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Analysing the Impact of COVID-19 on Iraq's Stock Exchange: Performance of Agri-Business and Other Sectors Using Tobin's Q

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This study investigates the evolution of corporate performance on the Iraq Stock Exchange (ISX) throughout the COVID-19 pandemic, with an emphasis on the agribusiness sector. Employing Tobin's Q as the metric for assessing firm performance, the analysis encompasses eleven companies spanning the agriculture, industry, services, and tourism sectors, over the period from March 2020 to December 2022. Using a panel dynamic ordinary least squares (PDOLS) model for estimation, the results reveal substantial heterogeneity in firm performance at the commodity level. Notably, agribusiness entities exhibited varied degrees of resilience in contrast to their counterparts operating outside the agricultural domain. The outcomes suggest that COVID-19-related variables—namely, the incidence of new infections and the cumulative death toll—adversely influenced overall corporate performance. However, firms within the agribusiness sector displayed operational adaptability and sustained their market value. These insights underscore the necessity for sector-specific policy interventions, particularly those aimed at reinforcing agricultural resilience and promoting sustainable development in the face of Iraq's shifting economic context.

Keywords: Tobin's Q, Agri-Business, Iraq Stock Exchange, COVID-19, Sectoral Analysis, Company Performance, Panel Data.

Introduction

COVID-19 pandemic outbreak, caused by the new coronavirus (SARS-CoV-2), represents one of the largest worldwide health crises of the contemporary world, imposing significant and multidimensional impacts on global economies, financial systems, and corporate world (De Stefani, 2021; Ding et al., 2021; Goodell, 2020). First identified in Wuhan, China, towards the end of 2019, the virus rapidly expanded to become a worldwide pandemic, prompting the World Health Organization (WHO) to announce a global health emergency during the first quarter of 2020 (Liu, Yue, & Tchounwou, 2020). For the purpose of containing it, the global community implemented wide-scale public intervention measures involving lockdowns, travel bans, shutdowns of businesses, and mandated social distancing actions. Although the measures were indispensable for the wellbeing of the people, they caused significant economic downturns and led to a global recession (Haroon et al., 2021; Zaremba et al., 2022).

Economic impacts were specifically drastic for emerging and developing nations, like Iraq, with structures marked by vulnerabilities, lack of industrial diversification, and high dependence on revenues generated from commodities (Abid et al., 2022; Asa'd, Nour, & Atout, 2023). The Iraqi economic environment, with industrial, service, tourist, and agricultural businesses, offers an ideal case to study the disparate impacts of the outbreak across sectors (Wikipedia, 2020). The emergency measures undertaken by the Iraqi government, involving mobility restrictions, suspensions of commercial activities, came with major impacts on both demand and supply sides, highlighting systemic weaknesses of corporate structures, governance processes, and financial strength (Abid et al., 2022; Pagano & Zechner, 2022). Understanding sector differences in coping with large-scale disturbances like COVID-19 is essential for developing successful corporate strategies as well as national policy structures. The literature highlights the fact that the pandemic's influence on the performance of companies is not uniform, but rather depends on some organisational factors, sector type, size, ownership structure, and geographical settings (Al Amosh & Khatib, 2023; Ding et al., 2021). For example, Asa'd et al. (2023) reported finding that, for Palestine, some firm-level performance indicators were hardly affected, while the pandemic substantially modified the linkage between financial indicators and the valuation of companies. Research conducted throughout the Arab world has also highlighted the double-faced role of the pandemic towards the demand and supply side, with the resulting need for more targeted intervention mechanisms to enhance the strength of the economy (Abid et al., 2022).

To evaluate corporate performance during crises, forward-looking financial indicators are essential. Tobin's Q—defined as the ratio of a firm's market value to the replacement cost of its assets—has emerged as a reliable metric of value creation, investor sentiment, and managerial effectiveness in uncertain environments (Chung & Pruitt, 1994; Yermack, 1996). It reflects both current market position and investor expectations regarding future profitability. Prior studies have employed Tobin's Q to examine factors such as board composition (Yermack, 1996), capital structure (Pagano & Zechner, 2022), financial health (Mustika & Abidin, 2024), and external shocks (Haroon et al., 2021). During the pandemic, research has shown that COVID-19 indicators—such as daily infections, case counts, and mortality rates—significantly affect firm valuation and market outcomes (Adikari & Buddhika, 2023; Mustika & Abidin, 2024; Zaremba et al., 2022). For instance, Adikari & Buddhika (2023) found links between infection rates and stock index fluctuations in Sri Lanka, driven by policy and media responses. Zaremba et al. (2022)

also observed rising volatility and risk premiums in global bond markets due to pandemic developments. At the firm level, adaptability, strong governance, and industry-specific factors have been identified as key buffers against such macroeconomic shocks (Ding et al., 2021; Pagano & Zechner, 2022).

Despite the growing body of research on the economic fallout of COVID-19, empirical investigations focusing specifically on Iraq remain limited. This is particularly evident in relation to inter-sectoral dynamics and the performance of firms within the agri-business domain. The agricultural sector plays a pivotal role in Iraq's national priorities, contributing to food security, employment, and diversification efforts beyond the oil industry. However, it remains highly susceptible to disruptions in logistics, labour availability, and consumption patterns during global crises (Abid et al., 2022; Asa'd et al., 2023). Simultaneously, non-agricultural sectors, such as industry, tourism, and services, are integral to Iraq's macroeconomic stability and labour market performance (Wikipedia, 2020).

In light of this context, the current study aims to address this research gap by conducting a systematic evaluation of the impact of COVID-19 on corporate performance within the ISE. Particular emphasis is placed on agri-business firms, although industrial, service, and tourism sectors are also incorporated into the analysis. Tobin's Q is employed as the central metric for evaluating performance, using monthly data spanning from March 2020 to December 2022. The study adopts the PDOLS method to estimate long-term sectoral relationships and capture the nuances of performance variability (Kao & Chiang, 2001; Stock & Watson, 1993). The primary objectives of this research are threefold: first, to classify listed firms in Iraq according to their efficiency in market value generation during the pandemic; second, to analyse the relationship between COVID-19 indicators (new infections, total cases, new deaths, total deaths) and firm performance across sectors; and third, to quantify the extent and direction of the pandemic's influence on corporate value within the Iraqi context. The study posits that the performance of firms, as measured through Tobin's Q, will differ across sectors, and that pandemic-related variables will have statistically significant associations with firm value, with agri-business entities displaying distinctive behavioural patterns.

