [20,21] further position resilience as the ability to accommodate change and evolve, turning shocks and disruptions, such as a financial crisis or pandemic, into regeneration and creative thinking opportunities. Many companies undoubtedly want to be resilient, continue functioning, and constantly adjust to the risks exposed, but inherent and institutional limitations exist. This applies particularly to SMEs in many developing countries and emerging economies worldwide.

Ref. [22] argue that to keep the economies going during the COVID-19 pandemic, SMEs in advanced countries rapidly implemented technology and pushed public and private sector businesses to the digital realm. However, there are huge concerns around the digital divide and the inherent challenges for companies in developing countries to adopt technology and fast-track their digital transformation strategies to cope with the impact of the technology. In addressing this concern, this study aims to review the impact of digital technologies on SMEs' resilience during the COVID-19 pandemic, focusing on SMEs in developing countries. Using data collected through a survey of 96 SME owners across six developing countries, the study establishes the digital factors that have influenced the SMEs' resilience during the COVID-19 pandemic.

This research contributes to the current literature in several ways. First, given the limited research on the effect of the pandemic on developing countries, this work adds to the growing literature evaluating the impact of the pandemic on SMEs. Second, the research sheds new light on how digital technologies affect SMEs' resilience. Previous research studies [11,13,22–25] have investigated the impact of the COVID-19 pandemic, but few have examined the influence of digital technologies on SMEs' resilience, particularly in developing countries. Moreover, this study generates significant interest from a broad audience, such as regulators, academics, shareholders, executives, investors, etc. It recommends that SMEs explicitly devote more time to implementing new measures that will ensure the efficacy of digital technologies. The rest of the research paper is organized as follows. Section 2 discusses the literature review and hypotheses. The following section introduces the sample, and the different variables used. Section 4 discusses the empirical findings and Section 5 is to conclude.

2. Literature Review and Hypotheses

2.1. Digital Technologies and SMEs' Resilience

Thanks to digital technologies, SMEs can boost their agility and change their business models in weeks, if not days, rather than months [6]. Another benefit of digital technologies for SMEs is that they may help them to convert internal operations and procedures, improve performance efficiencies and effectiveness, re-engineer business models, mitigate risks, and ensure corporate survival [26]. Ref. [19] suggest that digital technology adoption increases SMEs' resilience during disruptive situations in developing countries. This result is also confirmed by [27] for a sample of 481 SMEs in Zambia, from 2019 to 2020. According to [28], firms can use digital technologies to help them to enhance their resilience capacity. In general, SMEs' limited ability, such as financial and human resources, leaves them with little flexibility in difficult situations. Advanced technologies provide small companies with more access to business tools, allowing them to quickly change their activities during crises, without huge upfront investment, and remain resilient. In this context, [29] state that the internet and telecommunications revolutions have given SMEs new, low-cost options to market their products and promote their brands. Ref. [30] adds that incorporating digital transformation into the sales function allows businesses to create money in new and innovative ways and predictably avoid failure. Ref. [22] suggest that technical innovation leads to economic development by increasing efficient demand and adding value. According to [15], staying close to consumers boosts a company's chances of success, and the digital transformation of the sales department is one step in this direction. Additionally, due to the global spread of COVID-19, the significance of technological innovation in improving productivity has been emphasized [22]. In circumstances where direct interaction is difficult or impossible, such as during community internment, virtual reality technology will assist managers in planning and performing remote corporate operations and activities. During the COVID-19 pandemic, managers evaluated workers' performance and results using online dashboards and digital data [31]. Ref. [32] suggest that managers' roles in the COVID-19 situation were minimized. In many businesses, the rapid digital transformation has resulted in the automation of specific routine tasks. In their efforts to support workers and their firms through this challenging and stressful period, [32] note that certain managers may face a job loss or increased pressure. Ref. [18] claims that some Chief Executive Officers (CEOs) of multinational corporations have expressed discontent with the configuration of their global communication networks with some of the most widely utilized local communication technologies. Moreover, the lack of appropriate communication network infrastructures and the relatively high cost of equipment, out of reach for the vast majority of the population, complicate the dilemma for developing countries. It limits their connectivity and technological transmission [33]. The problem is exacerbated by the government's lack of interest in and support for developing the infrastructure required to expand internet access, either due to a lack of funding or a failure to prioritize technological innovation effectively. As a result, we propose the following hypothesis:

