



The Impact of the COVID-19 Pandemic on Software Business Enterprises in Pakistan: Analysis and Implications



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Abstract: The COVID-19 pandemic emerged over three years ago as a public health crisis, swiftly evolving into a worldwide economic crisis with far-reaching implications for global business enterprises and industries. The unprecedented disruption has varied across sectors, with some experiencing severe consequences while others have thrived. As governments and economies continue to recover from the pandemic's effects, it is crucial to analyze and comprehend these impacts to foster sustainable growth and prepare for future disruptions. This study aims to examine the COVID-19 pandemic's ramifications on Pakistan's software business enterprises by addressing three exploratory research questions: a) the pandemic's influence on Pakistan's software business enterprises, b) actions and initiatives undertaken by these enterprises during the pandemic, and c) the contributions made by these enterprises in combating the pandemic. Employing a mixed-methods approach, a survey research design was developed, incorporating both quantitative and qualitative methods to create a questionnaire grounded in a literature review. The findings of the survey are presented and discussed in-depth. This research contributes to the expanding body of knowledge on the COVID-19 pandemic's effects on business enterprises and industries.

Keywords: Pandemic; COVID-19; Disruption; Global industries; Software enterprises

1 Introduction

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, originated in Wuhan, China, towards the end of 2019 and had infected at least 830 individuals across nine countries by January 24, 2020 [1]. On March 11, 2020, the World Health Organization (WHO) declared the outbreak a global pandemic [2]. Nations worldwide undertook crucial steps in line with WHO guidelines, which included stringent monitoring, contact tracing, protective measures, travel restrictions, and social distancing mandates, to limit the virus's spread [3].

The pandemic and the associated preventive measures significantly impacted the global industry, leading to business closures and the halting of trade. These disruptions severely affected economic growth and stoked fears of a worldwide economic crisis, reminiscent of the unemployment rates witnessed during the Great Depression of the 1930s [4].

In June 2020, the Organization for Economic Cooperation and Development (OECD) markedly downgraded its November 2019 growth estimate from 2.9% to a range of -6.0% to -7.6%, contingent on the single or double wave of outbreaks [4]. Particularly for Pakistan, a decrease in the annual GDP from 1.9% in 2019 to -2.6% in 2020 was projected by the World Bank [4]. Already facing fiscal and current account deficits in July 2019, Pakistan was compelled to negotiate an Extended Fund Facility (EFF) program with the International Monetary Fund (IMF) well before the onset of the pandemic. However, the mitigation measures to reduce the current account deficit (CAD) by over 70%, including severe import reductions and a significant fall in currency value, took a toll on economic growth, which plummeted from 5.6% in 2018 to 1.9% in 2019. With the advent of the pandemic, these deficits have begun to re-emerge, prompted by a sharp decline in exports and international remittances.

Industries varied widely in their responses to the crisis. Six leading industries, including semiconductors, healthcare, and software, added \$275 billion annually to their projected economic-profit pool, while the six least

successful industries, namely insurance, transportation, and energy, lost \$373 billion [5]. Notably, global IT expenditure was predicted to decrease by 2.7% in 2020 despite the increased demand for some technologies and services due to short-term contingency plans and budget cuts [6].

However, amidst these crises, the IT sector in Pakistan displayed promising growth trends. Representing approximately 1% of the country's GDP, the IT sector's exports rose from \$3.3 billion in 2016-2017 to \$5 billion, with expectations of further growth to \$6 billion. Several IT subsectors, including Software Enterprise, Marketing tech, and financial services, also reported growth [7]. This research aims to investigate the impact of the COVID-19 pandemic on the software business enterprises in Pakistan, explore their responses, and understand their contributions to mitigating the pandemic's effects.

This research aims to:

- (1) RQ1. Examine the COVID-19 pandemic's impact on the software business enterprises in Pakistan.
- (2) RQ2. Identify the actions and strategies employed by Pakistani software enterprises in response to the COVID-19 pandemic.
- (3) RQ3. Explore how software business enterprises in Pakistan are contributing to efforts against the COVID-19 pandemic.

Therefore, the overarching goals of this research include identifying the impact of the COVID-19 pandemic on SMEs in Pakistan, understanding the challenges that software firms in Pakistan faced during this period, and examining the steps taken to combat these challenges. The research will also delve into the role of software technology applications in alleviating the pandemic's effects and propose strategies for managing potential future crises.