The anticipated findings are expected to offer valuable implications for stakeholders, including investors, business leaders, and policymakers, by shedding light on the relative resilience of Iraq's economic sectors to external shocks. Furthermore, this study contributes to the academic discourse on crisis response, sectoral adaptation, and sustainable recovery strategies within the framework of emerging and resource-dependent economies (Abid et al., 2022; Ding et al., 2021; Haroon et al., 2021). Figure 1 presents the conceptual framework of the study, outlining the anticipated relationships between COVID-19-related indicators and corporate performance, as reflected by Tobin's Q.

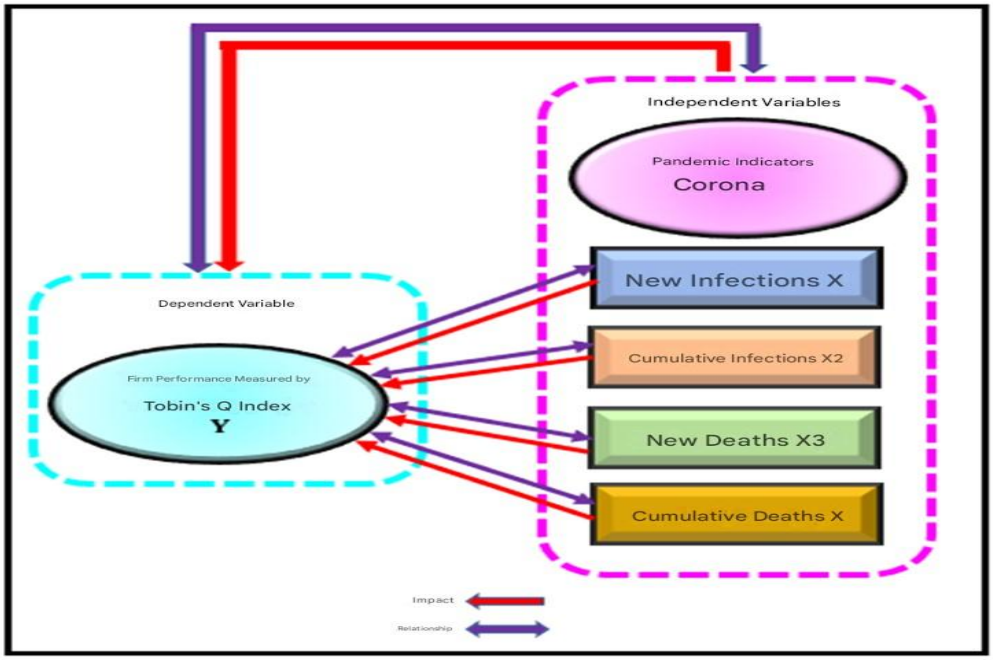

Figure 1: Hypothesis Scheme of Research.

Literature Review

Adikari & Buddhika (2023) analysed the implications of the COVID-19 pandemic on the stock market performance of the Colombo Stock Exchange. Employing a log-linear multiple regression approach, they assessed the relationship between stock indices and various pandemic-related variables. Their findings demonstrated a positive correlation between daily COVID-19 cases and death figures with stock market indices, suggesting that heightened media attention and corresponding governmental measures played a significant role in shaping market dynamics. Additionally, the imposition of travel restrictions exhibited a negative association with market performance, highlighting the adverse effects of mobility constraints on investor sentiment, market responsiveness, and economic activity. The study offered empirical insight into how public health emergencies, through multiple pandemic-related factors, have shaped behaviours within financial

markets (Adikari & Buddhika, 2023). Abid et al. (2022) investigated the economic repercussions of the pandemic across Arab nations, revealing that COVID-19 generated a dual shock impacting both supply and demand structures. Their research underscored the urgent need for effective economic policies to address the prolonged consequences of the crisis, particularly in economies already burdened by structural weaknesses. The study documented the detrimental impact on financial systems, including heightened fragility within financial markets and the broader service sector. It called for a cohesive policy response, including fiscal and monetary interventions led by Arab central banks and financial institutions, to contain the pandemic's spread and to stimulate economic recovery. Furthermore, the authors advocated for coordinated international action to mitigate the broader consequences of the crisis through joint recovery strategies.

The Al Amosh & Khatib (2023) study analysed the performance of companies within G20 nations during the pandemic, with particular reference to the role of COVID-19 and the resulting significance for Environmental, Social, and Governance (ESG) measures. Employing an exhaustive methodological approach consisting of descriptive statistics, correlation matrices, fixed-effects regression, and the Generalised Method of Moments (GMM) estimator, the analysis established the disruption of corporate financial performance by the pandemic as significant. The findings further illustrated the moderating role of ESG dimensions, operating as buffers helping firms to preserve financial stability across the crisis period. The analysis substantiated the increasing importance of the dimensions of ESG as organisational resilience-enhancing strategic instruments as well as investor confidence attractors amidst uncertain circumstances (Al Amosh & Khatib, 2023).

Mysaka & Derun (2021) aimed to determine dominant financial indicators affecting Tobin's Q among publicly traded companies, differentiating between income-sensitive and growth-oriented investors. The quantitative examination incorporated two sets of data consisting of 75 New York Stock Exchange (NYSE)-listed companies and 34 NASDAQ companies, as a representation of some of the largest global companies, according to Forbes. The observations were that dividend payments significantly appealed to income-oriented investors, whereas revenue performance captured the attention of growth investors the most. The conclusion drew from the study was that investments were significantly determined by the reliability and transparency of financial reporting. Therefore, it advocated for corporate managers to focus on financial policies corresponding to the preferred preferences of both types of investors to increase recognizability and retainability.