Hypothesis 1. *There is a significant relationship between digital technologies and SMEs' resilience during the COVID-19 pandemic.*

2.2. Working from Home and SMEs' Resilience

According to [23,25], working from home is one of the most well-known phenomena related to the COVID-19 pandemic. Ref. [30] claims that working from home has been introduced because a significant proportion of the workforce cannot continue working. Shops have been temporarily closed, and doing business with them is now only possible via their websites. Most companies have adopted work-from-home policies and assisted their staff in setting up their home offices, including buying additional smartphones, tablets, and computer monitors [34]. Ref. [28] states that teleworking helps firms to maintain business continuity and provide resilience. Ref. [17] claim that those who can work from home

have improved economic resilience and increased personal safety in developing countries. According to work adjustment theory, the COVID-19 pandemic has profoundly changed the way we work and the interaction between employers and employees [35]. Ref. [32] argue that digital technologies improve employees' efficiency and keep those working from home engaged. Ref. [32] claim that remote work is a critical source of financial and organizational resilience in times of crisis. Ref. [31] collected approximately three million tweets in March 2020, documenting people's use of web-conferencing technologies such as Zoom during the COVID-19 pandemic. They show that web-conferencing systems facilitated access to ordinary activities and connections that had been "locked away" due to COVID-19 mitigation measures, resulting in a new virtual togetherness. However, [34] predict that when employees work from home, they may feel isolated and lose their sense of connection to their colleagues and the company. Ref. [36] add that the close link between home and work is emotionally taxing, resulting in exhaustion and negative feelings. Ref. [18] conducted a study in France with 1574 teleworkers. Their findings show that one of the most significant barriers to telework adjustment is a lack of contact and informal relationships with co-workers, and overall input from the manager and the business. Ref. [3] conclude that epidemic-induced telework shares some traits with traditional telework. Nevertheless, it appears to have specific features that differentiate it as a unique context with distinct conceptual boundaries. Ref. [37] add that, during the current pandemic, the productivity of employees working at home in developing countries has been reduced due to poor digitization. To succeed in this new working method, firms must set up several systems, including checking remote server accessibility, instant messaging, e-mail management, etc. Managers should be briefed on remote management techniques. Moreover, it seems necessary to develop a charter for teleworking. We hypothesize that:

Hypothesis 2. *There is a positive relationship between working from home and SMEs' resilience during the COVID-19 crisis.*

2.3. Government Support and SMEs' Resilience

According to [1], governments have established many programs to address SMEs' requirements since the pandemic. The primary objective has been to give crucial funds and support to SME owners in the short term. Similarly, [38] argue that the government must assist SMEs at risk. Ref. [39] add that support measures designed by states should be based on defined economic policy goals, be systemic, and include long-term company development priorities. These support measures are aimed at providing emergency liquidity assistance in various forms. Indeed, the following three categories can be used to classify liquidity support measures: 1—job retention programs, such as short-term labor programs and wage subsidy programs; these policies are aimed at businesses and the self-employed to reduce unemployment and increase consumer demand; 2—payment deferrals, such as income and corporation tax deferrals, value-added tax, social security and pension payments, debt payment moratoria and waivers of utility payments, and exemptions or reductions of financing interest and fees, which help SMEs to maintain liquidity by lowering operational costs; 3—debt-based financial support, which includes expanded and simplified loan guarantees, direct financing through governmental institutions, and assistance for non-banking finance, grants and subsidies, or equity or quasi-equity, including conversion loans [28]. For example, [28] indicates that wage subsidies are utilized in one form or another by 51 of the 55 nations for which information has been gathered, while payment deferrals are used by 50 of the 55 nations. The primary goal of government support should be to preserve company resilience and continuity [27,39]. According to a McKinsey study of various small company surveys in the United States, 1.4–2.1 million (25–36%) small firms might close permanently due to the disruption caused by the COVID-19 epidemic in only the first four months. Ref. [38] show that government support should be implemented quickly to prevent layoffs. According to [40], government aids are in place to help businesses retain employees. Ref. [41] argue that government support measures aim to evaluate the risks

that companies face, improve financial institutions’ risk acceptance by providing long-term tax relief and investments for enterprises, etc. Ref. [4] add that government support is essential for firms in developing countries with little cash flow to survive and recover during a crisis. Ref. [27] note that developing-country governments may lack the same tools and resources as their counterparts in North America or Western Europe. We state the following hypothesis:

