

JEBI

ISSN 2791-8122

VOLUME: 3

ISSUE: 1

2023

Journal of

**ECONOMICS AND BUSINESS
ISSUES**



JEBI

JOURNAL OF ECONOMICS AND BUSINESS ISSUES

VOLUME: 3

ISSUE: 1

March 2023



JEBI



**JOURNAL OF ECONOMICS
AND
BUSINESS ISSUES**

Journal Homepage: <https://www.jebi-academic.org>

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Journal of Economics and Business Issues

March 2023, Volume:3, Issue:1

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Forecasting Short-Term Covid-19 Cumulative Cases with Prophet Model: An Example from G7 Countries

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Abstract: The Covid-19 pandemic, which emerged in Wuhan, China, in December 2019, has become unpreventable worldwide after spreading rapidly across the country. The unpreparedness of countries for the pandemic has negatively affected many areas, especially the health sector, and has caused a struggle with a lack of capacity, resources, and commitment in general. Therefore, predictions have become essential to understand the mechanism of infectious disease spread. In literature, while there are many models for obtaining infectious disease predictions, machine learning models are also widely used today. The Prophet model, as one of these models, consists of three main components: a trend (logistic) function that captures non-periodic changes, a seasonality (Fourier) function that captures periodic changes, and a holiday function that captures irregular periods. The study aims to obtain five-day short-term predictions and prediction intervals using the Prophet model with the cumulative data of G7 countries. Additionally, the RMSE statistic is used to compare the performance of the predictions. As a result, relatively better results are obtained for Canada and Germany with low RMSE values. In conclusion, the Prophet model provides researchers and policymakers with high-performance results with low RMSE values in short-term predictions.

Keywords: Forecasting; Prophet Model; Covid-19

Citation: Zoğal, Y, (2023) Forecasting Short-Term Covid-19 Cumulative Cases with Prophet Model: An Example from G7 Countries. *Journal Of Economic and Business Issues*, 3(1), 01-09.

1. Introduction

In December 2019, it was reported to the world that a virus associated with severe acute respiratory syndrome began to spread across China's Wuhan city. This virus, later named Covid-19, has started to spread worldwide, and cases have become unpreventable. In the WHO Director-General's statement on COVID-19 dated March 11, 2020, he stated that in two weeks, the number of Covid-19 cases increased thirteen times, the number of affected countries tripled, there were more than 118,000 cases in 114 countries and 4,291 people died [21].

The unpreparedness of countries for infectious diseases has caused them to struggle with a lack of capacity, resources, and determination in general, especially in the health sector. In addition to the severe impact of COVID-19 on healthcare systems, the pandemic has had a significant and rapidly escalating impact on the world economy and businesses.

The COVID-19 pandemic has been ongoing for more than three years and continues to cause significant health and economic losses. According to official estimates, more than 6 million people have died from the virus, with studies estimating the actual death toll to be much higher, ranging from 16 to 20 million, which is approximately equal to that of World War I. According to the IMF's World Economic Outlook (2022), the cumulative output loss from the pandemic through 2024 is projected to be about \$13.8 trillion and it is likely that the actual loss will be even higher [9]. According to the World Economic Outlook (WEO) report published in October 2021, the economic contraction for G7 countries is as follows: Germany at 4.6%, France at 8%, Italy at 8.9%, United Kingdom at 9.8%, United States at 4.3%, Canada at 5.3%, and Japan at 4.6% [8]. In G7 countries, the pandemic has led to a significant increase in unemployment and a decrease in economic activity. G7 countries have also seen a decline in consumer spending, particularly in sectors such as travel and tourism.

The economic impact of the COVID-19 pandemic has been very severe and has occurred much more rapidly than the 2008 global financial crisis (GFC) and the Great Depression. The rapid

Received: 29/12/ 2022

Accepted: 31/01/2023

Published: 27/03/2023

spread of the virus and the measures put in place to control it have led to widespread job losses and business closures, disruptions in global supply chains, and a decline in economic activity. In the 2008 GFC and the Great Depression, stock markets collapsed by 50% or more, credit markets froze up, massive bankruptcies followed, unemployment rates soared above 10%, and GDP contracted at an annualized rate of 10% or more, but all of this took around three years to play out [14]. While in the current crisis, similarly dire macroeconomic and financial outcomes have materialized in a much shorter period, in some cases, just three weeks. The speed of the economic downturn caused by the COVID-19 pandemic is largely due to the rapid spread of the virus and the measures put in place to control it. The pandemic has also led to a significant increase in public debt as governments have implemented large-scale fiscal stimulus packages to mitigate the economic impact of the pandemic.

The COVID-19 crisis has brought an unprecedented shock to the labor market and has led to an unemployment crisis. Restrictions and lockdowns implemented since March 2020, as well as the decline in demand caused by the pandemic, have led to millions of job losses around the world [5]. Although some measures taken to prevent the spread of the virus have allowed some people to work from home, in most countries it has caused unemployment. The visible contraction in the economy is reflected in the unemployment rates. According to the IMF's report in 2021, the unemployment rate in G7 countries is Germany at 3.8%, France at 8%, Italy at 9.3%, United Kingdom at 4.5%, United States at 8.1%, Canada at 9.6% and Japan at 2.8%. In addition to the hike in unemployment rates, the profound effect has started to increase income inequalities and poverty, which was estimated as more 71 million people as of March 2021 [22].

The outbreak of COVID-19 has had a significant impact on global supply chains. The disruption of transportation and production caused by lockdowns and other measures taken to contain the spread of the virus has led to shortages of goods and materials, delays in delivery times, and increased costs for businesses. Consumers have also been affected by the disruption of supply chains, with many facing shortages of essential goods and higher prices for products. The domino effect of broken supply chains is that it can cause a ripple effect throughout the economy, affecting not just producers and consumers but also other businesses that rely on them. This can lead to job losses, reduced economic activity, and other negative consequences.

On the supply side, production chains have been disrupted, while on the demand side, consumption and investment spending have been negatively affected. This is likely to exacerbate the ongoing economic downturn, making it more pronounced. To address both the pandemic and economic downturn, governments have been urged to "Go big. Act fast. Keep the lights on" by economist Richard Baldwin, who argues that combining restrictive policies that reduce production with stimulus policies that maintain spending will create supply-side problems and lead to cost-driven inflation [2]. In other words, the idea that the global downturn can be revived only by increasing credit and borrowing more heavily for consumption is an illusion [19].

The COVID-19 pandemic has had a significant impact on healthcare economics around the world. In the short run, healthcare facilities have been overwhelmed by the influx of patients, leading to increased costs for inpatient and outpatient care. This has been compounded by the need for additional resources such as personal protective equipment and additional staff to handle the increased workload. In the long run, the economic impact of the pandemic on healthcare systems may be even more severe. The prolonged disruption of healthcare services and the increased demand for care could lead to higher costs for both patients and healthcare providers, as well as longer wait times for appointments and procedures. Additionally, the pandemic has led to a decline in revenue for many healthcare providers and hospitals, which could lead to financial difficulties and closures. This could lead to further strain on the healthcare system in the long run as the population increases and aging.

The listed reasons above make understanding the spread mechanism and forecasting essential for effectively managing the pandemic and minimizing its impact on public health and the economy.

In the literature, many studies deal with understanding the spread mechanism. For instance, the mathematical SIR (Susceptible, Infected and Recovered) model provides differential solutions by dividing the total population into different groups. The model describes the flow of individuals between these compartments based on certain assumptions, such as the rate at which infected individuals infect susceptible individuals (the infection rate) and the rate at which infected individuals recover or are removed from the population (the removal rate). The SIR model can be used to estimate the number of individuals who will be infected and recovered over time, as well as the peak of the epidemic. Although the characteristics of the infectious disease shape the model, it does not provide satisfactory results in the early stages of the disease. The econometric time series model, ARIMA (autoregressive integrated moving average), provides more realistic results as the data increase since it predicts the future of the variable with past values. The ARIMA model can be used to model and forecast time series data with a trend and/or seasonality. The ARIMA model

is widely used in various fields such as finance, economics, engineering, and infectious diseases, and it is considered as one of the most powerful tool for time series forecasting. In addition, machine learning models (supervised learning, reinforcement learning models, deep learning models, ensemble models) are frequently used to predict infectious diseases. The present study aims to provide a five-day Covid-19 prediction for G7 (Canada, France, Germany, Italy, Japan, Japan, UK and USA) countries with the Prophet model.

Moreover, it allows comparisons with the RMSE (root mean square error) statistic to evaluate the performance of the analysis results. G7 countries were chosen because data sharing problems are less for these countries, and doubts about the accuracy of the number of cases announced are minimal. Based on the results obtained with the Prophet model, the results closest to reality with the lowest RMSE value were obtained first for Canada and then for Germany. Likewise, it was found that the prediction values for the first day generally have lower RMSE. In other words, RMSEs increase as we move away from the actual data for prediction.

The next section of the study presents the literature review and the theoretical framework for the model. In the third section, empirical findings will be presented. The last section of the study will provide a general evaluation of the research and analysis.

2. Literature Review and Theoretical Background

2.1. Literature Review

It is explained the results of SIR, SEIR, SEIRU, SIRD, SLIAR, ARIMA, ARIMA and SIDARTHE models used in the prediction of the spread mechanism, peak and decline of Covid-19 cases and the difficulties in creating predictions. The results of studies conducted with these models for different countries are graphed, and the performance of the models are compared with actual values and deviation value of predictions. Regarding this issue, it was shown that the highest deviation was found in the simple mathematical model and SIRD model for California [1].

The study used ARIMA model to forecast the trend of the COVID-19 outbreak in Italy, Spain, and France, which are the countries that were most affected by the pandemic in Europe, using data from the period of February 21 to April 15, 2020. The different past period ARIMA models were compared with the MAPE performance value and the ARIMA (0,2,1), ARIMA (1,2,0), and ARIMA (0,2,1) models were selected for the countries, respectively. With these selected models, short-term predictions were made for the period of April 16 to April 25, 2020. The study is showing that the ARIMA models can be used to effectively predict the trend of the COVID-19 outbreak, which can help governments and healthcare providers to prepare better and allocate resources more efficiently [4].