There is a growing volume of literature dealing with the different effects of COVID-19 on corporate performance within sectors and regions. Asa'd et al. (2023) studied companies listed on the Palestine Exchange between 2019 and 2020 to evaluate the pandemic's effect on financial metrics including return on assets (ROA), return on equity (ROE), earnings per share (EPS), and stock return. Although there was no significant effect on these financial parameters, the study registered the disruption caused by the pandemic to Tobin's Q's relationship with firm valuation measures, especially with price-to-earnings (P/E) ratios. From a wider lens, Ding et al. (2021) compared over 6,700 companies across 61 economies, concluding financially sound companies or firms with lower pandemic exposure could help to curb stock price decline. Larger companies, together with companies with family or government ownership, also showed higher resilience during the pandemic times. Pagano & Zechner (2022) also revealed that soundfully structured liquidity positions alongside pre-crisis financial policies helped absorb financial shock, thus underscoring the active role played by fiscal planning to build organisational flexibility. For Indonesia, Mustika & Abidin (2024) investigated the years 2019 to 2022 on the study of banking firms, revealing that the capital adequacy ratio (CAR), asset size, and human capital were significantly correlated with ROA. In contrast, operating efficiency (BOPO) and non-performing loans (NPLs) had negative impacts on the financial performance. The findings present further proof of the intricate relationship between internal financial indicators and external crises, showcasing the varied influence of the COVID-19 pandemic on the financial performance of banks within emerging markets.

Covid-19 Pandemic

On 8 February 2020, the novel coronavirus was identified as a new pathogen responsible for infecting the respiratory system, particularly in cases of pneumonia first detected in Wuhan in late 2019. Initially referred to as "novel pneumonia" by China's National Health Commission, the disease caused by this virus underwent a change in its official English designation on 22 February of the same year. This renaming occurred prior to the formal endorsement of the terminology by the WHO on 1 February. However, the Chinese-language designation of the virus remained consistent throughout this period (De Stefani, 2021). The classification of a virus as an epidemic is generally applied when it spreads within a geographically confined area, even if that area expands over time. However, when the disease surpasses containment measures and begins to spread extensively across multiple countries or regions, it is reclassified as a pandemic.

The WHO formally declared the virus a pandemic early in 2020, following its rapid global transmission (Liu et al., 2020). In the context of Iraq, the first confirmed case of COVID-19 was reported on 24 February 2020, when the Ministry of Health announced that an Iranian religious student in Najaf had tested positive for the virus. The infected individual was immediately isolated, along with nine persons who had been in close contact with him. In response, the General Directorate of Education in Najaf suspended all educational activities across the governorate until further notice. Following the initial case, the virus continued to spread throughout the country. By 10 June 2020, the total number of confirmed infections had reached 15,414, with the number of fatalities rising to 426 (Wikipedia, 2020).

Corporate Performance and Tobin's Q Scale

At the onset of 2020, the COVID-19 pandemic precipitated a significant global economic contraction. Numerous studies

have concluded that the economic disruption resulting from this health crisis has surpassed that of previous pandemics or epidemics in scale and severity (Goodell, 2020). According to Zaremba et al. (2022) and Haroon et al. (2021), the pandemic triggered a substantial rise in market risk across global financial systems. In response, both developed and developing nations implemented a range of unconventional fiscal policy interventions aimed at reducing uncertainty and restoring investor confidence. However, the absence of coordinated international efforts limited the overall effectiveness of these measures, thereby diminishing their potential impact on financial market stability.

Yermack (1996) investigated the association between the structures of corporate governance and the value of firms by observing the financial and governance attributes of 452 large US firms between 1984 and 1991. The investigation established a negative association between board size and the corporate value, measured by Tobin's Q. Using fixed, random, and ordinary least squares (OLS) techniques, Yermack established that small boards were related to better managerial efficiency and good financial performance. The investigation further controlled for other performance proxies, namely, return on assets (ROA) and return on sales (ROS), and eventually confirmed the proposition the Tobin's Q measures the value created by good governance mechanisms.

Methods

This study employs a quantitative panel data approach to investigate the impacts of COVID-19 variables on the financial performance of firms listed on the Iraq Stock Exchange. The date range for the dataset is between March 2020 and December 2022, with the observations on a monthly frequency from eleven companies operating in the agricultural, industrial, services, and tourism sectors. These companies were picked on the criteria of uninterrupted listing along with the persistent availability of financial information and information related to the pandemic across the study horizon, generating a balanced panel of 374 firm-month observations (11 firms for 34 months). Financial data were extracted from Iraq Stock Exchange publications and corporate financial statements, whereas data on the pandemic—covering new cases, total infections, new fatalities, and cumulative deaths—were compiled from the World Health Organization and the Iraqi Ministry of Health (WHO, 2022; Wikipedia, 2020). Firm performance was assessed using Tobin's Q, calculated as the ratio of the sum of the market value of equity and the book value of liabilities to total assets (Chung & Pruitt, 1994; Yermack, 1996). This metric captures how capital markets evaluate a firm's worth relative to its asset replacement cost, rendering it particularly relevant in crisis contexts due to its forward-looking characteristics (Pagano & Zechner, 2022). The key independent variables included monthly and cumulative statistics for COVID-19 infections and deaths, consistent with the methodology applied in recent studies investigating pandemic-induced effects (Abid et al., 2022; Adikari & Buddhika, 2023).

To accommodate firm-level unobserved heterogeneity and temporal dynamics, appropriate panel data estimation techniques were employed (Stock & Watson, 1993). Tests for cross-sectional dependence, specifically the Breusch-Pagan LM and the Pesaran scaled LM, indicated statistically significant interdependencies across the cross-sectional units (Breusch & Pagan, 1980; Pesaran, 2004). Unit root diagnostics using Pesaran's CIPS test (Hadri, 2000; Pesaran, 2004) revealed that Tobin's Q was stationary in levels (I(0)), whereas all pandemic-related indicators exhibited integration of order one (I(1)). Given the presence of variables with differing integration properties, the Pedroni residual-based cointegration test was utilised to ascertain the existence of a stable long-term relationship among the variables (Pedroni, 2004). Long-term linkages between COVID-19 indicators and firm performance were then estimated through the PDOLS technique (Kao & Chiang, 2001; Saikkonen, 1991). This method effectively addresses the issues of endogeneity and serial correlation by incorporating leads and lags of the first-differenced regressors. Due to its suitability for small panels and established application in crisis-period analyses, PDOLS is considered an appropriate estimator in this context (Abid et al., 2022; Asa'd et al., 2023).