2 COVID-19 and the Pakistani Software Industry

2.1 SMEs in the Pakistani Software Industry

Small-to-Medium Enterprises (SMEs) are a significant part of both the global and Pakistani business landscape. Defined by parameters such as revenue, assets, or workforce size, SMEs account for a notable 99% of all companies within the European Union [8]. In Pakistan, these enterprises, defined by the State Bank of Pakistan, employ up to 50 workers for small businesses and up to 250 for medium to large enterprises, excluding public limited companies [9].

SMEs in Pakistan make up around 90% of all businesses, contributing approximately 40% to the annual GDP while employing 80% of the non-agricultural workforce [10]. Nonetheless, they often grapple with resource constraints that can adversely affect essential operations, including technology upgrades, marketing, and personnel development [10]. To alleviate these challenges, the Small and Medium Enterprises Development Authority (SMEDA) was established in 1998, with the dual mandate of fostering a supportive environment for SMEs and providing business development services [10].

Of particular interest is the software industry in Pakistan, which has exhibited substantial growth, despite various obstacles. Challenges, including inadequate governmental support, low economic stability, judicial inadequacies, power issues, and unstable internet availability, have not thwarted the industry's progress [11, 12]. Despite having only 12 designated software technology parks, a consequence of limited government funding, the industry has flourished [11].

The government's decision to make software exports tax-free has invigorated the market growth for software SMEs. Further, collaborations between non-profit and government organizations have led to entrepreneurial initiatives that provide training, technology funding, and financial facilitation [13]. Competitive pricing, lower than international rates, has attracted foreign software firms to Pakistan, boosting software exports by 2.4%, from \$1.06 billion to \$1.09 billion in 2018-19 [14, 15]. Given these advances, the Pakistan Software Export Board anticipates continued growth in the sector, projecting an additional 3% increase in the coming years [14, 15].

2.2 Impact of COVID-19 on the Software Sector

The global software industry, including that of Pakistan, faced a substantial negative impact due to the onset of the COVID-19 pandemic. Established sectors were already grappling with issues such as developing high-performance HR and operating with contemporary innovation. The outbreak of the virus magnified these problems, leading to contract discontinuations, work suspension, decreased sales, and delayed project payments [16].

Due to the pandemic, creativity dwindled, unemployment rose and businesses faced payment issues for already completed services. Many customers contemplated withdrawing their contractual agreements entirely. Businesses with a product-centric focus bore the brunt of missed payments and reduced accounts, leading to fewer subscriptions. This situation also resonated with software business start-ups, who faced reduced demand, investments, and valuations, sometimes leading to business closure [17].

China, one of the world's major software development hubs, suffered an unexpected hit as the pandemic struck. Its intertwined market structure led to a massive disruption in the multinational IT and web app development industry. Numerous tech giants reliant on China's industrial sectors had to partially or entirely shut down their operations,

leading to resource scarcity and project delays [18]. To curb the virus's spread, countries-imposed curfews and social gathering restrictions, resulting in event cancellations, such as technology conferences worldwide.

In particular, several significant events like Workday's annual internal sales meeting, Domo's Domopalooza, Facebook's F8 Software Technologies, Apple's Worldwide Developers Conference, Google's I / O software developers meeting, and Microsoft's Build Developer Conference were either cancelled or moved online. Adobe and Dell Technologies followed suit, canceling their events in response to safety concerns [19–26].

The production disruption also affected companies' revenue streams. Tencent warned about a slow-down in cloud-related programs, which would negatively impact their near-term sales from cloud services [27]. There was a shortage of diverse tech products, including VR headsets, iPhones, vehicles, and more, as Chinese manufacturers faced production challenges. Facebook even had to stop taking orders for its latest Oculus Quest VR headset due to these supply chain issues [28].

On the brighter side, the pandemic also sparked some positive changes in the software industry. The demand for cloud-based applications soared due to the increase in remote work, leading to increased stock levels and extensions in infrastructure, development, and ERP software sectors. This surge resulted in substantial recurring sales, robust profit margins, and valuable assets related to collaboration, connectivity, content distribution, and security [29, 30].