It is aimed to obtain forecasts for two days, namely February 11 and 12, using an ARIMA model with the Covid-19 case counts for the period between January 20 and February 10, 2020, published by Johns Hopkins University. They emphasized that case definition and data collection for cases should be simultaneous to obtain more realistic predictions [3].

It is aimed to predict the number of positive cases of different influenza (for H1N1 and H3N2 viruses) that may occur in 2016 with the number of pediatric cases of the influenza season between 2007 and 2015. To this end, they used both ARIMA and seasonal ARIMA, that is, SARIMA (an ARIMA model that can capture seasonal effects-seasonal autoregressive integrated moving average). The prediction results of the models are evaluated according to performance criteria. Accordingly, it is shown that the ARIMA model gives better and more realistic results than the SARIMA model in case prediction [7].

Time series models are used (ARIMA and SARIMA) and a machine learning model (Prophet model). The prediction is based on daily and cumulative Covid-19 data for the United States, India, and Brazil, and they obtain short-term prediction results. Specifically, the Prophet model, which can capture periodic features in the data, gives better results for the US forecasts, while the ARIMA model gives better results for Brazil and India, whose cumulative cases tend to grow. The SARIMA model also captures daily cases' seasonal characteristics and provides better prediction results [20].

It is used ARIMA from time series models and Prophet, GLMNet (generalized linear model elastic net), random forest and XGBoost from machine learning models to predict Covid-19 cases. Based on the results of the analysis, ARIMA and Prophet models are more appropriate and ideal forecasts for the countries in question, especially the ARIMA model gives better results in Afghanistan, Bangladesh, India, Maldives, and Sri Lanka. They explained that the random forest machine learning model was excluded due to its poor fit to the data set [16].

It is obtained short-term prediction results with Covid-19 data for India for the period January 30 - December 7, 2020. The results were obtained using ARIMA and some machine learning models such as Prophet, LSTM (long short-term memory), RNN (recurrent neural network), GRU (gated recurrent unit) and LSTM-GRU models. R2 and RMSE values were obtained for numerical

comparison of the performance of the models. In conclusion, it is shown that the LSTM-GRU model is superior to the others with high R2 and low RMSE values [15].

It is used Covid-19 data for twenty countries and obtained short and long-run predictions using SEIR, polynomial regression, ARIMA and Prophet model. According to the prediction results, the polynomial regression model gives the best short-term predictions, while the SEIR model gives the best long-term predictions [6].

It is developed a new exponential growth model in their study, arguing that improving epidemic models can be more helpful in explaining different periods of an epidemic. The model aims to characterize the stage of the epidemic, especially when it shows an upward trend, and to capture the changing epidemic profile for that period. To this end, the model is applied to eight different infectious diseases with various transmission routes in twenty different geographies and the same infectious disease (Ebola) in different periods. The results show that the growth rate of the same infectious disease changes over time and how different geographical and social conditions affect the growth rate. It is explained that the epidemic growth rate is primarily influenced by limited population contact structure, behavioural change over time or early control interventions [18].

In a study, the authors have highlighted the failures of models used to predict the spread of infectious diseases. The failure of models used to predict the spread of COVID-19, has made this situation even more pronounced. The reasons for this failure are poor data input, poor modeling, inaccurate and inconsistent assumptions, the predictors being overly sensitive, the distinctive features of the outbreak not yet fully determined and included in the models, the lack of accuracy of existing prevention measures, lack of transparency of data, lack of determining parameters, and reporting errors. However, solutions for some of these issues have been proposed such as making wave predictions instead of point predictions and selecting models that are developed and expanded based on performance results [10].

In a study, the authors aimed to use various time series forecasting models such as Prophet, Holt-Winters, LSTM, ARIMA, and ARIMA-NARNN to predict short-term daily and cumulative case forecasts of Covid-19, model the general trend of the outbreak, and model the time series based on linear and non-linear features. The results obtained were compared with various statistical measurements. In this regard, it was reported that the models showed good performance, but the ARIMA and NARNN (ARIMA-NARNN) hybrid combination had the best performance [12].

In a study, the aim is to estimate the extent of the COVID-19 outbreak in Pakistan and case forecast predictions using ARIMA, Diffusion, SIRD and Prophet Models. The short-term forecast results obtained show similarities and indicated that the highest number of infectious cases could be reached between June 2020 and July 2020. Due to this reason, it is conveyed that most of the population is under the threat of COVID-19 and that the measures taken by the government should be reviewed and improved [11].

2.2. Theoretical Background

Prophet model is a time series forecasting model developed by Facebook's Core Data Science team in 2018. It is designed to make forecasting future data points as simple as possible and is particularly well-suited for business time series data. Prophet is a procedure for forecasting time series data based on an additive model where non-linear trends are fit with yearly, weekly, and daily seasonality, plus holiday effects [13]. The model has three different components [17].

$$y(t) = g(t) + s(t) + h(t) + \varepsilon_t \quad (1)$$

Here, $y(t)$ is the number of cases, $g(t)$ is the trend, that is, the trend function that captures non-periodic changes in the time series, $s(t)$ is the seasonality, that is, the part of the time series that captures periodic (weekly or yearly) changes, $h(t)$ is the part that represents holidays that occur at irregular intervals, and ε_t is the error term that includes specific changes that cannot be covered or handled by the model [17]. The functions handled in the model are as follows:

$$g(t) = \frac{C}{1 + \exp(-k(t-m))} \quad (2)$$

As the growth in Facebook is similar to growth in a natural ecosystem (just like the increase in cases), a logistic growth model was added to capture the increase in the trend. C denotes the carrying capacity, k denotes the growth rate, and m denotes the offset parameter.

$$s(t) = \sum_{n=1}^{\infty} a_n \cos \frac{2n\pi t}{p} + b_n \sin \frac{2n\pi t}{p} \quad (3)$$

Time series are often susceptible to multi-period seasonality due to the human behaviour they represent. This can be a five-day working week, vacation schedules or school holidays that follow each year [17]. To capture these periodic effects, the Fourier model is used. Here p is the periodic term the time series is expected to have regularly.

$$h(t) = Z(t)\kappa \quad (4)$$

$$Z(t) = [i(t \in D_1), \dots, i(t \in D_i)] \quad (5)$$

New year holidays, religious holidays or events that may have a country-wide impact are predictable shocks for time series models. For this reason, the impact of such holidays on the model is included daily. D_i is defined for each holiday i in the model. Therefore, that time series interval represents the presence of that holiday if it coincides with that period. The κ parameter is defined as the corresponding change parameter in the forecast if the day of that holiday changes in the time series.

Since the Prophet model includes both logistic and Fourier, it captures periodic waves in the observations more efficiently, allowing for relatively better predictions with outliers in the data. It works best with time series that have strong seasonal effects and several seasons of historical data. Prophet is robust to missing data and shifts in the trend, and typically handles outliers well [13].

One of the frequently used statistical values for comparing the performance of model results is the root mean square error (RMSE). Here, $\hat{y}$ is the prediction value, y is the actual value, and n is the total number of observations. RMSE is calculated as the square root of the mean of the squared differences between predicted values and actual values. The formula is as follows:

$$\sqrt{\sum \frac{(\hat{y}-y)^2}{n}} \quad (6)$$

The RMSE value is expressed in the same units as the original data, so it can be directly interpreted in terms of the problem being solved. The smaller the RMSE value, the better the model is at predicting the actual values. However, it should be noted that comparing RMSE values between different datasets or problems can be misleading as the scale of the data and the specific problem objectives can be different.

3. Empirical Findings

In the study, the daily number of Covid-19 cumulative cases for G7 countries was obtained from Our World in Data for 180 days, starting with the day of the first occurrence. The date range for each country varies according to the day the case first started. In the prediction analyses for each country, the forecasted first day is the prediction for the 181st day, the forecasted second day is the prediction for the 182nd day, the forecasted third day is the prediction for the 183rd day, the forecasted fourth day is the prediction for the 184th day, and the forecasted fifth day is the prediction for the 185th day.

Table 1. Forecast and actual values

		1st day	2nd day	3rd day	4th day	5th day
Canada	$\hat{y}$ (forecasted)	112,220	112,754	113,281	113,779	114,163
	y (actual)	112,281	112,663	113,399	113,836	114,172
	RMSE	4.58	6.78	8.77	4.23	0.69
France	$\hat{y}$ (forecasted)	222,122	224,749	227,016	228,708	232,624
	y (actual)	217,517	218,753	219,844	219,928	219,932
	RMSE	343.20	446.94	534.56	654.42	946.02
Germany	$\hat{y}$ (forecasted)	204,765	205,044	205,280	205,604	205,939
	y (actual)	204,964	205,269	205,609	206,242	206,926
	RMSE	14.83	16.77	24.52	47.55	73.57
Italy	$\hat{y}$ (forecasted)	246,860	247,480	248,205	249,144	250,159
	y (actual)	246,776	247,158	247,537	247,832	248,070
	RMSE	6.25	24.00	49.81	97.79	155.71
	$\hat{y}$ (forecasted)	25,877	26,562	27,300	28,103	28,961

Japan	y (actual)	25,680	26,312	27,107	28,088	28,867
	RMSE	14.71	18.63	14.39	1.09	6.97
UK	$\hat{y}$ (forecasted)	301,982	303,226	304,626	306,014	307,628
	y (actual)	301,455	302,301	303,181	303,942	304,685
	RMSE	39.30	68.92	107.73	154.46	219.38
USA	$\hat{y}$ (forecasted)	3,834,404	3,897,260	3,958,010	4,017,141	4,072,962
	y (actual)	3,828,431	3,896,716	3,964,163	4,031,940	4,106,884
	RMSE	445.20	40.55	458.62	1,103.05	2,528.40