The empirical specification proceeds by initially defining the dynamic model in its first-differenced form as follows:

$$\Delta Y_t = \lambda Y_{t-1} + \sum_{i=1}^{k-1} \alpha \Delta Y_{t-i} + \beta X_t + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where:

ΔY_t = Change in Firm Performance (Tobin's Q) at Time t

λ = Parameter for Lagged Performance

α = Parameter(s) for Additional Lags

X_t = Vector of Pandemic Indicators (New Infections X_{1t}, Cumulative Infections X_{2t}, New Deaths X_{3t}, Cumulative Deaths X_{4t}

Subsequently, the long-term equilibrium association among the variables is represented as follows:

$$Y_t = \alpha_0 + \beta X_t + \sum_{i=-k}^{k} \Phi X^*_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where:

Y_t = Firm Performance (Tobin's Q)

α_0 = Intercept

X_t = Vector of Independent Variables as Above

Φ = Coefficients for Leads and Lags of Differenced Regressors X^*_{t-i}

Incorporating both forward and backward lags (ranging from –k to +k) of the first-differenced independent variables serves to mitigate issues related to potential endogeneity and autocorrelation. This comprehensive PDOLS specification accounts for the presence of variables with differing integration orders, addresses cross-sectional dependence, and corrects for endogenous relationships, thereby producing consistent and efficient long-run coefficient estimates regarding the influence of COVID-19-related indicators on firm performance (Kao & Chiang, 2001; Pedroni, 2004). All econometric estimations and related statistical procedures were executed using EViews version 12 and SPSS version 26. Descriptive analysis and graphical representations were performed in Microsoft Excel. Since the study relied exclusively on

secondary data sourced from publicly accessible platforms, ethical clearance was not deemed necessary. This methodological structure provides a sound empirical foundation for evaluating the effects of pandemic-induced shocks on firm performance across various sectors in Iraq, yielding findings of relevance to academic researchers, investors, and policymakers focused on financial stability and resilience during periods of crisis (Asa'd et al., 2023; Ding et al., 2021; Pagano & Zechner, 2022).

Results

Descriptive Statistics

Performance Indicator (Tobin's Q)

Table 1 presents the descriptive statistics of firm performance, measured using Tobin's Q, across the entire study period. The summary includes the mean, minimum, and maximum values, along with the standard deviation, and an analysis of the mean values for the firm performance index (Tobin's Q) reveals notable variation among the companies studied from March 2020 to December 2022. The Mosul Theme Cities Company (SMOF) recorded the highest average performance, with a Tobin's Q of 4.838866, indicating that its share value significantly exceeded the cost of replacing its assets. The peak performance for SMOF occurred in October 2020, reaching a Tobin's Q value of 8.503403, while the same month in 2021 marked its lowest performance at 3.728576. The standard deviation of 0.966835 points reflects substantial fluctuation in the firm's performance throughout the study period.

Table 1: Some Descriptive Statistics for the Average Performance of the Selected Companies for the Period (March/2020-December/2022).

Company	Mean	Maximum	Minimum	Std. Dev.
AISP	0.320810	0.466408	0.141438	0.079422
IBSD	1.195107	1.785583	0.456821	0.339813
TASC	1.004552	1.270556	0.529947	0.204793
IITC	0.789570	1.467058	0.102924	0.422890
AMEF	1.325651	2.336251	0.481208	0.581546
SMOF	4.838866	8.503403	3.728576	0.966835
AIRP	1.673304	2.193209	1.070628	0.333741
IMAP	1.932477	3.641774	0.559287	0.900904
HNTI	2.624231	3.406746	2.226938	0.335329
HBAG	3.068328	4.244178	2.566234	0.454337
SBPT	3.223325	7.014445	1.932982	1.001610
All	1.999657	8.503403	0.102924	1.394161

In contrast, the Iraqi Company for Seed Production (AISP) ranked lowest among the selected firms, with an average Tobin's Q of 0.32081, suggesting that its market valuation remained well below the replacement cost of its assets. The company's highest performance was recorded in January 2022 at 0.466408, while the lowest, 0.141438, was observed in the same month of 2021. The relatively low standard deviation of 0.079422 indicates a consistent underperformance over the observed timeframe. Among the remaining firms, most demonstrated satisfactory performance levels, with Tobin's Q values exceeding one, except for the Iraqi Company for Carpets and Furnishings (IITC), which showed persistently low average performance during the study period. Table 2 and Figure 2 illustrate the average annual firm performance, as measured by the Tobin's Q index, across the study period from 2020 to 2022.

Table 2: Average Annual Performance of the Study Sample (2020-2022).

Companies	2020		2021		2022	
Iraqi Seed Production (AISP)	0.283845	↓	0.289485	↓	0.392939	↓
Baghdad Soft Drinks (IBSD)	0.777926	↓	1.422362	↑	1.315504	↑
Asiacell (TASC)	0.716946	↓	1.092065	↑	1.156711	↑
Iraqi Carpets & Furnishings (IITC)	0.391170	↓	0.751443	↓	1.159698	↑
Middle Eastern Fish (AMEF)	0.542353	↓	1.907172	↑	1.396880	↑
Al Mosul for Funfairs and Tourist Investment (SMOF)	4.086977	↑	4.807813	↑	5.496494	↑
Agricultural Products Marketing (AIRP)	1.255281	↑	1.788757	↑	1.906203	↑
Almansour Pharmaceuticals (IMAP)	1.064674	↑	2.786899	↑	1.801224	↑
National Tourism Investment Company (HNTI)	2.612534	↑	2.430928	↑	2.827280	↑
Baghdad Hotel (HBAG)	2.775860	↑	3.513782	↑	2.866599	↑
Baghdad Iraq Public Transport (SBPT)	2.219613	↑	3.325570	↑	3.957507	↑

↑ Good Performance: Overvaluation occurs when a company's market shares are worth more than the cost of replacing its assets.

↓ Defaulting Performance: Undervalued means that a company's market shares are worth less than the cost of replacing its assets.

Moreover, Table 2 and Figure 2 reflect a generally strong performance among the majority of firms in the sample during the 2020–2022 period. This assessment is based on Tobin's Q values exceeding one, which indicate that market valuation surpassed the replacement cost of assets. In 2020, six companies exhibited satisfactory performance,

increasing to nine firms in 2021 and reaching ten in 2022. However, certain firms displayed inconsistent performance over the three-year span, including IBSD, AMEF, IMAP, HNTI, and HBAG. Conversely, upward performance trends were observed in AISP, TASC, IITC, SMOF, AIRP, and SBPT.