Hypothesis 3. *There is a positive relationship between government support measures and SMEs’ resilience during the COVID-19 crisis.*

3. Methodology

3.1. Research Method and Sample

Considering that there are many options for research methods, we adopted a quantitative research method to empirically investigate the influence of digital technologies on SMEs’ resilience during the recent crisis [42]. Quantitative research focuses on hypothesis testing, cause and effect analysis, and prediction [43] and has been utilized by [44]. It is based on traditional scientific research that creates numerical data and usually establishes causal relationships between two or more variables, using statistical methods to test the significance of the relationships. In addition, the need to gain insights from different SMEs from different countries using interviews and other qualitative methods will be very impractical and challenging. Therefore, it was considered more appropriate to use questionnaires and adopt quantitative research. This is a similar approach that many researchers adopt when focusing on SMEs in multiple countries [45,46]. We adopted a quantitative analysis of a questionnaire that targeted SME owners in six countries—Bahrain, Egypt, Pakistan, Saudi Arabia, Tunisia, and the United Arab Emirates. These six countries are all developing countries according to [47], and, based on EUROSTAT’s Structural Business Statistics, SMEs are defined as firms with less than 250 employees. Our data were collected during the first half of January 2021. Participation in the survey was voluntary while respecting the confidentiality of the personal information and other ethical considerations indicated in the questionnaire tips. The survey guidelines were explained to the participants before the information dissemination. They were asked to answer as many questions as possible. However, they could leave a section blank if they were unsure of the answer. A total of 136 respondents were recruited, but 40 were removed from the study because they answered less than 80% of the questions correctly and omitted some crucial information. Data from a final sample of 96 respondents were subsequently analyzed. Data were entered into Excel for information documentation, and STATA was used for data analysis. Eventually, the descriptive statistics of this study showed that the majority of the participants (82.5 percent) were male, and 43.8 percent of the participants were between the ages of 35 and 45 years. Further sample demographics are presented in Table 1.

Table 1. Profile of respondents.

Profile of Respondents	Frequency	%
Gender distribution		
Male	79	82.5
Female	17	17.5
Distribution by age		
Less than 35 years	19	19.8
Between 35 and 45 years	43	43.8
More than 45 years	34	36.5

Table 1. *Cont.*

Profile of Respondents	Frequency	%
Distribution by country		
Bahrain	9	9.38
Egypt	12	12.5
Pakistan	25	26.04
Saudi Arabia	10	10.42
Tunisia	30	31
United Arab Emirates	10	10.42
Status of respondents		
Managing Director	16	16.5
Financial Director	11	11.3
Technical Director	9	9.38
Operation Director	12	12.5
General Manager	16	22.7
Human Resources Manager	14	14.4
Accountant	10	10.42
Auditor	8	8.3
SME sector		
Accounting/Auditing/Law	33	34.36
Clothing/Textile/Leather	10	10.42
Machinery/Equipment/Heavy Industry	13	13.54
Food/Beverages/Cosmetics	5	5.21
Trading/Import and Export	4	4.17
Agriculture/Fishery/Forestry	4	4.18
Manufacturing	3	3.12
Others	24	25

3.2. Questionnaire Development

We disseminated our survey electronically via an online questionnaire. The adoption of computerized surveys has become an option to facilitate the development of scientific research. Moreover, since the end of the 1990s, electronic surveys have increased considerably [48]. The study used a multi-item approach in the survey's design [49], using 5-point Likert scales, ranging from 1 strongly disagree to 5 strongly agree. To enhance the reliability and validity of the study, three constructs were measured: control information and introduction, the business situation in times of COVID-19, and digital transition within the SMEs during the COVID-19 pandemic. Table 2 provides all the constructs and items used in this study.