For G7 countries, the predictions of the number of cumulative cases for the 181st, 182nd, 183rd, 184th, and 185th day, the actual number of cumulative cases of these days, and RMSEs for each day are reported in Table 1. For France, Germany, Italy, and the UK, the RMSE increases with distance from the period used for the prediction between day one and day five, while for Canada, Japan, and the USA, the RMSE varies. When analyzed in detail, the estimated number of coincidences for Canada for the five days ranged from 112,200 to 114,163. The actual number of cases during this period ranges from 112,281 to 114,172. The lowest RMSE value for Canada was obtained on the fifth day. For France, predicted values ranged from 222,122 to 232,624, and actual values ranged from 217,517 to 219,932. The lowest RMSE value for France was obtained on the first day and increased until the fifth day. For Germany, the estimated number of cases ranged from 204,765 to 205,939, while the actual cases ranged from 204,964 to 206,926. The lowest RMSE for Germany was obtained on the first day. For Italy, the predicted cumulative cases were 246,860 on the first day and 250,159 on the last day (the fifth day). The cumulative number of cases for the five days varies between 246,776 and 248,070. The lowest RMSE for Italy was obtained on the first day. The estimated cumulative number of cases for Japan varies between 25,877 and 28,961. The cumulative number of cases ranges from 25,680 on the first day to 28,867 on the fifth day. The lowest RMSE for Japan was obtained on the fourth day. For the UK, the predictions for the number of cases ranged from 301,982 to 307,628 for the five days. The actual number of cases ranged from 301,455 to 304,685. The lowest RMSE for the UK is obtained for the first day of the prediction. Finally, the estimated cumulative data in the USA are 3,834,404 for the first day and 4,072,962 for the fifth day. The actual cumulative cases during this period vary between 3,708,557 and 3,708,557. The lowest RMSE for the USA was obtained on the second day.

The lower and upper bound predictions of the estimated numbers of cumulative cases according to the prophet model are reported in Table 2. For Canada, except for the fifth day, the predicted number of cases on all other days fell between the lower and upper bounds. For France, the number of cases on the fourth and fifth days was below the lower predicted value. In Germany, the number of cumulative cases remained within the predicted range. The number of cumulative cases in Italy on the first day only, in Japan on the fourth day, and in the USA on the second day only was within the predicted range. For the UK, the number of cumulative cases on all days was below the lower bound of the prediction.

Table 2. Interval of forecasted value

			1st day	2nd day	3rd day	4th day	5th day
Canada	Forecasted	$\hat{y}$ lower	112,112	112,640	113,158	113,637	113,979
		$\hat{y}$ upper	112,309	112,871	113,401	113,930	114,373
France	Forecasted	$\hat{y}$ lower	214,108	215,628	218,392	220,465	224,020
		$\hat{y}$ upper	230,679	233,821	235,715	236,962	240,967
Germany	Forecasted	$\hat{y}$ lower	204,238	204,441	204,610	204,761	204,764
		$\hat{y}$ upper	205,315	205,611	205,950	206,579	207,308
Italy	Forecasted	$\hat{y}$ lower	246,557	247,171	247,832	248,778	249,692
		$\hat{y}$ upper	247,153	247,788	248,568	249,534	250,632
Japan	Forecasted	$\hat{y}$ lower	25,823	26,507	27,241	28,037	28,893
		$\hat{y}$ upper	25,931	26,621	27,363	28,164	29,032
UK	Forecasted	$\hat{y}$ lower	301,638	302,846	304,237	305,568	307,094
		$\hat{y}$ upper	302,349	303,605	305,058	306,505	308,225
USA	Forecasted	$\hat{y}$ lower	3,831,657	3,894,363	3,954,755	4,013,203	4,067,776
		$\hat{y}$ upper	3,837,258	3,900,328	3,961,460	4,021,477	4,077,922

The graphs of actual and predicted predictions are presented in Figure 1. It can be seen that the predicted values fit well with the actual values. The RMSE values also support this.

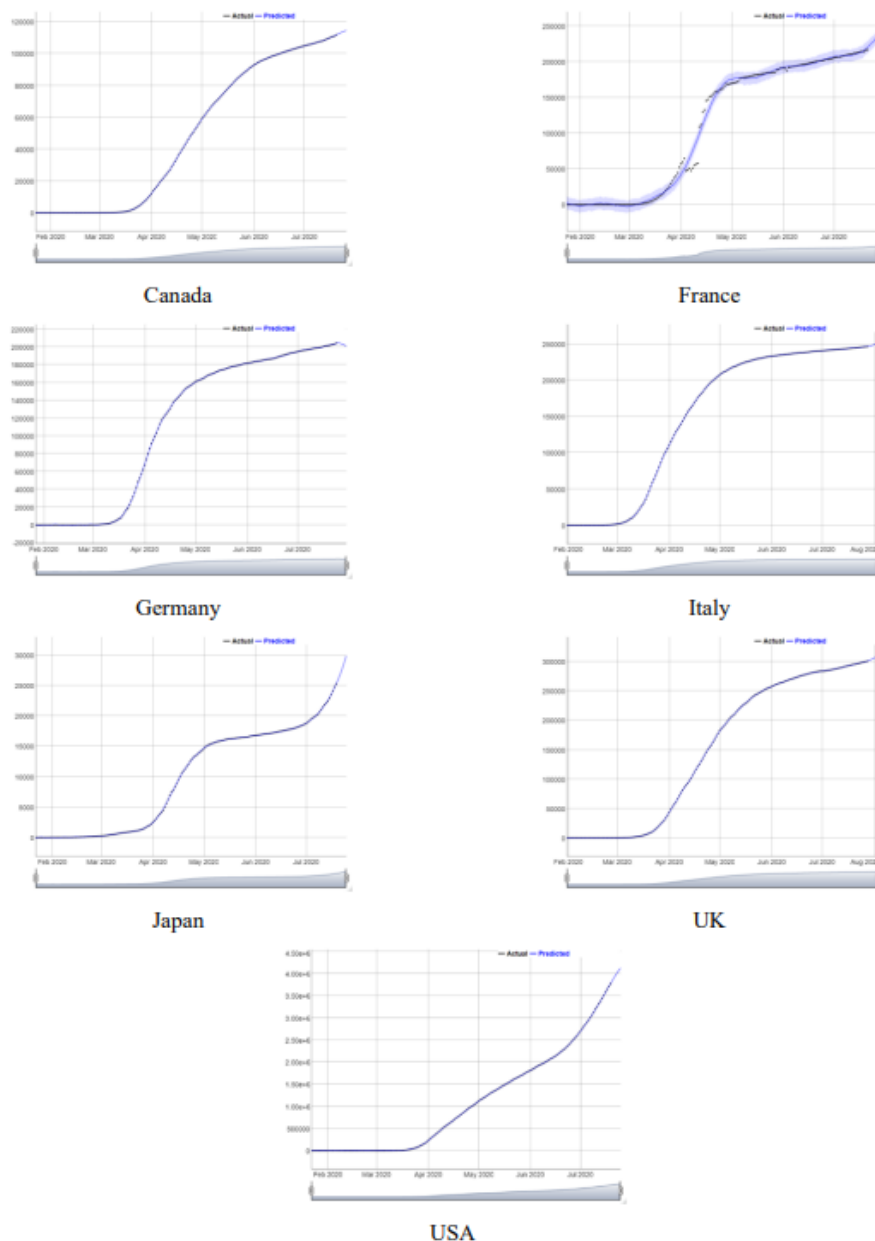


Figure 1. Cumulative graph and forecasted trend of countries

4. Conclusions

The rapid spread of the Covid-19 pandemic among countries has prompted the need for research on infectious diseases' spread mechanism and predictions. This study aims to analyze Covid-19 five-day prediction forecasts for G7 countries using the Prophet model, one of the machine learning models. For this purpose, five-day forecasts, five-day forecast intervals and RMSE statistics for the results obtained with the Prophet model were calculated.

Based on the forecasting results obtained using the Prophet model, Canada's closest predictions (lowest RMSE) were obtained. Canada and Germany, Italy, Japan, Italy, Japan and the UK have particularly close predictions for the first day. The possible reasons for the close predictions are that these countries have implemented nationwide shutdowns and did not change their data enough to affect the results during the 180 days. The most distant predictions (highest RMSE) are obtained for the USA. The reason for the highest RMSE for the USA is the parameter added to the model for shutdown days. In the USA, closure decisions were made at the state and county level rather than the federal government at the beginning of the pandemic and were inconsistent. For France, which has the highest RMSE results in predictions with the USA, the reason can be

attributed to data corrections at the beginning of the pandemic. In light of these results, it is observed that the prophet model as a machine learning model provides accurate predictions when the correct data is provided, the number of data-related corrections is reduced, and a regular shutdown regime is followed.

Forecasting the spread of COVID-19 is important for policymakers because it helps them to make informed decisions about how to respond to the pandemic. Accurate forecasts of the number of cases can inform decisions about lockdowns, school closures, and other public health measures. They can also help policymakers to plan for the distribution of vaccines and other medical resources. Additionally, forecasts can help policymakers to identify areas of the population that may be at particularly high risk, so that they can target interventions to those groups. Overall, the policy makers would consider the prophet model in forecasting the spread of infectious to limit the adverse effects on economies and businesses.

Funding: This research received no external funding.

Acknowledgments: The author is a PhD student at Institute of Graduate Programs, Ankara Hacı Bayram Veli University. This article is partly derived from the PhD thesis and extended with additional analyses.

Conflicts of Interest: The author declares no conflict of interest.

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Islamic Economic Methodology and Development Relationship**

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** This article was presented on May 26-28, 2022 at 3rd. International Islamic Finance and Accounting Congress organized by Hasan Kalyoncu University.