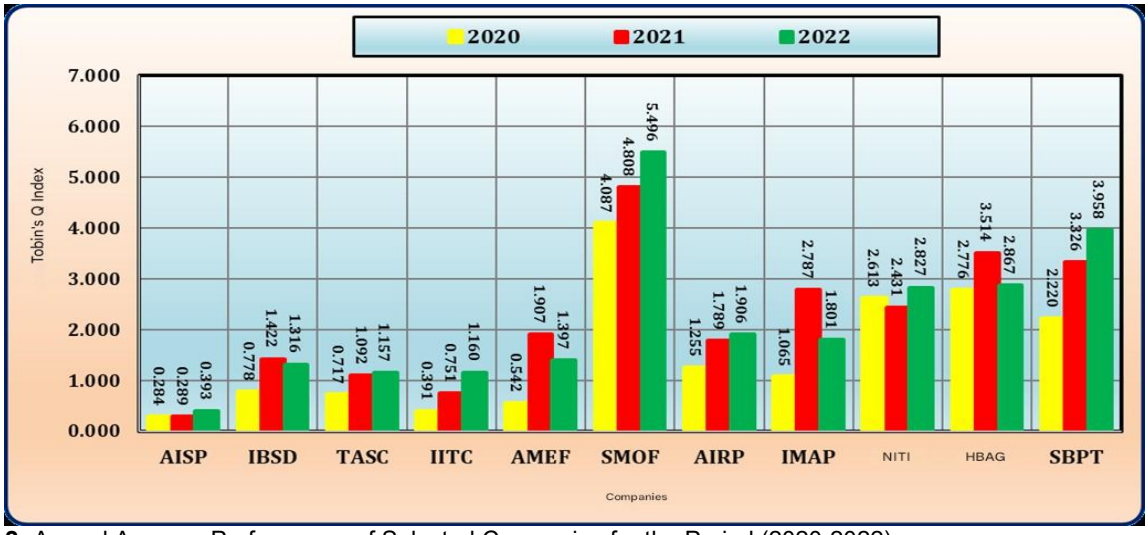

Figure 2: Annual Average Performance of Selected Companies for the Period (2020-2022).

Corona Indicators

Table 3 provides summary statistics for the COVID-19 indicators over the study period, including the mean, minimum, maximum, and standard deviation values, and during this period, the mean number of newly reported COVID-19 cases was 72,511. The highest recorded level occurred in August 2021, reaching 324,851 cases, whereas the lowest figure was observed in March 2020, with only 506 cases reported. The standard deviation of 75,666 cases reflects substantial variability in the incidence of new infections throughout the analysis period. Regarding cumulative cases, the average number recorded was 6,015,401. The peak was reached in October 2022, with cumulative infections totalling 12,304,890, while the lowest count at the start of the observation period was 899 cases. The standard deviation of 4,108,061 for cumulative infections indicates considerable fluctuation over time. Figure 3 illustrates the progression of both new and cumulative cases across the research period, revealing marked volatility in both metrics. Notably, a pronounced decline in new infections is observed following August 2021. This trend corresponds with a marginal rise in cumulative cases, suggesting the presence of a potential inverse association between the number of new infections and the cumulative total during the evaluated timeframe.

Table 3: Some Descriptive Statistics of Corona Indicators for the Period (March/2020-December/2022).

Statistic	X_1	X_2	X_3	X_4
Mean	72511	6015401	746	72755
Maximum	324851	12304890	2624	126788
Minimum	506	899	4	70
Std. Dev.	75666	4108061	801	38849

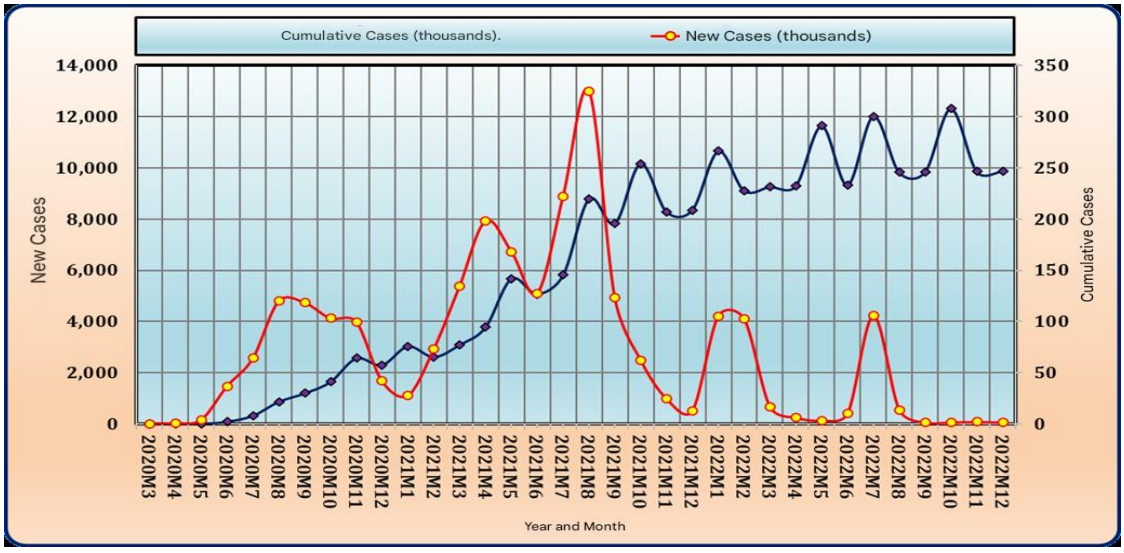

Figure 3: New Monthly and Cumulative Infections of the Corona for the Period (March/2020-December/2022).

The mean number of newly reported deaths due to COVID-19 during the study period stood at 746. The peak occurred in July 2020, when fatalities rose to 2,624, while the lowest number was recorded in November 2022, with only 4 deaths. The standard deviation of 801 suggests considerable variation in the number of new fatalities across the research timeframe. For cumulative deaths, the average during the study period was 72,755. The highest cumulative total was documented in July 2022, reaching 126,788 deaths, whereas the lowest cumulative figure at the outset of the study period was 70 deaths. A standard deviation of 38,849 reflects notable fluctuations in the cumulative death toll over time. Figure 4 illustrates the progression of both new and cumulative COVID-19-related deaths throughout the observation period. The patterns displayed closely mirror those observed for infection rates, with distinct variability evident in both newly reported and cumulative fatalities. Additionally, the figure highlights a marked decline in new deaths following August 2021. This trend corresponded with a marginal increase in cumulative deaths, indicating a likely inverse relationship between the two variables over the course of the study.