3.3. Variable Measurement

3.3.1. Dependent Variable

Several approaches assessing resilience have been proposed in recent years, using quantitative and qualitative methods [50–52]. Ref. [52] add that resilience is difficult to quantify. Ref. [52] state that sales and market confidence are essential aspects of an enterprise's resilience. According to [53], increased sales and production permits a company to strengthen its resilience capability during times of crisis and uncertainty. Ref. [11] predicts that product excellence, management behavior, and process efficiency are three essential components of business resilience. Furthermore, [53] show a substantial correlation between a leader's behavior and a company's success. As per their findings, the manager's behavior can have a favorable impact on the company's performance. According to [54], the company should avoid layoffs, provide more flexible working hours, and provide paid sick leave. Otherwise, [54] claim that numerous businesses used financial instruments to mitigate the COVID-19 crisis's adverse effects and survive (e.g., tax stimulus, direct funding, delays in paying taxes, sales on credit, purchases on credit, etc.).

According to [50], the resilience variable covers production, sales, financial access, and the manager’s function. This method looked at the various aspects of SMEs’ resilience. Each variable was reverse-coded before being combined [50]. Indeed, to measure the SMEs’ production, interviewees were questioned about their current status on a scale of 1 (the firm maintains its current level of production) to 3 (total stoppage of the production). Another indicator of resilience was sales, graded on a scale of 1 (increase) to 3 (decrease). In addition, respondents were asked about the relevance of the manager’s position compared to 2019. A scale of 1 (yes) to 2 (no) was employed. On a scale of 1 (increased) to 3 (decreased), interviewees were asked about the total number of employees during the COVID-19 crisis to assess SMEs’ labor. Finance access, measured on a scale of 1 (commercial bank loans) to 5 (purchases on credit), was another resilience indicator.

3.3.2. Measurement of the Independent Variables

SMEs increasingly use the web and web-related technologies to make new business models and boost their ability to adapt to the COVID-19 crisis [22]. Many communication technology choices are obtainable to handle recently established remote employees thanks to the internet and web-based technology. E-mail alone is insufficient. Ref. [34] claim that firms used daily mailings, phone, WhatsApp, messaging, information blogs or podcasts, or a service hotline to connect with their employees. Ref. [55] states that SMEs adopt digital technologies differently according to their needs.

We extracted characteristics from a review of several academic papers to examine the empirical impact of digital technologies on SMEs’ resilience during the COVID-19 pandemic. In particular, we have found that **DigiTech** is a binary variable that is 1 if the SMEs use digital technologies and 0 otherwise, **WFH** is a binary variable that is 1 if employees work from home during the COVID-19 crisis and 0 otherwise, and **GVS** is a binary variable that is 1 if the SMEs received any government support and 0 otherwise.

To improve our empirical results, we added five control variables. **CON** is a binary variable that is 1 if there is good connection quality within the SMEs and 0 otherwise; **SIZE** is the SMEs’ size; **COVID** is the Case Fatality Ratio for COVID-19; **GDP** is the economic growth rate of the gross domestic product; **INF** is the inflation rate¹. Table 2 describes the used variables.

Table 2. Description of used variables.

Variable Name	Definition	Measure	Reference (s)
RES	Production	An ordinal variable measured on 3-point scale (1= the firm keeps the same level of production, 2 = part-time work, 3 = total stoppage of production).	[11,50,53,54,56]
	Sales	An ordinal variable measured on 3-point scale (1= increase, 2 = remain the same, 3 = decrease).	[25,50]
	Manager	An ordinal variable measured on 2-point scale (1= yes, 2 = no).	[22,31,32,50,53]
	Labor	An ordinal variable measured on 3-point scale (1 = increased, 2 = remained the same, 3 = decreased).	[50,54]
	Finance access	An ordinal variable measured on 5-point scale (1 = loans from commercial banks, 2 = loans from non-banking financial institutions, 3 = delaying payments to suppliers or workers, 4 = sales on credit, 5 = purchases on credit).	[50,56]
DigiTech	Digital technologies	A binary variable that is 1 if the SMEs use digital technologies during the COVID-19 and 0 otherwise.	[11,16,18,22,31,34,55]
WFH	Working from home	A binary variable that is 1 if employees work from home during the COVID-19 crisis and 0 otherwise.	[23,30,32,37]
GVS	Government support	A binary variable that is 1 if the SMEs received any government support and 0 otherwise.	[1,4,38,40,41]

Table 2. Cont.