Abstract: Economics foresees the rational and fair execution of the economic order among individuals. Economic activities cover the activities that individuals have to do to survive. Economic activities differ according to culture, social life and ideologies. Just as the science of economics cannot be thought of independently from other fields, the method followed by economics, such as law, politics, history and sociology, cannot be considered independent of other sciences and most importantly, moral structure, they are in a complementary position. Islam, on the other hand, contains its own norms and moral values that concern both individual and social economic attitudes. Economics examines all kinds of regulations of the market, the distribution of resources and how they should be distributed in the present and in the future, while Islamic economics deals with the science of economics from an Islamic point of view. The utopian idea of economics, which belongs to individualism, is studied that Islam is a beneficial system not only for Muslims but also for all humanity that exists and will exist. For this reason, in this study, it is aimed to explore the basic conceptual framework, the scope of Islamic economics and to determine the direction of the applied methods in the axis of Islamic economics. It is explained within the framework of the concepts of economic growth and development, which are important indicators in the interpretation of Islamic economics in economies and the measurement of the success of the economy. It is predicted that Islamic economics will be accepted all over the world, regardless of the research method, by bringing reasonable solutions to the economic problems of countries. Emphasis is placed on the importance of an understanding of economic growth and development that encompasses all of the world markets in achieving the ultimate goals, and only by considering the concepts of innovative, entrepreneurial, justice and morality in a holistic way, a change can be achieved.

Keywords: Economics, Islamic Economics, Development.

Citation: Eryolu, G. & Özaydın, A. (2023) Islamic Economic Methodology and Development Relationship. *Journal Of Economic and Business Issues*, 3(1), 10-15.

1. Introduction

The first expectation for societies is to improve the welfare level and to provide an environment of trust. The realization of expectations is significantly related to economic development. Therefore, economic development for societies has been the primary goal from past to present. (Karagül and Açıkgöz, 2009)

Economic development; all social-political structure, production level, education level, human rights and democratization level of individuals living in a society include health and humane living levels. Although economic development is among the most discussed economic concepts, it cannot be said that there is a hypothesis that can be applied in practice to solve the development problem. The reason is that although economics, as a social discipline, has an important place in the literature of economics, this feature has been ignored when it comes to solving economic problems. Namely, although production and consumption have a place completely in the science of economics, it is not possible to analyze the human being, who is the leading role of both production and consumption, with all their characteristics. Because the states and actions of individuals are related and different from their value judgments, sadness, anger, beliefs, expectations and sense of trust. It is constantly variable. There is no objectivity. For this reason, it has been thought that it should be reconsidered in economics, where the capitalist system is dominant and moral values are ignored, and it seems that the studies on the relationship between religion, culture and economy,

Received: 21/07/2022

Accepted: 20/12/2022

Published: 27/03/2023

especially within the framework of economics, have been given priority and increased in recent years. (Karagul and Açıkgöz, 2009)

Ensuring and maintaining economic growth and development are among the main objectives of developed and developing countries. (Karakaya, 2020). The development of a country does not depend on only one factor. Well-trained human factor, which is human capital, is the pioneer of development. Then, the geographical factor, race, religion, idea, economic, historical, social and cultural factors are the factors that affect development as a whole.

Islamic economics is trying to create an economic system that we can call Islamic within the world economic system. In Islamic economics, we can say that the ideas that will serve the economic system that will be embodied in practice rather than theory for all humanity and will benefit the society, in a sense, are Islamic Economics. (Trust, 1995)

If the factors that prioritize development in Islam, there are many methods for the advancement of humanity. Islam is a dynamic religion, aiming at the happiness of humanity by advancing it in the material and spiritual environment. Along with being dynamic, it took a stance against laziness and standing still. The religion of Islam, in order to be humane, is in harm, whose two days are equal, its hadith should be a principle for us. (Kayadibi, 2012)

One of the important issues of revealing the leading roles of Islamic economic studies in development is to organize the structures of the societies in which these studies are carried out, albeit slowly, in an Islamic form. Because it is not an issue that can be overcome only by theory.

One of the common points in Islamic economic studies is the rejection of homo economicus. Individuals should be living beings who know that they are no longer economic people with a western mentality, not only pursuing their own interests, but also altruistic and able to think of themselves with others, and intellectually knowing that such a behavior is more correct, as long as they are right.

The individual within the concept of Homo Islamus, which Zaim dealt with in 1995, is a responsible, benevolent, collaborative, just and moral being while living his life within the framework of the truths and wrongs commanded by Allah. If we give an example through this concept, just as the whole body is affected when a damage occurs to a person's body, the existence of people in need in a society will also affect the rest. In order to eliminate these destructive effects, we as a society must help the needy so that the individual and later the society can develop in peace and prosperity. To explain with a hadith, the hadith "Muslims, in loving each other, showing mercy and compassion to each other, is like a body that shares this pain with sleeplessness and high fever when one of its organs is sick." (Muslim, Birr, 66) is completed with the hadith.

For the solution of the development of the Islamic economic system, "Let them do it. Starting from the principle of "Let them pass" and saying that everyone should take care of themselves is an incomplete and wrong approach. Both the individuals they reach and the state are obliged to help people below a certain average life level through various methods and to raise their life level above the average.

This study is limited to the problem of how Islamic economics can provide development in this market, rather than revealing the Islamic economic system. In the study, priority was given to subjects such as the individual, reason, morality, education, science, human rights, and social solidarity. These items are very important issues for the development and development of humanity. The methodology of Islamic economics and its reflections in Islamic economics in terms of development and growth are examined by adding verses and hadiths.

Economic activities, which are the environment where many material needs of human beings are met, are indispensable for societies. Adam Smith's famous "Homo Economicus" concept is a model of an individual who only thinks about his own interests and takes self-interested and rational decisions on the economic ground. However, there are moral concerns and restrictions for the individual who only considers his own interests in economic activities. The basic expectation of man is to gradually increase the current level of welfare and to create an environment of trust. The implementation of these goals is highly related to economic development. For economies, economic development has been an economic goal from past to present. For this reason, what economic development theoretically means, and which factors affect economic development positively or negatively have always been among the topics discussed. While there is production and consumption in the economics literature, there are differences as a result of the behavior of the individual who forms the basis of production and consumption. Because individuals' behaviors, beliefs, expectations, sadness, joy and trust depend on their level and these items vary. For this reason, it is foreseen that the science of economics, which is known as a completely capitalist and immoral theory, needs to be reconsidered, and therefore, it is seen that the studies of Islam and economics have increased rapidly in the axis of economic theory.

Firstly, the birth of economics will be mentioned and then how and when Islamic Economics was formed will be mentioned. Economics continues to dominate today despite the dominant economic thought, the 1929 Economic Depression, the 1970 oil crisis and the most recent 2008 global

financial crisis. Despite the economic growth in the world and the increase in real national income per capita, the injustice and crime rates in income distribution do not decrease, and the happiness of people does not increase. Societies and economies need a new economic understanding. In order for Islamic Economics to respond to the society, it needs to create its own school.

In the study, what is the science of Islamic economics and its place in the management of economic development, and what is the relationship of development in Islamic economics? The answer to the question has been sought. In order to understand the state and movements of the events in the market and to guide the economy correctly, it is aimed to examine how and in what direction the rules that shape social life move. Subjects such as human, rationality, morality, reason are mentioned. These concepts are remarkable aspects of the development and development of humanity.

2. Islamic Economics

Economics and Islam are always closely lived reality. Therefore, the logical framework imposes on us the need for a collaborative study of concepts.

Islamic economics is defined as a system of values that leads the economic behavior of individuals in an Islamic society, as a prediction that Islamic propositions are in force in social, political and legal circles. Islamic economics, a branch of economics, means the investigation of one of the economic systems. This branch of economics deals with the Islamic economic model, propositions and principles and thus examines their impact on economic measures. (Ersoy, 2015)

The existence of Islamic Economics coincides with the 20th century. The political changes experienced by Islamic states after the Second World War resulted in the independence of many Islamic countries. As a result, it enabled the rise of Islamic gains again and was effective in economics. Since every direction of the Western economy does not meet the criteria of Islam, efforts to turn to Islam in this area have started. The term 'Islamic Economics' was put forward by countries such as India and Pakistan, and the functioning of mainstream economics was tried to be adapted to Islam. Islamic economics can be studied and researched as a branch of knowledge determined by Islamic beliefs, science and culture, history and Islamic law. In addition to these factors, it is seen that he contributed to the works of history and politics as well as the works of Islamic law. Moreover, they are the product of the experiences of Islamic societies. (Tabakoglu, 2010)

The turning point of Islamic economics and the interest of the Muslim community in the world began with the 1st International Conference on Islamic Economics held in Saudi Arabia under the leadership of Melik Faisal. The 2nd was held in Pakistan (1983) and the 3rd in Malaysia (1992). Conferences caused the field to be heard and known to exist.

The emergence times of Islamic economics approaches are different. While the first of these doctrines reached the early Islamic economists, the later came into existence with the advancement of this branch of science.

The first doctrine treats Islamic economics as an aggregator of commandments and principles for all concerned with economics in the sources of Islamic law. Therefore, this approach requires both individual and social life under the leadership of the Qur'an and Sunnah. The second doctrine argues that Islamic economics is a possible means of attaining and attaining economic goals in Islam. Therefore, Islamic economics is the management of the economic life of the society in the way of achieving the goals of Islam, rather than the precise application of certain principles in the Shari'a. The third doctrine determines the duty of the Muslim in the economic life. Individual movements in Islamic economics; the differences in perception in the nature of the individual are different due to the goals of the individual. The different perceptions of the economic individual lead to different thought frames and their analysis. While the individual in the capitalist order can turn to interest and maximize his profit, the economic individual in Islamic economics, on the contrary, reflects the behavioral dimension of benevolence and brotherhood to the individual.

As a result, there is a deep relationship between economics and Islam. Islamic economics seeks answers not only to the "how" question, but also to the "why" question. The question of "why" is related to the ethical dimension of the event and compliance with ethical values is indispensable in Islamic economics. Islamic economics, taking its main source from Islam, tries to find solutions to the economic problems of the period.