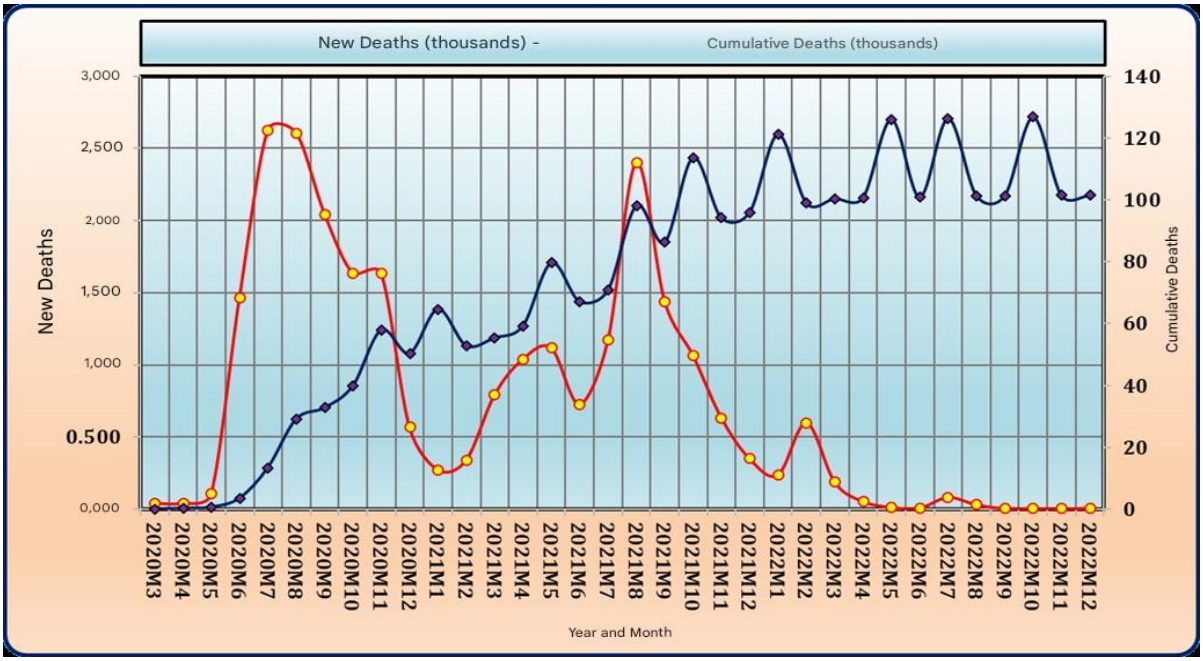

Figure 4: New Monthly and Cumulative Deaths Due to the Corona for the Period (March/2020-December/2022).

Variation in the Performance of Companies

Table 4 demonstrates evident variation in the average values of the performance index (Tobin's Q) across the selected companies during the period from March 2020 to December 2022. To statistically confirm the presence of significant differences in corporate performance among these firms, a one-way analysis of variance (ANOVA) was conducted. The outcomes of this analysis are presented in Table 4. Table 4 reveals statistically significant differences in the average performance index (Tobin's Q) among the selected companies over the period from March 2020 to December 2022. This finding leads to the rejection of the null hypothesis and the acceptance of the alternative hypothesis, as the p-value (0.000) falls below the 0.01 level of significance. These results indicate that corporate performance, as measured by Tobin's Q, varied across the sample during the research period. However, this does not imply that all firms differ significantly from one another in terms of performance. Some companies may exhibit similar or converging performance trends, while others may show greater divergence.

Table 4: The Single Variance of the Differences in the Average Performance Index Among the Selected Companies for the Period (March/2020-December/2022).

P-Value	Statistics (F)	Average Squares	Degrees Freedom	Sum of Squares	Sources of Variation
0	170.271**	59.759	10	597.594	**Inter-Firm**
		0.351	363	127.401	**Error**
			373	724.995	**Total**

Note: **statistically significant differences at a significant level (0.01).

Therefore, to identify homogeneous groups of companies based on performance levels, a post-hoc test, such as Duncan's multiple range test, was employed. The results of this classification are provided in Table 5. Moreover, Table 5 outlines the classification of companies in the study sample into performance-based groups according to their average Tobin's Q values over the research period. Using Duncan's test, the companies were divided into seven statistically homogeneous categories, each representing a distinct level of market performance. Notably, the SMOF emerged as the sole member of the highest-performing group, with an average Tobin's Q of

4.84, indicating that its market valuation substantially exceeded the replacement cost of its assets. The second tier comprises the HBAG and the SBPT, both exhibiting robust market performance, with average Tobin's Q values of 3.07 and 3.22, respectively. The HNTI occupies a separate, third group, with a commendable average of 2.62.

In the fourth group, the AIRP and IMAP demonstrated moderate performance levels, recording average values of 1.67 and 1.93. The fifth group includes TASC, IBSD, and AMEF, whose Tobin's Q scores ranged from approximately 1.00 to 1.33, reflecting market valuations marginally above asset replacement costs. The IITC was classified into the sixth group, with a lower average performance index of 0.79, indicating market undervaluation. Lastly, the AISP was placed in the seventh and lowest-performing category, with an average Tobin's Q of 0.32, highlighting a significant disparity between its market value and the cost of its assets. This grouping underscores the substantial variation in corporate performance across sectors during the COVID-19 period and offers critical insight into the diverse economic effects experienced by industries within Iraq.

Table 5: Duncan Test Results for Differences in Average Performance Indicators Among Selected Companies.

Company	Homogenous Groups of Companies						
	1	2	3	4	5	6	7
SMOF	4.838866						
HBAG		3.068328					
SBPT		3.223325					
HNTI			2.624231				
AIRP				1.673304			
IMAP				1.932477			
TASC					1.004552		
IBSD					1.195107		
AMEF					1.325651		
IITC						0.789570	
AISP							0.320810
Sig.	1.000	0.281	1.000	0.072	0.186	0.135	1.000

Note: The table is generated from SPSS-26 program outputs.