With most companies opting for remote work, there was a rise in demand for more specialized solutions like Electronic Signature and IaaS. This shift helped cloud businesses and application performance monitoring systems such as ServiceNow, Microsoft Teams, and Dynatrace. Microsoft Teams, for instance, reported a daily active user growth by 33 million [31–33].

In the pandemic's first phase, there was a surge in demand for collaborative software functions, endpoint protection, video conferencing, and network usage fields. Even ERP and CRM companies fared well, as ongoing software rollouts proved difficult to interrupt [32].

2.3 Technological Interventions Amid the Pandemic

The National Information Technology Board (NITB), under the Ministry of IT and Telecommunication, has pioneered a software application known as "Covid-19 Gov Pk". This application provides essential information on all preventive measures against Coronavirus (COVID-19), incorporating features such as a COVID-19 Current Status Dashboard, Hand-Washing Alarms, a COVID-19 Chatbot, and WHO video clips. Work is underway on an additional "Radius Alert" system, which will enable users to identify Coronavirus patients within a certain radius to maintain social distancing [14, 15].

Software engineers worldwide are contributing to the fight against COVID-19 by developing technological solutions. An array of public health agencies, institutions, and NGOs globally have established opt-in contact tracing systems. Technology giants like Google and Apple have jointly initiated a project to leverage Bluetooth technology to help curb the virus transmission while prioritizing user privacy [34].

The World Health Organization has launched the Academy Application to assist health workers during the pandemic and the WHO Info Application for public education. These apps provide access to a plethora of WHO-developed COVID-19 resources [35]. Many countries, including China, the US, and others in Europe and Asia, have demonstrated the efficacy of electronic monitoring in combating the virus. The use of cutting-edge technology such as hospital management software, tele-health technologies, AI-powered diagnostic tools, and emergency alert systems, has proved to be instrumental [36].

Software companies are responding to the pandemic in various ways, such as providing guidance, offering telecommuting services, applying computational expertise for COVID-19 research, and more. The Business Software Alliance (BSA), a trade association established by Microsoft, is a leading advocate for the global software industry. During the pandemic, BSA, together with Software.org, is offering free access to its services, monitoring virus transmission, supporting clinical testing, contributing to relief funds, and working to keep the public safe [37, 38].

Countries around the world have been utilizing software technology to mitigate the effects of COVID-19. China, for instance, has collaborated with tech giants like Alibaba and Tencent to implement a color-coded health rating system, thereby enabling efficient tracking and controlling of the virus spread [39, 40]. South Korea, on the other hand, leveraged AI to develop a software for early detection of COVID-19 symptoms [41].

Australia and India launched contact tracing apps, "COVIDSafe" and "Aarogya Setu" respectively, to identify and track the spread of the virus [42, 43]. In South Africa, Praekelt.org established a WhatsApp network for COVID-19 updates [44]. The UK government introduced an online WhatsApp chatbot to respond to public queries about the virus [45]. Germany utilized Apple and Google's privacy-focused APIs to create a contact-tracing app [46].

Digital tools have also been utilized in the education sector. Countries such as South Korea, China, Italy, Brazil, Israel, Uganda, the US, and Poland have resorted to online learning platforms like Microsoft Teams, Kolibri, Google Hangouts, and Alibaba's DingTalk. The utilization of these resources has facilitated communication and continuity of daily life amidst the COVID-19 pandemic [45].

3 Research Methodology

The research methodology, defined as a compendium of techniques and methods applied for analysis, essentially serves as a comprehensive guide to conducting research [47]. It elucidates and critically assesses approaches and resources, elucidates conclusions and implications, and contrasts potentialities. The present study deployed a mixed-methods approach, using Qualtrics for data collection.

The mixed-methods approach incorporates both quantitative and qualitative techniques in a single study, thereby furnishing a more comprehensive understanding of the research subject [48]. The quantitative component involves numerical data and measures, enabling researchers to explore and analyze phenomena through statistical analysis. Conversely, the qualitative aspect involves textually-rich data, providing deeper insights into the research question.

In contrast to exclusive reliance on a single method, a mixed-methods approach utilizes an array of data collection and analysis techniques. By combining both quantitative and qualitative data, it offers a more holistic explanation of the research question [49]. Hence, the mixed-methods approach can be broadly construed as a methodology in which data is gathered, analyzed, synthesized, and inferences are drawn using both qualitative and quantitative approaches.