3. Economic Development

Economic development is defined as the transformation of a society's mode of production to produce high value-added products, a fair distribution of income and raising living standards. In the light of this definition, the objectives of development are listed below:

- Human dimension; to increase living standards,

- Production and technology dimension; to start the production of higher value-added products,
- Environmental dimension; to cause minimal damage to the environment,
- Dominance dimension; to be ahead in the race with societies,
- Employment dimension; increasing employment opportunities and improving working conditions,
- Freedom dimension; to increase the level of freedom in terms of economic, political, social and international relations,

Unlike economic growth, economic development must include the following five elements:

- Improvement of humanitarian conditions,
- Sustainable growth,
- Modernization in social, political and institutional fields,
- Structural change in production,
- Technological progress.

The development process needs both economic growth and social changes. The share of economic development is great for the underdeveloped countries to be able to scale up to the standards. Because in underdeveloped countries, the social structure should be corrected before the growth data. In underdeveloped countries, there is an employment problem, this causes the main problems that directly concern the society, such as education and health, and cannot advance the social structure with incorrect policy practices.

The development process also includes developing appropriate policies in terms of the aforementioned negativities. Because development, together with the improvement of economic indicators, leads to a relief that spreads to all segments of the society. In order for economic development to be implemented in the most effective way, certain reforms should be realized, and regulations should be expanded and encouraged in the industry, service and agriculture sectors.

Development does not mean an increase in absolute production and per capita income, but an improvement in economic, social and cultural order in an underdeveloped economy. Among the main elements of development are the increase in per capita income, the change in the productivity and quantities of production factors, the increase of the share of industry in national income and exports, etc. fundamental reforms.

When the concepts of growth and development are compared, growth is “the expansion in the productive capacity of an economy that can be measured quantitatively” (Freyssinet, 1985). The concept of economic development indicates qualitative change. Qualitative change refers to both more efficiency and changes in technical and institutional infrastructure. When the concepts of growth and development are compared, economic growth; it can be said that it refers to the increase process at the same level, while economic development refers to the adventure of structural change in which the one that is different from all of them takes place. (Karataş and Çankaya, 2010).

4. Relationship between Islamic Economics and Development

As a concept, economic development is always kept hot on the agenda, and discussions remain hot on what economic development means, which factors affect economic development, and how they trigger it in a positive or negative way. From an economic point of view, one of the foremost problems of Turkey and other developing countries is development. So, what is development in Islamic economics? First of all, the most dynamic element of development is people. Starting from human beings, the elements necessary for the development of especially developing countries are realized by the fact that they can save and use their savings in the most effective way. Capital accumulation leading to economic development can only be realized by transforming the increased savings into investments. In the realization of economic development, in addition to increasing the savings, which is the most basic indicator of development in our country, it is necessary to transform the increased savings into the most effective investment areas and to be encouraging in all respects. (Aras, 2000).

In economic development, it is aimed to transform the production structure in a country's economy into a way to produce high value-added products and to increase the level of welfare by distributing this product fairly among the income groups in the market. The main purpose of economic development is to make individuals free in all aspects in the context of economic, political, social and international relations. (Source, 2011).

In the development dimension of Islamic economics, it is seen as an obligation to re-investigate the way or model that will develop the society. The main goal of this study is to investigate Islamic development.

The shape of a country's economic policy is determined by the existing economic-social system and its framework and economic growth process. They reveal what kind of person and society type is desired. Our world either does not know or ignores the approaches of Islam about the concept of economic development formed in the capitalist system and its connections. What are Islam's thoughts on economic development? An answer to this question is sought. In line with today's modern economy, Islam has a stable, harmonious, civilized economic development model and economic policies with humane values. In the concept of Homo Islamus, which has these features, the feature that distinguishes it from other human types is that its only purpose in life is not material pleasure. For Homo Islamus, the loftiest goal is not to be rich financially. He is a virtuous, benevolent, benevolent type of person. (Hamitogullari, 1984). The Islamic development model takes from all the material and spiritual dimensions of the human being. These features are explained in the light of verses and hadiths with the concepts of "falah" and "favz" mentioned in the Qur'an as the purpose of development in Islam. (Umer, 2008)

"Whoever does good deeds, whether male or female, as a believer, we will make him live a good life. And we will certainly reward them with the best of what they do." (An-Nahl 16/97). The verse is taken as the most general goal of development in Islam.

The dynamic power created by the spiritual pleasure of obeying divine orders should not be thrown into the background. It is to raise the interest of the society above the interest of the individual (Islam aims at social benefits, not narrow and individualistic benefits). The thought of Islam is the most important force that directs the human being. It turns the economy into an environment that protects it from waste. Islam commands a business sharing that opens up to cooperation.

For a Muslim, life is a means of pleasing Allah and attaining happiness in both worlds. It has features that will lead to sharing in all times of life. Islamic economics is a cooperative feature. It is an economy with a social morality. The task of Homo Islamicus emerges in the economy to think not only of himself but also of society. It brings a minimum livelihood rule to every member of the society.

Development is the effort required to achieve a better level in both material and spiritual aspects. "Allah (swt) does not change what is in a society until they change their characteristics." (er-Ra'd 13/11) As stated in the verse, it is necessary to make the necessary material and spiritual effort.

Also, St. the Prophet (saas) sought refuge in Allah from laziness and weakness in his prayers. "O Allah, I seek refuge in you from distress, sadness, helplessness, laziness, stinginess, debt and the pressure of people." (Tirmidhi , " Daavât " , 71; Bukhari , " Jihad " , 25; Muslim, " Dhikr " , 17). In this hadith, it is prayed by using the features of backwardness.

The strong relationship between economic development and Islam is seen in the realization of the socio-economic justice and welfare (falah) of all individuals. The development of countries will be possible with the conditions suggested by Islam.

5. Results

Economic development is positively associated with the efficient use of a society's tangible and intangible value. But so far, the level of economic success has been unilaterally associated only with material factors. The fact that those who are rich in natural resources are poor and those who are deprived of natural resources are economically developed make us think about these presented theories. Therefore, economic development is intangible; its relationship with religious belief principles was examined in the study.

Undoubtedly, it is useful to consider that the foresight and political propositions to be made for economics, which is a social science, are not the only variable that explains the change or break in this thought system and the changes in the economy of societies.

It is the dominant school of economics that started with Adam Smith and developed itself in the axis of different names for the formation of the Islamic Economic School. It is necessary to reduce its dominance in economics education, economic literature and economic decision-making mechanisms, and the studies on the new alternative Islamic economics should be taken into consideration.

The understanding of development in Islam is based on increasing the level of human welfare. However, the concept of welfare here is the attainment of happiness not only in life in this world, but also in the hereafter. Prosperity in the world is not only the high level of income, but also

showing a multidimensional level of development from education to health, from social solidarity to good governance. (Calgan, 2019).

While forming the theory of Islamic economics, our main sources are the Qur'an and the Sunnah. It is seen that concepts such as halal production, income and consumption, moral values, fair sharing, cooperation and spending are included in the Qur'an and Sunnah. The new generation of Islamic economists should create concrete theories of Islamic economics in the light of verses, hadiths and Islamic law, in addition to the knowledge that has existed as a result of the studies that have come to the present day. A change can only be achieved by considering the concepts of innovative, entrepreneurial, justice and moral values holistically in achieving the ultimate goals of an understanding of economic growth and development that covers all of the world markets.

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The Moderating Role of Ethical Leadership in Preventing Employees' Burnout Caused by Work Overload: The Mediating Role of Emotional Exhaustion

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Abstract: This study sets out to investigate how work overload causes employees to feel emotionally exhausted which in turn leads them toward burnout. The study further explores the moderating effect of ethical leadership on the relationship between emotional exhaustion and employee burnout. The theoretical framework of the study was tested using survey responses gathered from 385 faculty members of Pakistani public higher educational institutions (HEIs). The statistical analysis was performed to confirm the hypotheses using SPSS software. Results indicated that all of the hypotheses were confirmed and the theoretical model was proved to be significant. The work overload caused employees to feel emotionally exhausted. And the emotional exhaustion made employees more prone to burnout. As expected, emotional exhaustion significantly mediated the positive effect of work overload on employee burnout. Furthermore, the ethical leadership was found to moderate the relationship between emotional exhaustion and employee burnout. The moderating effect of ethical leadership on the association between emotional exhaustion and employee burnout has never been studied especially in Pakistani public HEIs context.

Keywords: Work Overload; Emotional Exhaustion; Employee burnout; Ethical leadership; Job burnout

Citation: Zahra, F. (2023) The Moderating Role of Ethical Leadership in Preventing Employees' Burnout Caused by Work Overload: The Mediating Role of Emotional Exhaustion. *Journal Of Economic and Business Issues*, 3(1), 16-32.

1. Introduction

1.1 Background

Recent global ethical business scandals bring light to and raise awareness of the ethical issues in leadership and the importance of leading ethically in the organizations (Resick et al., 2011; Toor & Ofori, 2009). The past few years express an increased interest and focus on the promotion and development of moral practices and procedures in the organizations (De Hoogh & Den Hartog, 2008). The reason why concept of ethical leadership is considered to be incredibly important is because of the strong influence of leaders on the conduct of their subordinates and eventually on the performance of their respective organizations (Kanungo, 2001; Aronson, 2001; Trevino, Brown, & Hartman, 2003). Showing ignorance against ethical leadership can prove to be detrimental and deleterious as it can in turn could hurt the reputation of the organization (De Hoogh & Den Hartog, 2008).

The concept of employee burnout came to prominence in the mid-1970s in the United States (Maslach et al., 2001; 2015). The significant impact of this phenomenon is what made it controversial and important topic in the research field (Maslach et al., 2001). Recently numerous studies on destructive or detrimental employee behavior and attitude such as burnout has emerged (Neubert and Roberts 2013). However, in order to succeed it is important for organizations to have a knowledge about factors that contribute to burnout (Maslach & Leiter, 1997). The leadership has an immense and critical role in preventing employee burnout that results from mental, emotional and physical exhaustion (Maslach et al., 1984, 1981; Chughtai, Byrne, & Flood, 2014).