Correlations

Table 6 shows the values of partial correlations ($r_{XiXj.Y}$) between the variables of the corporate performance model. The results of the partial correlation analysis between the corporate performance index and each of the COVID-19 indicators, while controlling for the influence of the remaining variables, reveal no statistically significant associations. This conclusion is supported by the weak correlation coefficients and the corresponding probability values, all of which exceeded the conventional significance level of 0.05. These findings suggest the absence of meaningful relationships between the COVID-19 indicators and corporate performance. Consequently, the observed variations in the performance index of the companies under investigation throughout the period from March 2020 to December 2022 cannot be attributed to fluctuations in COVID-19 indicators (namely, new infections, cumulative infections, new deaths, and cumulative deaths). Instead, these changes appear to be driven by other underlying factors beyond the pandemic-related metrics.

Table 6: Partial Correlations Between the Corporate Performance Index and the Indicators of the Corona Pandemic.

	X1	X2	X3	X4
Y	0.060	0.023	-0.046	0.015
Prob.	0.205	0.652	0.372	0.769

CT and Module Root Certification Tests

Table 7 presents the outcomes of four cross-sectional dependence tests, all of which confirm the presence of cross-sectional dependence at the 1% level of significance for the dataset and for each variable under investigation. This result implies that any variation or external shock affecting a specific variable in one company is likely to influence the same variable across other companies within the sample, and a second-generation panel unit root test, the Pesaran CIPS test, is applied to address cross-sectional dependence. As shown in Table 8, the Tobin's Q is stationary at level (I(0)) at the 1% significance level, while the COVID-19 variables are non-stationary at level but become stationary after first differencing (I(1)). Based on these results, the dynamic ordinary least squares (DOLS) method is used for model estimation following confirmation of co-integration.

Table 7: CT Certification Test Results.

Variable	Breusch-Pagan LM	Pesaran Scaled LM	Bias-Corrected Scaled LM	Pesaran CD
Y	439.1019***	36.6227***	36.4560***	15.3718***
X_1	1870.000***	173.0535***	172.8868***	43.2435***
X_2	1870.000***	173.0535***	172.8868***	43.2435***
X_3	1870.000***	173.0535***	172.8868***	43.2435***
X_4	1870.000***	173.0535***	172.8868***	43.2435***

Note: *** indicates significance at the 1% level of testing.

Table 8: Second-Generation Unit Root Test (CIPS) for Search Variables Time Series.

Variables		CIPS	Remark
Y	Level	-2.4642**	I(0)
	1st diff.	---	
X_1	Level	-1.9866	I(1)
	1st diff.	-16.8660**	
X_2	Level	-1.4040	I(1)
	1st diff.	-5.5136**	
X_3	Level	-0.7083	I(1)
	1st diff.	-13.6326**	
X_4	Level	-0.1399	I(1)
	1st diff.	-4.7938**	

Note: ** indicates significance at the 1% level of testing.

Cointegration Test

The outcomes of the joint co-integration test demonstrate the presence of a long-run equilibrium relationship among the corporate performance index, new infections, cumulative infections, new deaths, and cumulative deaths. The test statistics within both the within-dimension and between-dimension are statistically significant, suggesting that these five variables exhibit co-movement over time. This implies that a change in one of these variables is, on average, accompanied by corresponding changes in the others, indicating long-term interdependence. The Pedroni test evaluates co-integration through two dimensions: within-group (Panel V, Rho, PP, and ADF statistics) and between-group (Group Rho, PP, and ADF statistics), derived from residual-based unit root tests across cross-sectional units. As shown in Table 9, five of the seven statistics are significant at the 5% level, providing strong evidence of co-integration. Thus, the null hypothesis is rejected in both dimensions, confirming a long-term relationship among the model's variables.

Table 9: Pedroni Cointegration Test.

Pedroni Residual Cointegration Test Null Hypothesis: No Cointegration Alternative Hypothesis: Common AR Coefficients (Within-Dimension)		
	Statistic	**Prob.**
Panel V-Statistic	-1.788657	0.963
Panel Rho-Statistic	-2.089442*	0.018
Panel PP-Statistic	-4.605498**	0.000
Panel ADF-Statistic	-2.786155**	0.003
Alternative Hypothesis: Individual AR Coefficients (Between-Dimension)		
	Statistic	**Prob.**
Group Rho-Statistic	-0.230032	0.409
Group PP-Statistic	-3.728819**	0.000
Group ADF-Statistic	-2.584157**	0.005

Note: ** and * indicates significance at the 1 and 5% level of testing, respectively.

Model Estimation

In light of the preceding findings, the long-run association between the Tobin's Q and the COVID-19 indicators—namely, new infections, cumulative infections, new deaths, and cumulative deaths—will be estimated. Several estimation techniques are available, with the choice dependent on the nature of the dataset and the outcomes of the previously conducted diagnostic tests. Given these considerations, the PDOLS method has been selected for this analysis. A key advantage of the PDOLS approach lies in its applicability to datasets containing both stationary and non-stationary variables, which enables the inclusion of all identified independent variables in the model. This estimation procedure is aligned with the unit root test results presented in Table 10.

Table 10: Results of PDO.LS Method for Estimating the Long-Term Relationship of the Corporate Performance Model.

Dependent Variable: Y Method: PDOLS				
Variable	**Coefficient**	**Std. Error**	**T-Statistic**	**Prob.**
$\Delta(X_1)$	-0.0000013	0.0000002	-8.16434**	0.000
$\Delta(X_2)$	0.0000010	0.00000002	47.42039**	0.000
$\Delta(X_3)$	-0.000059	0.0000170	-3.55521**	0.000
$\Delta(X_4)$	-0.000082	0.0000019	-42.85127**	0.000
R-Squared	0.7766	Long-Run Variance		0.0078
Adjusted R-Squared	0.6889			

Note: ** and * indicates significance at the 1 and 5% level of testing, respectively.

The findings presented in Table 10 demonstrate that all four COVID-19 indicators exert a statistically significant influence on the Tobin's Q Corporate Performance Index for the companies included in the study over the long term.

The term "long run" in this context refers to the delayed manifestation of the effects of pandemic-related variables, where monthly fluctuations in these indicators impact corporate performance in subsequent months. The individual impact of each variable is detailed as follows:

New Infections (X1): The analysis reveals a significant negative long-term effect of new infections on corporate performance, with a p-value of 0.000, which is well below the 0.01 level of significance. Specifically, each additional case of new infection during the pandemic is associated with a decline of approximately 0.0000013 units in Tobin's Q over time. Among the four pandemic indicators, new infections rank third in terms of their negative impact on company performance.