The present study employed a combined methodology, leveraging both quantitative and qualitative data to yield primary and secondary results. The adoption of a mixed-methods approach facilitated a more comprehensive exploration of the research question. The survey questionnaire was meticulously crafted to be clear, unambiguous, and geared towards eliciting answers to the research question. The choice of response options was largely influenced by literature review insights.

The questionnaire comprised ten questions and was designed to be descriptive and succinct. It was tailored to the context of COVID-19's impact on Pakistani software companies and was drafted in a manner that is intuitive and comprehensible for respondents. The questionnaire incorporated elements of both the quantitative and qualitative approach. For instance, respondents were provided with multiple-choice options, and simultaneously, given the opportunity to provide textual responses to open-ended questions.

The integration of mixed methods in this research offered a comprehensive exploration of the effects of COVID-19 on software companies in Pakistan. By combining qualitative responses to open-ended questions with quantitative data analysis, a more nuanced understanding of the impact of the pandemic was achieved. In future studies, it could be beneficial to broaden the scope of the questionnaire to capture more diverse aspects of the software companies' response to the pandemic, thus deepening the understanding of this critical topic.

4 Results

4.1 Descriptive Statistics

The descriptive statistics relating to the respondents' demographic information are provided in Table 1. This data reveals a predominance of responses from middle management, accounting for 58% of total responses. Junior management, representing the second-largest group, contributed 32% of responses. Meanwhile, senior management and executive ranks made up 5% each of the total responses.

Examining the data relating to professional experience in the Software Business Enterprises in Pakistan, 57% of respondents reported a tenure of 1-5 years. Contrastingly, 43% of respondents reported experience exceeding five years. This distribution indicates a broad range of expertise and perspective amongst the respondents, a factor beneficial for the thoroughness and applicability of the study.

In terms of educational qualifications, the majority of respondents, or 81%, held undergraduate degrees. This finding suggests a prevalent trend among software enterprises in Pakistan to employ individuals with lower academic qualifications. In comparison, respondents with postgraduate (Master's) degrees accounted for 19% of the total.

The study's participating organizations demonstrated a well-distributed respondents' spread, bearing relevant professional characteristics and experience. The majority of responses were sourced from individuals holding positions in junior and middle management, with the latter group contributing the lion's share at 58%.

The distribution of respondents by area of expertise further bolstered the study's goals. The focus was placed on receiving responses from various disciplines within the software industry, including, but not limited to, Software Engineering and Software Development.

Notably, 33% of responses were derived from medium-sized enterprises, and 24% originated from large enterprises in Pakistan. The remaining 44% of responses were distributed amongst small and micro enterprises. Moreover, the surveyed enterprises varied in their professional domain: 45% were exclusively Software-oriented, 40% dealt with both Software and Information Technology, and the remaining 15% were purely Information Technology enterprises.

These data provide a comprehensive understanding of the demographic distribution and professional characteristics of the surveyed population, thus serving as a foundation for a detailed and thorough discussion of the research results in subsequent sections.

Table 1. Descriptive statistics of respondents' demographic information

Variable	Percentage (%)
Type of Management	
Executive	5%
Senior Management	5%
Middle Management	58%
Junior Management	32%
Total	100%
Years of Experience	
11-20 years	5%
6-10 years	38%
1-5 years	57%
Total	100%
Qualification	
Master's Degree	19%
Bachelor's Degree	81%
Total	100%
Area of Expertise	
Procurement Manager	3%
Network Engineer	3%
Data Analyst	6%
Web Developer	12%
Database Developer	3%
Business Intelligence (BI) Analyst	3%
Business Intelligence (BI) Developer	3%
System Analyst	3%
Business Process Improvement (Scrum Master)	3%
UX Designer	3%
Software Architect and Manager	3%
Full Stack Lead Engineer	3%
Software developer	13%
Software Engineer	39%
Total	100%
Size of Business	
Large (500+ employees)	24%
Medium (100 to 499 employees)	33%
Small (10 to 99 employees)	20%
Micro (less than 10 employees)	23%
Total	100%
Industrial Sector	
IT	15%
Software	45%
Both	40%
Total	100%
Software and Services	
Programming Software	13%
Driver Software	1%
Application Software	23%
System Software	11%
IT Consulting & Other Services	17%
Data Processing & Outsourced Services	8%
Internet Services & Infrastructure	8%
Software Services	19%
Total	100%