Variable Name	Definition	Measure	Reference (s)
CON	Connection quality	A binary variable that is 1 if there is good connection quality within the SMEs and 0 otherwise.	[41]
SIZE	The SMEs' size	An ordinal variable measured on 4-point scale (1 = 100 and above, 4 = 9 and below). SIZE is coded 1 if the employee number is less than 9, 2 if the number is between 10 and 49, 3 if the number is between 51 and 99, and 4 if the number is more than 100.	[35]
COVID	The Case Fatality Ratio for COVID-19	(Deaths due to disease/Confirmed cases) × 100	[57,58]
GDP	Gross domestic product	The economic growth rate of the gross domestic product.	[59,60]
INF	Inflation	The inflation rate.	[59,60]

3.4. Model Specification

According to [61–64], we used the ordinary least squares (OLS) method to estimate the impact of digital technologies on SMEs' resilience throughout the COVID-19 pandemic. OLS regression is a mathematical and analytical technique for predicting the relationship between one or more independent variables and a dependent variable, according to [65]. We suggest the subsequent model:

$$RES_i = C + \beta_1 DigiTech_i + \beta_2 WFH_i + \beta_3 GVS_i + \beta_4 CON_i + \beta_5 SIZE_i + \beta_6 COVID_i + \beta_7 GDP_i + \beta_8 INF_i + \epsilon_{it}$$

Here, C is the constant. β_1 to β_3 are the coefficients of the interest variable, and β_5 to β_8 are the coefficients of the control variables. Moreover, 'i' indicates the SMEs' number, ranging from 1 to 96. ϵ denotes the error term.

4. Results

4.1. Descriptive Statistics

According to the descriptive data in Table 3, the mean of the (RES) variable, which ranges from 0 to 11, is 5.166. The average size of SMEs (SIZE) is 1.926. The mean of the (COVID) variable is 2.926, with 0.318 and 5.922 as its minimum and highest values, respectively. The (GDP) variable has an average of 105.044. The variable (INF) ranges from –1.86 to 9.05, with a mean of 5.048.

Table 3. Descriptive statistics.

VARIABLES	Mean	Sd	Min	Max
RES	5.166	2.907	0	11
SIZE	1.926	1.178	1	4
COVID	2.926	0.849	0.318	5.922
GDP	105.044	145.334	37.87	793
INF	5.048	2.031	–1.86	9.05

Table 4 reveals that digital technologies are used by 60.42 percent of SMEs, and 36.56 percent of employees work from home. Furthermore, 34.38 percent of SMEs receive government assistance, and 43.75 percent of businesses have good connectivity.

Table 4. Frequency of binary variables.

Variables	DigiTech		WFH		GVS		CON	
	1	0	1	0	1	0	1	0
Frequency %	60.42	39.58	36.56	63.44	34.38	65.63	43.75	56.25

4.2. Cross-Correlation Matrix

The analysis of the cross-correlation matrix in Table 5 reveals that there is no multicollinearity, and hence all independent variables are included in the regression model. The independent variables are not significantly connected and have a correlation coefficient of less than 0.7 [66].

Table 5. Cross-correlation matrix.

Variables	DigiTech	WFH	GVS	CON	Size	COVID	GDP	INF
DigiTech	1.000							
WFH	0.073	1.000						
GVS	0.220	0.130	1.000					
CON	0.102	−0.020	0.107	1.000				
Size	−0.216	0.066	−0.086	0.092	1.000			
COVID	−0.084	0.035	−0.201	−0.210	−0.001	1.000		
GDP	0.074	−0.149	0.089	0.137	0.092	−0.438	1.000	
INF	0.111	−0.174	0.037	0.189	0.021	0.006	0.320	1.000