The ethical leadership forms a significantly positive correlation with employees' well-being (Chughtai, Byrne, & Flood, 2014; Brown et al., 2005). The ethical leader through his moral conduct and principles guides the subordinates in a manner which in turn causes a rise in their productivity levels and job satisfaction and lowers their chances of feeling stressed out and exhausted because of demanding work. (Mo & Shi, 2015; Sharif & Scandura, 2013; Schaufeli & Bakker, 2004).

Received: 14/01/2023

Accepted: 01/02/2023

Published: 27/03/2023

Hence, it is concluded that organizations that prioritize ethical leadership and give significant importance to ethical behaviors and practices witness a great reduction in feelings of stress and burnout among employees. The subordinates are more willing to trust the leaders who emphasize transparency, honesty, authenticity, credibility, power sharing, fairness, integrity, compassion and empathy, which are the attributes or qualities exhibited by an ethical leader (Trevino, Brown & Harrison., 2005).

As noted above, previous studies have found a significant impact of ethical leadership on number of positive outcomes. For instance, ethical leadership has been found to be associated with employee well-being, (Chughtai, Byrne, & Flood, 2014) improved work performance, increased job satisfaction, dedication and efficiency, voice behavior and psychological safety (Walumbwa & Schaubroeck, 2009), employees' readiness to communicate concerns to management (Trevino, Brown & Harrison., 2005), intrinsic motivation, job loyalty, trust on top management and organizational optimism (De Hoogh et al., 2008; Piccolo et al., 2010; Resick et al., 2011). However, the moderating role of ethical leadership on the burnout was never examined in the previous studies, and especially in Pakistan there exists a major research gap. Therefore, the aim of the present research is threefold. First, it seeks to establish an association among work overload and emotional exhaustion. Second, it seeks to determine how emotional exhaustion leads the employees toward employee burnout. Furthermore, the research investigates how ethical leadership moderates the direct link between emotional exhaustion and employee burnout.

1.2 Significance of the Study

The current study seeks to contribute to the emerging body of research on ethical leadership and Human Resource Management (HRM) with the main objective of enhancing workplace practices and outcomes for both employers and employees by exploring moderating role of ethical leadership in preventing employee burnout. The employee burnout is considered to be an important concept for the organizations because of its significant implications such as emotional exhaustion. Thence, this study is set out to help organizations and their management in improving organizational culture or environment by fostering superior ethical leadership practices and behaviors, and in preventing employees from experiencing burnout in the workplace.

1.3 Problem Statement

The alarming issue of employee burnout has become a worldwide epidemic. However, the literature available on what kind of relationship ethical leadership forms with employee burnout is still limited. The employee burnout is the emerging and salient phenomenon for the organizations but no research has been done to explore how ethical leadership acts as a moderator on the direct effect that exists between emotional exhaustion and employee burnout. Specifically in Pakistan no study has been conducted of this sort. Therefore, this study aims to fill this research gap.

2. Literature Review and Theoretical Framework

2.1 Work Overload

Work overload has become a serious and critical issue for organizations now a days that demands immediate attention. This upsurge in work overload causes alarming increase in stress, exhaustion and work-life conflict among employees, decreases their morale and motivation to work which ultimately leads towards poor job performance and low employee engagement. These factors further leads to low job satisfaction among employees. The employees rarely have enough time to relax or function properly while working because of extra work or work overload combined with emotional or mental exhaustion (Ali & Farooqi, 2014). This is backed by previous researches that overload in work increases occupational stress in employees causing them to have trouble focusing. This results in compromised job performance of the employees which ultimately leads towards lower levels of satisfaction related to one's job (Ali et al., 2014). The studies have proved that factors that contribute to occupational stress include increased workload, which is also strongly positively associated with job dissatisfaction (Paktinat & Rafeei, 2012). Another study conducted by Obiora & Iwuoha, (2013) claims that the critical issue of work overload is a very serious problem not only for the employee himself but for the organizations as well. They also go on and report that work overload is the primary reason of stress in job that further leads employees towards job dissatisfaction (Obiora & Iwuoha, 2013).

Work overload has been explained as the "greatness of job tasks and might cause mental distress for employees" (Johari, Ridzoan & Zarefar, 2019). Additionally, this is the phenomena that points out to the amount of assignments and activities that exceeds the designated responsibilities of an employee. (Ali & Farooqi, 2014) This aspect refers to the degree of work stress experienced by employees because of conception that they are unable to handle or be active with the amount of

tasks or work assignments they have been given (Idris, 2011). Work overload can also exist because of factors that include long hours and time pressure. The previous literature suggests that pressure that stems from extra workload is considered to be a reason behind compromising employees' performance significantly (Schultz et al., 2015). The pressure also tends to increase as employees go up the employment stairs and began to acquire senior level positions. The reason for an increase in pressure is more responsibilities and work overload which in return influences the employee's job performance (Schultz & Schultz, 2015). Hence, the problem of work overload concerns the organizations which are these days seeking only employees with high performance (Malta, 2004).

2.2 Emotional Exhaustion

Maslach, Leiter & Schaufeli, (2001) defines emotional exhaustion employees experience at workplace as "feelings of being overextended and depleted of one's emotional and physical resources". Emotional exhaustion means reduction in emotional resources (Ertop, 2019). It refers to the feelings of emotional void followed by intense mental pressure, and severe reduction in abilities to cope up with side effects of being exposed to scenarios for a prolonged period that cause constant stress (Maslach et al., 2016). This causes a great decline in the mental, physical and emotional strength and energy level of employees (Leiter, Maslach & Frame, 2015). Emotionally exhausted individuals experience depletion of energy and feel that all of their resources are diminished. Emotional exhaustion also causes employees to feel tensed and frustrated. Feelings of tension and frustration are often combined with feelings of extreme tiredness. When employees feel extremely tired and exhausted, they are not being able to focus properly on their work and start to withdraw from assigned tasks to protect themselves from burning out (Ertop, 2019).

To study the concept of emotional exhaustion is crucial because it is linked to various relevant outcomes for instance job satisfaction, intention to quit (Skaalvik & Skaalvik, 2017), and job performance (Huyghebaert et al., 2018). Past studies indicate that emotional exhaustion has a significant influence on both employee and his or her respective organization (Halbesleben and Buckley 2004). Research shows that it has a significant negative impact on the mental as well as physical health of an employee and can lead to poor and compromised well-being (Chughtai, Byrne, & Flood, 2014), job dissatisfaction and lower job commitment, high turnover rates and lower job performance (Maslach et al. 2001; Lee & Ashforth, 1996).

2.3 Employee Burnout

Employee burnout at workplace has become a critical issue worldwide that requires immediate attention. Employees at all levels report that they feel insecure, undervalued, stressed out, alienated, and misunderstood at their workplace (Maslach & Leiter, 1997). Although the phenomenon of job burnout is not new but the term recently grabbed the attention of scholars. The initial studies were conducted in the year 1975 by a notable psychiatrist named Freudenberg who was carrying out his research at an agency that specialized in medical care, followed by another well-known scholar Maslach (1976), who was a social psychologist studying emotions at work. Freudenberg (1975) described effects of the burnout as experiencing mental exhaustion as well as feeling less enthusiastic and committed to one's job.

Maslach et al. (2001) defines employee burnout as prolonged response to chronic mental, emotional and interpersonal stressors at work, and is comprised of three key dimensions i.e. emotional exhaustion, feelings of cynicism, and diminished personal accomplishment. Exhaustion is referred to as a root cause of employees' burnout and it is the first indication that individual is suffering from the burnout syndrome (Seidler, et al., 2014; Maslach et al., 2001; Maslach et al., 2015). It is the most essential criterion of occupational burnout (Maslach et al., 2001). The second aspect, cynicism causes employees to psychologically distance. It leads them to experience negative feelings toward their work and feel detached and alienated (Maslach et al., 2015). The third dimension, feelings of reduced personal accomplishment basically means losing confidence in one's capabilities to efficiently carry out the task and considering their contributions to be worthless. Employees start to view themselves as incompetent for the job (Maslach et al., 2001; Maslach et al., 2015).

Employees experience burnout because of the problematic relationships that exist between them and their employed organizations. When organizational processes and structures do not align with the tendencies and capabilities of their employees it causes them to feel stressed out, tensed and frustrated. The stress and tension leads the employees to feel depletion of energy and results in significantly reduced participation. They end up feeling incompetent and inefficient for the job and give up (Maslach & Leiter, 1997).

2.4 Ethical Leadership

Ethical scandals in corporates worldwide (Mehta, 2003; Colvin, 2003; Revell, 2003) have brought attention of organizations to realize the need for ethical leadership (Resick et al., 2011). The corporate scandals concerning ethical conduct have shed light on the importance of the role leadership plays in forming a workplace culture that promotes ethical values and principles (Trevino, Brown, & Harrison, 2005). Previous research points to the fact that most employees tend to look outwards for inspiration of moral conduct rather than inside (Bassberg, 1969; Treviño, 1986). Thus, leaders can be a primary and main provider of such assistance and counselling at work (Trevino, Brown, & Harrison, 2005).

The importance of moral leadership for leading effectively in the organization has been a topic of interest for decades (Bass & Steidlmeier, 1999). This concept emphasizes dignity, being well-informed about ethical duties, integrity, inclination toward collectivism, preference for civilized conduct, perceptive and considering of the needs and rights of others, and accountability management (Trevino, Brown, & Harrison, 2005; Treviño et al., 2006; Gini, 1997; Fluker, 2002; Kanungo & Mendonca, 1996; Gottlieb & Sanzgiri, 1996). Brown et al. (2005, p. 120) describes ethical leadership as “the demonstration of normatively appropriate conduct through personal actions and interpersonal relationships, and the promotion of such conduct to followers through two-way communication, reinforcement, and decision-making”. Basically it focuses on the way managers utilize the given authority by not only practicing the ethical values in their professional life but in their personal life as well. Hence, they are the ethical persons as well as the ethical supervisors (Resick et al., 2006; De Hoogh et al., 2008; Treviño et al., 2003; Brown & Treviño, 2006).