Source: Software Enterprises in Pakistan Survey via Qualtrics, January 2020

4.2 Analysis of Exploratory Research Questions

4.2.1 The impact of COVID-19 pandemic on the software business enterprises in Pakistan

The repercussions of the COVID-19 pandemic on Pakistan's software business enterprises are elucidated in Table 2. Interestingly, 40% of the impact was noted as significantly negative, whereas 35% was observed as positive. The remaining 25% indicated no change in operations due to the pandemic. A sector-specific breakdown revealed that large enterprises largely experienced a positive impact (60%), with the remaining 40% reporting no change. Contrastingly, small enterprises bore the brunt, with 75% indicating a negative impact and the remaining 25% reporting no change. Medium enterprises exhibited a more balanced impact with 37% reporting a positive impact, 38% negative, and 25% noting no change. Micro-enterprises experienced a 33% positive impact, with the remaining 67% reporting no change.

Table 2. COVID- 19 pandemic impact on Pakistan's software business enterprises

Impact of COVID-19 Pandemic	Negative	Positive	No Impact	Total
Overall Impact	40 %	35 %	25	100 %
Impact on Micro Software Enterprises	67 %	33 %	-	100 %
Impact on Small Software Enterprises	75 %	-	25 %	100 %
Impact on Medium Software Enterprises	38 %	37 %	25 %	100 %
Impact on Large Software Enterprises	-	60 %	40 %	100 %

The challenges faced by software business enterprises amid the pandemic, regardless of their positive, negative, or neutral impact, are presented in Table 3. Common challenges, including a decrease in new sales and projects and payment delays for delivered projects, were observed across all enterprise types. Among these, medium enterprises were seen to face a broader array of challenges. Small enterprises, on the other hand, indicated that a major challenge was the inability to make new recruitments.

Table 3. Challenges due to COVID-19 pandemic

Software Enterprises	Large	Medium	Small	Micro
No New Recruitment	20 %	17 %	25 %	14 %
Revocation of The Project	-	4 %	-	29 %
Lack of New Sales and Projects	40 %	26 %	25 %	29 %
Missed Payment for The Project Delivered	-	13 %	-	-
Delay in Payment for The Project Delivered	20 %	17 %	17 %	14 %
Employees Salary Payment	-	13 %	17 %	-
Delay in Payment of Loans	-	-	8 %	14 %
Rent Payment	-	4 %	8 %	-
Employees Salary Payment	20 %	4 %	-	-

Table 4. Remote working due to COVID-19

Software Enterprises	Large	Medium	Small	Micro
Staff Working from Home	15 %	20 %	15 %	15 %
Remote Working Impact	15 %	5 %	15 %	5 %
Remote Work Continuation	10 %	10 %	-	10 %

The effects of remote working are elucidated in Table 4. There was a noticeable impact on work performance with remote work due to multiple challenges such as lack of guidance for junior team members, difficulty meeting targets, low productivity, and managing impromptu meetings. However, flexible working hours emerged as a positive outcome. Enterprises experiencing a positive business impact and open to working from home posit that the software industry could fully transition to a remote working model in the future, given the availability of efficient communication channels. This shift is perceived to result in significant savings for both companies and employees by reducing office space and travel costs. Conversely, enterprises that reported a negative business impact, yet open to remote work, noted cost effectiveness, less time spent on travel, higher productivity, and improved deliverables as benefits. Employees working in comfort and at their preferred times were seen as a bonus. Yet, it was noted that only a small percentage of employees were willing to continue working from home.