Cumulative Infections (X2): Cumulative infection figures also show a statistically significant association with corporate performance, with a p-value of 0.000 (significant at the 0.01 level). Interestingly, this relationship is positive, with one additional cumulative case corresponding to an increase of 0.000001 in Tobin's Q. This counterintuitive result may be explained by the observed inverse correlation (-0.10) between new and cumulative infections. As new infections rise, cumulative cases may increase at a slower rate or even decrease, potentially due to a higher number of recoveries resulting from improved medical treatment and growing expertise. This recovery trend could signal the beginning of the pandemic's decline, possibly contributing to market optimism. This indicator ranks fourth in terms of its influence on corporate performance.

New Deaths (X3): The results indicate a significant negative relationship between new deaths and company performance, with a p-value of 0.000 (below the 0.01 threshold). Each additional new death contributes to a decline of 0.000059 in the performance index over the long term. In terms of relative influence, new deaths rank second among the pandemic indicators affecting corporate performance.

Cumulative Deaths (X4): Cumulative mortality exhibits the most substantial negative influence on corporate performance among all pandemic indicators. The p-value for this variable is 0.000, confirming significance at the 0.01 level. An increase of one cumulative death results in a 0.000082-point decline in Tobin's Q in the long term. This variable ranks first in terms of its impact on the corporate performance index.

The four pandemic-related variables collectively explain approximately 69% of the variation in corporate performance, as reflected by the R^2 value. The model's overall significance is strongly supported by the Wald test results in Table 11, with both F-statistic and chi-square p-values at 0.000, well below the 1% threshold. These findings confirm that the COVID-19 indicators have a statistically significant and substantial impact on Tobin's Q, the chosen measure of corporate performance in this study.

Table 11: WALD Test for Corporate Performance Model Significance.

Wald Test			
Test Statistic	**Value**	**df**	**Prob.**
F-Statistic	585.8095**	(4, 247)	0.000
Chi-Square	2343.238**	4	0.000
Null Hypothesis: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$			
Null Hypothesis Summary			
$\hat{\beta}_1$		-0.0000013	0.0000002
$\hat{\beta}_2$		0.0000010	0.00000002
$\hat{\beta}_3$		-0.000059	0.0000170
$\hat{\beta}_4$		-0.000082	0.0000019

Note: **indicates significance at the 1% level of testing.

Discussion

This study presents sound empirical evidence on the disparate impacts of the COVID-19 outbreak on corporate performance across sectors in Iraq, with particular reference to agri-business firms. The findings exhibit significant variation in financial resilience, as measured by Tobin's Q, highlighting the importance of sector-specific characteristics and organisational responsiveness to external disturbances. Agri-business firms showed distinct behavioural patterns, highlighting the crucial importance of food value chains and market integration during the calamities, supportive of previous studies on food systems' vulnerabilities (Abid et al., 2022; Asa'd et al., 2023) and responsiveness to external disasters. By applying high-quality panel data methods, such as PDOLS estimation and cointegration testing, the paper presents a comprehensive evaluation of the long-run relationships between indicators of the pandemic and firm valuation. Both new and cumulative infections and deaths emerge with significant but differing impacts on corporate performance, while cumulative deaths registered the largest negative impact. The result agrees with international evidence on the worsening of public health crises being erosive to investor confidence and firm valuation (Ding et al., 2021; Haroon et al., 2021). On the other hand, the positive coefficient established with cumulative infections could indicate firms' ability to rebuild and gradually return to operation with the gradually restored infrastructure for healthcare and restored supply chains with the progression of time.

Moreover, the agglomeration of firm-level findings reflects the differential impacts of the pandemic, highlighting the requirement for context-sensitive assessments, specifically for the sectors of food security and national socio-economic resilience, such as agriculture (Adikari & Buddhika, 2023; Pagano & Zechner, 2022). The findings further underscore the requirement for resilient agri-business infrastructure along with the integration of innovation and strategic policy measures for long-term sectoral sustainability. Overall, this paper presents timely insights for policymakers and sector

practitioners seeking to inform sustainable recovery processes as well as enhance economic preparedness across Iraq's dynamic business environment.

Conclusion and Policy Implications

This paper presents an intra-industry analysis of the impact of the COVID-19 outbreak on the performance of companies listed on the Iraq Stock Exchange, with sectoral gaps captured by Tobin's Q. The findings point to marked variability in firm-level outcomes throughout the pandemic, as companies were categorised into seven statistically distinct performance clusters. Some firms, such as the SMOF, sustained strong market valuations, whereas others, notably the AISP, faced notable undervaluation. Despite observable volatility in pandemic-related metrics—including the number of new infections and deaths—simple bivariate correlations failed to reveal statistically significant associations with firm performance, suggesting the involvement of additional mediating or moderating variables. Nonetheless, advanced estimation techniques, including cointegration and panel data models, indicated that the pandemic-related indicators collectively accounted for 69% of the variation in Tobin's Q. Among these, cumulative deaths exerted the most substantial long-term negative effect on firm value, followed by new deaths and new infections. Interestingly, cumulative infections were found to have a slightly positive association, potentially reflecting firms' adaptive capacity and progressive economic adjustment as the pandemic unfolded.

From a strategic and policy-oriented perspective, these outcomes underscore the relevance of leveraging market-based metrics such as Tobin's Q to gauge sectoral resilience and firm adaptability during systemic disturbances. The presence of cross-sectional dependence in the data signals that pandemic effects likely propagated through inter-firm and inter-industry linkages. This highlights the pressing need for improved institutional coordination within the Iraqi corporate sector, enabling knowledge exchange and the implementation of effective crisis mitigation strategies. There is also a strong case for designing targeted training programmes and capacity-building initiatives to equip corporate leadership with robust risk management skills and contingency planning capabilities. Furthermore, although pandemic-related variables exhibited notable long-term effects, unexplained variations in firm performance imply the existence of additional determinants—such as disruptions in supply chains, policy responses, or managerial practices—that merit further exploration. Future investigations should therefore adopt integrated, multi-sectoral research designs, incorporating firm-specific and sector-level data to unravel the complex pathways through which organisations withstand and adapt to global crises.

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