4.3. Findings

Our findings on the association between digital technologies and SMEs’ resilience during the COVID-19 pandemic are summarized in Table 6. The coefficient of the (DigiTech) variable is positive and significant at the 5% level, which implies that digital technologies positively impacted the SMEs’ resilience over the COVID-19 crisis. H1, thus, is supported. This positive relationship opposes the study by [33], who surveyed 10 Australian business managers and found that digital technologies do not improve companies’ resilience. This result confirms previous research findings indicating that digital technologies help SMEs to be more resilient and survive [6,22,26,30,31,67]. Indeed, digital technologies for SMEs improve performance, reduce risks, and ensure the company’s survival. This finding is also corroborated by [15]. They anticipate that organizations would be able to generate revenue and enhance their finances by applying digital transformation in the sales function. Additionally, the results indicate that implementing digital technologies boosts a company’s efficiency [16]. According to [18], firms are utilizing the latest digital technologies to build capabilities for improving operational efficiency and agility and give end-users distinctive value to keep up with increasing expectations and the demand for personalized offers. Ref. [22] suggest that the virtual space reclaims organizational roles, allowing them to function regularly and keep economies afloat in the COVID-19 pandemic. We conclude that the digitalization of SMEs has enhanced their capacity to adjust to significant crises and to survive. Therefore, SMEs have to encourage the use of digital technologies. The (WFH) variable positively impacted SMEs’ resilience during the current crisis. H2, thus, is supported. This outcome indicates that working from home has improved SMEs’ resilience during the current pandemic, confirming the affordance theory predictions and previous research results [30,32,34]. It seems that remote work is a critical source of financial and organizational resilience in times of crisis. Digital technologies improve employees’ efficiency, and those who work from home are more engaged. Ref. [68] argue that one of the primary benefits of working from home contributing to employees’ well-being is increased job autonomy, allowing knowledge workers to have more flexibility in their schedules. This finding, in contrast, does not confirm the results of various studies [33,35–37]. Furthermore, the result is not in line with the predictions of [36], suggesting that remote work adds to the constraints of managing home surroundings that are not always favorable to work. We conclude that SMEs have to encourage the working-from-home practice. We also note that the coefficient associated with the (GVS) variable positively affects the SMEs’ resilience. H3, therefore, is supported. This outcome suggests that government support helps SMEs to survive and minimize the negative impact of the COVID-19 pandemic, and it backs up earlier research findings [25,29,38,40,41]. Government help, according to [4], is crucial for enterprises with restricted cash flow to survive and recover during a crisis. Thus, national

governments should play a critical role in developing appropriate solutions to improve the business climate and alleviate the negative consequences of the COVID-19 crisis.

Table 6. Panel regression results.

VARIABLES	RES
DigiTech	1.455 (0.012) **
WFH	1.665 (0.004) ***
GVS	1.238 (0.034) **
CON	0.483 (0.383)
SIZE	0.573 (0.015) **
COVID	0.240 (0.425)
GDP	0.002 (0.228)
INF	−0.229 (0.169)
Constant	1.300 (0.362)
N	96

Notes: ** significant at 5 percent, and *** significant at 1 percent.

Finally, concerning the control variables, the (SIZE) variable positively impacts SMEs’ resilience. This finding opposes [69] study, indicating that small businesses have a sound risk-diversification strategy and develop financial products. Other than this, the results demonstrate that other control variables (CON, COVID, GDP, and INF) had no impact on the SMEs’ resilience over the COVID-19 crisis.

5. Discussion: Digital Technology, SMEs’ Resilience, and Open Innovation

This study carries several theoretical implications. First, considering the limited research on the impact of the pandemic on developing countries and emerging economies, this research contributes to the growing literature evaluating the impact of the pandemic on SMEs. It recognizes that businesses in developing countries are making efforts to remain resilient amidst the impending challenges of the pandemic. Secondly, the study offers a new perspective on how digital technologies affect SMEs’ resilience during the COVID-19 pandemic. Previous research papers [11,13,23–25,70] have studied the impact of the COVID-19 pandemic, but only a few have related digital technologies and their effect on SMEs’ resilience. Third, this fills gaps in the literature by providing new empirical proof from a multi-country perspective on SME resilience and the impact of technology.

Practical and managerial implications relevant to crucial stakeholders also emerged from this study. We provide valuable insights for SME managers, technology developers, and policymakers. Managers need to recognize the value in developing the human capacity of the team; staff are to become conversant with digital technology and how it will enhance their business operations. Ref. [43] indicate that SMEs have more flexibility in their environment due to their smaller size. As a result, SMEs have characteristics that may support them in surviving crises and, therefore, managers should endeavor to train their staff to adapt to the changing work environments. This can be done in stages as their finances allow. Studies have shown that COVID-19 has had an uneven impact with regard to gender, and women have been unduly adversely affected [2,71].