Table 5. Steps, measures, and initiatives in response to COVID-19 impact

Software Enterprises	Large	Medium	Small	Micro
Customized/New Products	17 %	20 %	-	22 %
Teleworking	-	10 %	10 %	22 %
Increase Online Operations/Online Marketing	50 %	-	30 %	22 %
Apply for Financial Loans	-	-	-	12 %
Payroll Cut	17 %	40 %	30 %	22 %
Temporarily Reduced Employment	16 %	20 %	20 %	-
Layoffs	-	10 %	10 %	-

Table 6. Initiatives to fight COVID-19 pandemic

Software Enterprises	Large	Medium	Small	Micro
Developing Products/Software's to Combat the Virus	-	33 %	-	-
Developing Products/Software's for Distance Learning	-	-	25 %	-
Developing Products/App's for healthcare	-	33 %	50 %	67 %
Developing Apps for Tracking and Prediction for COVID-19 Spread	50 %	34 %	25 %	33 %
Developing Apps/Tools for Cyber Attacks	50 %	-	-	-

Table 5 delineates the measures taken by software enterprises in response to the COVID-19 pandemic. Common measures included customizing and creating new products, increasing online operations and marketing, payroll cuts, and temporary employment reduction across all types of enterprises. Notably, medium and small enterprises also resorted to layoffs to manage the situation. One respondent noted the implementation of a “rigorous sales process” as a measure to ensure sales management remained accessible to the workforce. The technology associated with businesses continued to evolve as remote work increased due to the pandemic. With services shifting to online platforms, integrated user interfaces brought various applications onto a single platform, facilitating customer engagement, provided employees understood the functionality of these implementations.

Table 6 outlines the initiatives taken by software enterprises to combat the COVID-19 pandemic. All types of enterprises—large, medium, small, and micro—reported developing apps/products aimed at tracking, predicting, and minimizing the spread of COVID-19. Furthermore, several enterprises, specifically medium, small, and micro ones, developed apps for the healthcare system. In addition to this, 25% of small enterprises developed software and products for distance learning and education, further assisting in mitigating the pandemic's effects. One respondent mentioned their company's initiative to develop a food ordering app, indicating a strategic shift towards remote service provision given the social distancing and lockdown measures. Another respondent from a small enterprise highlighted their company's effort to spread knowledge about preventing COVID-19 infection. Given that only a few apps and web portals have been developed in Pakistan for this purpose, such initiatives can be seen as particularly helpful.

In summary, the impact of the COVID-19 pandemic on software business enterprises in Pakistan varies, with different types of enterprises experiencing different degrees of challenges and responding with a wide array of measures and initiatives. These findings reveal the resilience and adaptability of this sector amidst a global health crisis.

5 Discussion

The ensuing discussion offers a comprehensive evaluation of the impact of the COVID-19 pandemic on software enterprises in Pakistan, addressing the research questions posited in the introduction and in light of the results obtained from the study. Three principal research questions serve as the foundation for this study:

- RQ1: What are the implications of the COVID-19 pandemic on the software business enterprises in Pakistan?
- RQ2: What countermeasures and initiatives have been implemented by software enterprises in Pakistan during the COVID-19 pandemic?
- RQ3: How are software business enterprises in Pakistan contributing to the fight against the COVID-19 pandemic?

These research queries were addressed utilizing a combination of quantitative and qualitative data analysis. However, a deficiency in responses for qualitative data was observed. This may indicate either a lack of requisite knowledge to answer open-ended questions or a possible lack of motivation among respondents. To facilitate an accurate representation of the situation, this discussion will explore the implications of the COVID-19 pandemic on software business enterprises at a global scale before delving into the specificities of the situation in Pakistan.

5.1 Implications of the COVID-19 Pandemic on Software Business Enterprises in Pakistan

Results obtained from this study indicated a distinct correlation between the size of an enterprise and the extent of the impact experienced due to the COVID-19 pandemic. As noted in Section 1, large and medium-sized enterprises largely reported a positive impact, an opportunity for business development, or no impact, with businesses operating as usual. In contrast, small and micro-enterprises primarily reported negative implications for their businesses. Despite this, even the enterprises reporting negative or neutral impact observed some positive changes, such as opportunities for digitalization, an influx of new orders, and new research and development projects. Furthermore, irrespective of the enterprise size, all software business enterprises in Pakistan have been significantly affected by the pandemic. Businesses are either making a profit, a loss, or continuing usual operations but are facing or anticipating challenges. Challenges faced by these enterprises are in line with those noted in the reports discussed in Section 2, reinforcing the authenticity of the survey results and offering an understanding of the pandemic's impact on these enterprises.