2.5 Work Overload and Emotional Exhaustion

The type of relation employees form with their respective jobs and the problems or hardships that emerge as this working relation start to become worse or even unhealthy for the employees, have been recognized as an important phenomena of the contemporary times (Maslach, Schaufeli & Leiter, 2001). The changing working conditions and work overload to be specific is the main source of stress and exhaustion in the workplace (Laurence, Fried, & Raub, 2016). The work overload may occur because of many reasons, some of them include advancement in the technologies, new and challenging market demands, staff restructuring and adjustments (García-Arroyo & Segovia, 2019), and too much extra work (Ali & Farooqi, 2014). This changing environment of work that involves more challenging and greater demands from employees and especially the culture of work overload has put the employees under so much pressure and is affecting their work situation (García-Arroyo & Segovia, 2019). These changes can cause the employees to experience symptoms of stress and emotional exhaustion (Maslach et al., 2001; 2015; García-Arroyo & Segovia, 2019).

Emotional exhaustion is said to be the central aspect of the employee burnout and also the most commonly and widely complained about symptom of the employee burnout syndrome (Maslach et al., 2001; 2015; García-Arroyo et al., 2019). The findings of previous studies show that exhaustion that employees experience because of demanding and extra workload negatively affect employees’ satisfaction, commitment and performance (Paktinat & Rafeei, 2012). The stress at work due to work overload can become a serious and harmful issue not only for the employee himself or herself but also for the organization he or she works at as well (Ali & Farooqi, 2014).

Stress that results from various job related elements points to the aspects and elements that job entails, as well as the activities and duties performed by employees at workplace (Nguyen et al., 2018; García-Arroyo & Segovia, 2019). It manifests itself in the form of both qualitative and quantitative terms, particularly in the case of work overload specific situations (García-Arroyo & Segovia, 2019). Previous literature reports that work overload contributes to many serious psychological and physical health issues (Maslach et al., 2001; García-Arroyo & Segovia, 2019) such as fatigue, insomnia, tension, anxiety, lower self-esteem and depression etc. (Maslach et al., 2001; 2015). Carballo-Penela, Varela & Bande (2018) describes work overload as a job stressor that refers to such work related situations where job responsibilities surpasses the resources available to perform them (Shrimon, Gilboa, Fried, & Cooper, 2008). On the other hand, exhaustion is among the very first symptoms of burnout syndrome which results due to chronic stress caused by work related stress factors such as work overload followed by feelings of reduced energy (Maslach & Leiter, 1997; Lewin & Sager, 2009; Leiter, Maslach & Frame, 2015).

Intense and extra workload along with chronic fatigue and emotional exhaustion causes employees to be less committed and engaged in their work (Qaiser, Gulzar, Hussain & Shabbir, 2015). Work overload not only adversely affect employee’s well-being as well as in the context of work it causes them to perform their job ineffectively, commit mistakes and errors, and make poor decisions related to work. These negative effects become the reason of their compromised and poor health and well-being (Qaiser, Gulzar, Hussain & Shabbir, 2015).

Emotional exhaustion is not merely something that employees experience but rather it brings about set of actions one take to distance himself emotionally and cognitively from his job, most

likely to deal with increased work demands that extra workload imposes. Previous research indicates that most of the studies that have been conducted to examine the phenomenon of mental exhaustion was done on the workers who were doing “people work”. The people work means employees working in human services and health care, whose job requires them to deal with people on everyday basis (Maslach & Schaufeli, 1993; Maslach, Leiter & Schaufeli, 2001). Maslach et al., (2001) reports in his study that emotional work is more draining especially for situations where the role demands from the employees to portray emotions that are not consistent with their feelings. The growing demands of the today’s work can cause the employees to feel exhausted and can damage their capacity to respond to the changing needs their work demands. Because of such reasons, employees start to use cognitive distancing as a coping mechanism when they feel exhausted and emotionally drained. Exhaustion is the ultimate response of work overload that manifests itself in many forms including physiological and psychological problems that were discussed above i.e. tension, fatigue, stress, anxiety, insomnia, cognitive distancing and so forth (Maslach, Leiter & Schaufeli, 2001; Maslach & Frame, 2015). Therefore, the following hypothesis can be developed:

H1: There is a significant positive effect of work overload on emotional exhaustion experienced by employees.

2.6 Emotional Exhaustion and Employee Burnout

Seidler, et al. (2014) refers to emotional exhaustion as “the heart of the burnout”. It is the most commonly reported issue among those who experience job burnout (Leiter & Maslach, 2016; Leiter, Maslach & Frame, 2015). It is thought to be most obvious manifestation of occupational burnout (Leiter et al., 2015). Some scholars because of this significant association that emotional exhaustion has with employee burnout even claim that remaining components do not hold much importance as they seem unnecessary and irrelevant (Shirom, 1989). They have labeled this model as “exhaustion-only” model (Maslach et al., 2015).

Emotional exhaustion demonstrates the stress dimension of the employee burnout syndrome (Maslach et al., 2001). It includes feelings of drained physical, mental and cognitive energy and can be manifested in the form of lack of resources one needs to efficiently carry out the assigned tasks in the workplace (Maslach et al., 2015). Previous studies indicate that employees who show signs and symptoms of chronic emotional exhaustion display destructive behaviors (Maslach et al. 2001; Lee & Ashforth, 1996; Janssen, Lam & Huang, 2010). Maslach et al., (2001) describe in their study that exhausted employees tend to be less responsive and involved with the demands of their job and have trouble focusing on tasks due to drained out energy levels. A predicament with overwhelming job demands that leads employees towards chronic exhaustion is most likely going to negatively affect one’s job efficacy. Further, emotional exhaustion disrupts employees’ job effectiveness. It seems hard to have a sense of effectiveness and accomplishment when employees are stressed out as well as drained (Maslach, Leiter & Schaufeli, 2001).

Employee burnout is the ultimate response exhibited by employees experiencing feelings of emotional exhaustion and lack of physical and mental energy (Maslach, 1997; Maslach et al., 2001; 2015). Freudenberger, (1974) defines employee burnout as “mental and physical exhaustion” that occurs in the work settings. The intensity of burnout can vary from person to person, and different people can claim different symptoms (Freudenberger, 1974) but emotional exhaustion is always common (Maslach et al., 1993; 2001; 2015). Therefore, the following hypothesis can be derived:

H2: There is a significant positive effect of emotional exhaustion on employee burnout.

2.7 The Moderating Effect of Ethical Leadership on the Relationship between Emotional Exhaustion and Employee Burnout

The leadership style has a significant impact on the effectiveness and performance of the both employees and organization (De Hoogh & Den Hartog, 2008; Ahmadi, Ahmadi & Zohrabi, 2012). The leadership plays an immense and critical role in shaping and encouraging ethical environment in the organization. Leaders have a crucial impact in determining the conduct of employees and the organization (Trevino, Brown, & Hartman, 2003; Kanungo, 2001; Aronson, 2001). Ethical leadership is linked to various significant and positive consequences that are of interest to the organizations, some of the outcomes include leaders’ effectiveness, employee’s contentment related to job (Trevino, Brown, & Harrison, 2005; De Hoogh et al., 2008), work passion (Ahadiat & Dacko-Pikiewicz, 2020), commitment (Ahmadi, Ahmadi & Zohrabi, 2012), engagement, readiness to put forward issues in front of concerned authorities (Trevino, Brown, & Harrison, 2005), positive employee voice behavior (Walumbwa & Schaubroeck, 2009), organizational citizenship behavior (Brandon, 2013) and so forth. The ethical leadership has also been linked with employee’s overall well-being (Chughtai, Byrne, & Flood, 2014), trust and organizational optimism (De Hoogh et al., 2008).

It is evident from above mentioned positive outcomes of ethical leadership that leaders who prioritize ethical behaviors and practices in the workplace, allow employees to exhibit positive attitude toward their job and hence prevent them from experiencing negative feelings and ultimately exhaustion. Research indicates employees tend to trust the leaders who show great concern for their followers and emphasize ethical attributes and characteristics (Brown et al., 2005). The trust on leadership is manifested in advantageous consequences i.e. improved employees' behaviors and attitudes (Burke et al. 2007) and better job performance (Trevino, Brown, & Harrison, 2005; Neves & Caetano, 2009). Previous studies reveal that employees feel less exhausted and have higher level of satisfaction when their leader is ethical, thus, lowering their chances of burnout. In light of above arguments, the following hypothesis can be developed:

H3: Ethical leadership negatively moderates the relationship between emotional exhaustion and employee burnout such that when ethical leadership is high then it weakens the relationship between emotional exhaustion and employee burnout.

2.8 The Mediating Effect of Emotional Exhaustion on the Relationship between Work Overload and Employee Burnout

As noted above, previous studies on the topic of work overload has positively related work overload with chronic stress at workplace and feelings of severe emotional exhaustion (Laurence, Raub, & Fried, 2016; Abbas & Roger, 2013; Pienaar, Rothmann, & De Beer, 2016). Research has proven that fatigue and anxiety caused at work because of reasons such as work overload leads the employee toward burnout. Maslach et al. (2001) argue that exhaustion is mostly experienced with the combination of feelings of alienation and depersonalization which basically works as a defense mechanism for the employee dealing with extra burden that is imposed on the employee. It is very critical for organizations and management to know when employees are feeling exhausted and stressed out so they could take important measures to treat the problem otherwise if left untreated exhaustion can further lead to burnout (Maslach, 1997; Maslach et al., 2001; 2015).

There has been tremendous studies done on burnout that states that there are some situational factors i.e. work overload that correlates to employee burnout. In fact extra workload and strict deadlines are the main reasons of job-related stress (Maslach et al., 2015). Especially for employees whose jobs are demanding and oftentimes require them to deal with job overload. Such employees are more likely to experience burnout (Maslach et al., 2001). In view of these arguments, following hypothesis can be formulated:

H4: The emotional exhaustion mediates the relationship between work overload and employee burnout such that work overload leads toward heightened emotional exhaustion and presence of emotional exhaustion leads toward increased employee burnout.