The pandemic has had a disproportionate impact on women’s socio-economic outcomes [72]. Managers need to explore opportunities to use technology to manage this impact on women’s careers and allow them to be more integrated into business opera-

tions. This may involve allowing them to work collaboratively and remotely, exploring the various opportunities that digital technology offers. Following on from human capital development, investment in digital technology is essential now more than ever. The pandemic has shown that managers need to reinvent their business operations amid the impact of the crisis. There are growing prospects for artificial intelligence and automating business practices. Ref. [15] argue that the COVID-19 pandemic has encouraged businesses to adopt digital technologies on a larger scale and more rapidly. While we recognize the inherent challenges of operating businesses in developing countries [5], managers must explore options to integrate technology into business operations.

Technology developers also had a role to play in support of the digital transformation of SMEs in developing countries [43,73]. Tech developers should endeavor to establish country-centered innovations that meet the needs of businesses. Often, the ideas in developed countries may not be applicable in many of these developing countries [5]. For example, [74] reported that banks are using Unstructured Supplementary Service Data (USSD) on mobile phones with no access to the internet to ensure access to financial services in Nigeria. Therefore, developers should endeavor to develop accessible, affordable, and adaptable innovations for SMEs in developing countries. This could involve low-bandwidth technology and work with limited or slow access to the internet.

Policymakers and governments should endeavor to provide much-needed support to SMEs. These enterprises want to be resilient and survive, but they need help in their drive for digital transformation. This support could be in the form of grants and loans for companies to invest in technology as they mitigate the impact of the pandemic, tax breaks, and support for hiring staff and developing human capacity. In addition, governments need to recognize the role of SMEs in the economic development of their countries, provide an enabling business environment, and mitigate the negative impact of the COVID-19 crisis on SMEs' resilience.

6. Conclusions

SMEs are one of the most critical drivers of socio-economic progress in a country or region since they ensure the creation and development of permanent new jobs. They operate as a safe income for the population and provide their capability to pay. However, SMEs are most exposed to the economic crisis induced by COVID-19. To mitigate the negative effects of the COVID-19 epidemic on SMEs, firms and their leaders are looking for innovative ways to digitize company activities and undertake virtual operations, boosting their competitiveness and efficiency and ensuring their corporate survival.

This study investigated the impact of digital technologies on SMEs' resilience during the COVID-19 pandemic. To address this question, we surveyed 96 SMEs from six developing countries, and our findings present a link between digital technologies and SMEs' resilience. The results indicate that digital technologies positively affect SMEs' ability to resist the COVID-19 epidemic. This means that digital technologies help SMEs in developing countries to become more resilient and secure their future. Furthermore, the findings show that working from home and government support improve SMEs' resilience. We argue that digital technologies should be an essential element of policy solutions to COVID-19. Other independent variables (CON, COVID, GDP, and INF) had no impact on SMEs' resilience during the recent crisis. This study is of great interest to a broad audience, such as regulators, academics, shareholders, executives, investors, etc. It specifically recommends that SMEs implement new measures that will ensure the effectiveness of digital technologies.

Despite our contributions, there are still many avenues that future research can pursue. For example, as the sample in our paper had 96 SMEs, we acknowledge that other methods of estimating model parameters could be considered. Moreover, a future attempt may have a larger sample, increasing the research findings' generalizability. Similarly, our study is limited to 2021, and future researchers could explore the growing trends of digital technologies adopted by SMEs. In addition, more empirical analysis of digital technologies

and SMEs resilience is needed, perhaps with more qualitative insights through interviews with managers to understand their strategic directions.

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Notes:

1. The rate of economic growth of the gross domestic product, the rate of inflation, COVID-19 case numbers, and COVID-19 death numbers are often taken from the World Bank (4), Trading Economics (5), and the World Health Organization (6) websites.
 - (1) Available online: <https://fr.statista.com> (accessed on 18 March 2021).
 - (2) Available online: www.ilo.org (accessed on 8 February 2021).
 - (3) Available online: www.worlddata.info (accessed on 15 March 2021).
 - (4) Available online: www.worldbank.org (accessed on 15 March 2021).
 - (5) Available online: www.tradingeconomics.com (accessed on 12 June 2021).
 - (6) Available online: www.who.int (accessed on 7 March 2021).

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