5.2 Measures and Initiatives Undertaken by Software Enterprises in Pakistan During the COVID-19 Pandemic

Numerous common measures are being implemented by different-sized software enterprises in response to the pandemic, including payroll cuts, temporary employment reduction, increased online operations and marketing, teleworking, and the development of customized products. Globally, similar measures are being implemented, with businesses transitioning to online operations, employees working remotely, and new software applications being developed to address the challenges posed by COVID-19. Furthermore, in alignment with a PASHA (2020) report, Pakistani software business enterprises are also implementing measures such as:

- Curtailing additional costs (including compensation, healthcare, and overtime)
- Delaying evaluations
- Postponing reward plans
- Decreasing operating expenses
- Reducing financial bonuses

5.3 Contributions of Software Business Enterprises in Pakistan to the Fight Against COVID-19

The study results demonstrate that Pakistan's software business enterprises are making significant contributions to combat the COVID-19 pandemic through various initiatives, including:

- The development of software and products aimed at combating the virus
- The creation of products and software for distance learning and education
- The development of applications for healthcare
- The development of tracking applications for predicting the spread of COVID-19
- The creation of tools to address cyberattacks

As highlighted in the introduction, globally, many software businesses are contributing to the fight against the virus and supporting other businesses, governments, and educational systems by providing free access to tools and platforms that aid in education, business operations, and government services. Moreover, a service under the Ministry of IT and Telecommunications in Pakistan has developed a software application with features to mitigate the negative impact of COVID-19 spread. Alongside this, numerous apps and web portals are being developed in Pakistan, contributing to the collective fight against the COVID-19 pandemic.

6 Conclusions

This study elucidates the influence of the Coronavirus disease 2019 (COVID-19) pandemic on software enterprises in Pakistan, thereby contributing to a burgeoning body of literature assessing the repercussions of the pandemic on diverse business enterprises and industries. Despite Pakistan being classified as a low-income developing nation, the impact of the COVID-19 pandemic on its economy and business enterprises was not as deleterious as initially predicted, given that prolonged lockdowns were not instituted by the government. Nonetheless, effects on software enterprises were discernible.

The intricacies of the software industry differ substantially from those of traditional industries. Intellectual resources, akin to other industries, are integral to the software industry. With technologies constantly evolving, enterprises must invest time and resources in equipping their human capital to adapt to these changes. However, the onset of the COVID-19 pandemic exacerbated the challenges already faced by software enterprises in Pakistan, including lack of governmental support and criticisms regarding project quality.

The quantitative analysis revealed that regardless of the size - large, medium, or micro - all software enterprises in Pakistan have experienced, or are anticipating, challenges due to the pandemic. This has the potential to hinder progress in Pakistan's software industry. Although the software industry accounts for approximately 1%

of Pakistan's GDP, the implications of the pandemic could reduce this contribution, thereby influencing the national economy.

Moreover, this study identified varying impacts of COVID-19 on software enterprises of the same size. For instance, of the medium-sized enterprises surveyed, 43% reported a positive impact, 21% a negative impact, and the remaining 36% experienced no discernible impact. It was also observed that 63% of the workforce was teleworking due to the pandemic, but interestingly, 36% of these teleworkers expressed a preference for returning to office-based work, underlining the perceived importance of physical presence.

The software industry in Pakistan has the potential to lay the foundation of the country's economic structure, providing substantial employment opportunities and contributing significantly to regional exports. It is incumbent on software enterprises to provide employee training and foster international collaborations to navigate the pandemic. These enterprises should also analyze how their counterparts in other nations are addressing the situation and their roles in minimizing the impact of COVID-19.

Concurrently, the government should invest in and support the software industry to bolster the economy during such disruptions. Once a robust and healthy culture is established within Pakistan's software industry, constant improvement should be pursued.

In light of the profound effects of the COVID-19 pandemic, and based on the findings of this study, it is recommended that government and policy makers provide the necessary technological, financial, technical, managerial, and infrastructural support to exploit the significant growth opportunities within the software industry sector. They should also enhance the investment conditions for software enterprises and strengthen their capacity to respond to investment and trade opportunities. By doing so, the growth of software enterprises could significantly contribute to the country's sustainable economic growth, enabling these enterprises to play a pivotal role in the economy and support recovery from such disruptions.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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