2.9 Research Model

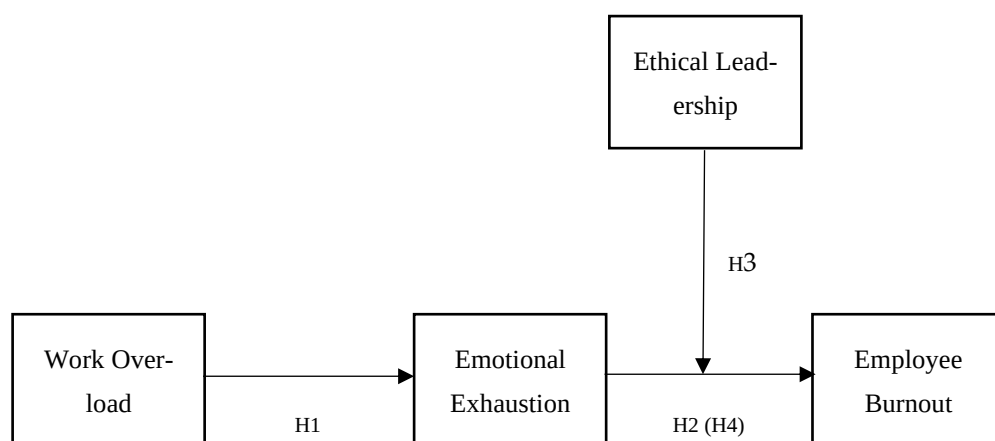


Figure 1: Research Model

3. Research Methodology

3.1 Data Collection

The study is cross-sectional in nature. The convenience sampling method is used for data collection. The survey responses were collected from faculty members of 17 Public HEIs operating in Islamabad and Wah Cantt, Pakistan. The reason for choosing this as target population is that research has proved that teachers working in a Public sector HEIs of Pakistan are more dissatisfied with their jobs as compared to the teaching staff working in a Private sector HEIs of Pakistan. The stress and exhaustion are the major reasons for this job dissatisfaction (Ayub, 2010). The sample size is about 385 at the confidence level of 95% and confidence interval or margin of error of 5%. As the population size is unknown; it is safe to take sample size of 385.

3.2 Instrument Selection

The questionnaire used for data collection was subdivided into two parts, the first part was related to participant's demographics and second one consisted of all the variables of the study i.e. work overload, emotional exhaustion, ethical leadership, and employee burnout. The demographics portion of the survey questionnaire included items such as age, gender, designation, qualification and experience etc. The section after that enlisted all the variables. Work Overload is evaluated by utilizing four items derived from Buckingham (2004) scale. The items are assessed by utilizing four point Likert Scale response that ranged from "Strongly Disagree" to "Strongly Agree". Emotional exhaustion was measured using 7 items, and employee burnout was assessed with 11 items extracted from the "The measurement of experienced burnout" (Maslach, & Jackson, 1981). The items were listed with 7-point Likert Scale response that ranged from "1= Strongly Disagree" to "7= Strongly Agree". To measure ethical leadership, Brown and Trevino et al.'s (2005) ten item scale was used. In order to evaluate the response given by the participants, five-point Likert Scale response was used in which 1 was for "Strongly Disagree" and 5 for "Strongly Agree".

3.3 Analytical Procedure

To ensure the internal consistency or reliability of the scales, Cronbach's alpha's values were examined. Skewness, Kurtosis and graphical methods i.e. scatter plot, histogram, and normal P-P plot etc were looked at to ensure the normality of the data. Correlation analysis was used to measure how the variables of the study were related to each other. Different types of regression analysis i.e. simple linear, mediation analysis, moderation analysis, and moderated mediation analysis (using PROCESS MACRO) were conducted to test the hypotheses of the study.

4. Results and Analysis

4.1 Normality Test

Table 1. Normality Analysis of the variables

Variables	Skewness		Kurtosis	
	Statistic	S.E	Statistic	S.E
Work Overload	-.290	.124	.475	.248
Emotional Exhaustion	-.923	.124	-.360	.248
Employee Burnout	-.158	.124	-1.097	.248
Ethical Leadership	.360	.124	-1.412	.248

Generally to test the normality of the sample data, the Shapiro-Wilk test or Kolmogorov-Smirnov Test is performed. But for the sample data (n) larger than 300, such tests may seem to be proven unreliable. In such case, normality is ensured by assessing skewness and kurtosis (Kim, 2013). The acceptable value range for the skewness and kurtosis in order for the sample data to be considered normally distributed is between -2 and +2 (George et al., 2010). The statistics for all the variables lie between the acceptable ranges. The skewness values for all the variables lie between -1 and +1 and are really close to 0 which indicates data is moderately normally distributed.

4.2 Reliability Analysis

Table 2. Reliability Statistics

Variables	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Work Overload	.623	.668	4
Emotional Exhaustion	.968	.968	7
Employee Burnout	.926	.926	11
Ethical Leadership	.978	.978	10

The Cronbach's alpha for all four variables' scales of the study is greater than 0.60, which represents internal consistency. Thus, data set can be considered reliable.

4.3 Simple Linear Regression Analysis

4.3.1 Regression Analysis for Hypothesis 1

Table 3. Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.7332	7.4211	5.2998	1.18103	385
Residual	-3.47969	2.51372	.00000	1.24704	385
Std. Predicted Value	-3.020	1.796	.000	1.000	385
Std. Residual	-2.787	2.013	.000	.999	385

a: Dependent Variable: Emotional Exhaustion

First, the linear regression is run to test the first hypothesis. In order to perform the linear regression analysis, there are certain assumptions that need to be met i.e. there should be a linear relationship between variables, there should not be an outlier etc. The minimum and maximum value for standardized residual should lie between -3.29 or +3.29 respectively. The minimum standardized residual value was -2.787 and maximum was +2.013, which satisfies the criteria that there are no outliers in the data. To make sure that the relationship among the variables was linear, the scatter plot was computed. The following scatter plot graph confirms the linearity among respective variables.

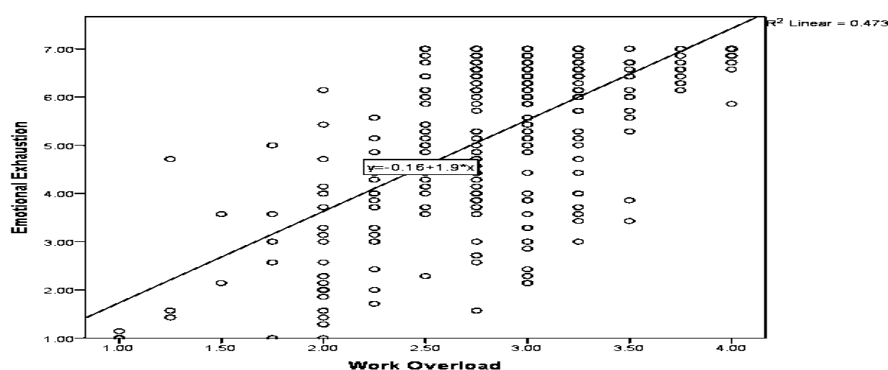


Figure 1. Scatterplot

The third assumption is that the data should have independence of observations which is indicated by Durbin-Watson value or statistic. It should be between 1 and 3. The value of Durbin Watson is 1.137, so the assumption has been met. The assumption of normality has also been met, as graphs i.e. PP plot, histogram and scatter plot etc. given below illustrate that data is normally distributed.

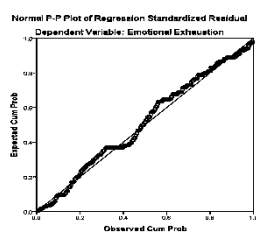


Figure 2. Normal PP Plot

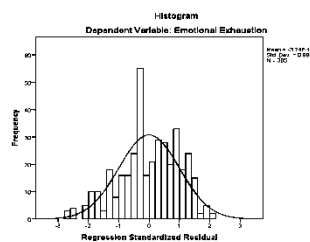


Figure 3. Histogram

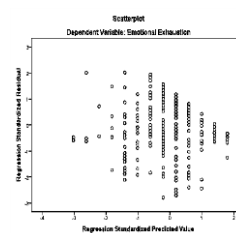


Figure 4. Scatterplot

Table 4. Correlations for Work Overload and Emotional Exhaustion

		Emotional Exhaustion	Work Overload
Pearson Correlation	Emotional Exhaustion	1.000	.688
	Work Overload	.688	1.000
Sig. (1-tailed)	Emotional Exhaustion	.	.000
	Work Overload	.000	.

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.688 ^a	.473	.471	1.24867	1.137

a: Predictors: (Constant), Work Overload
Dependent Variable: Emotional Exhaustion

Table 6. ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	535.617	1	535.617	343.527	.000 ^b
	Residual	597.163	383	1.559		
	Total	1132.781	384			

a. Dependent Variable: Emotional Exhaustion

b. Predictors: (Constant), Work Overload

The Pearson Correlation value is 0.688, which indicates that work overload and emotional exhibit a moderately strong positive correlation. The R Square is .473, which means that 47.3% variance in one's level of emotional exhaustion can be predicted from the degree of work overload. The significance value is 0.000 which indicates that the variables work overload and emotional exhaustion form a significant relationship with each other, confirming the formulated hypothesis.

The standardized coefficient is 0.688, which indicates the model demonstrates a strong relationship. The standardized coefficient beta suggests that for every one standard deviation increase in work overload will be followed by 0.688 of a standard deviation increase in emotional exhaustion.

The sign of unstandardized beta is positive, it means that emotional exhaustion among employees increases as the work overload increases. Hence, it can be said that, for every 1 unit increase in the work overload, the emotional exhaustion increases by 1.896 points.

Table 7. Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1					
	(Constant)	-.163	.302	-.540	.590
	Work Overload	1.896	.102	.688	.000

a. Dependent Variable: Emotional Exhaustion

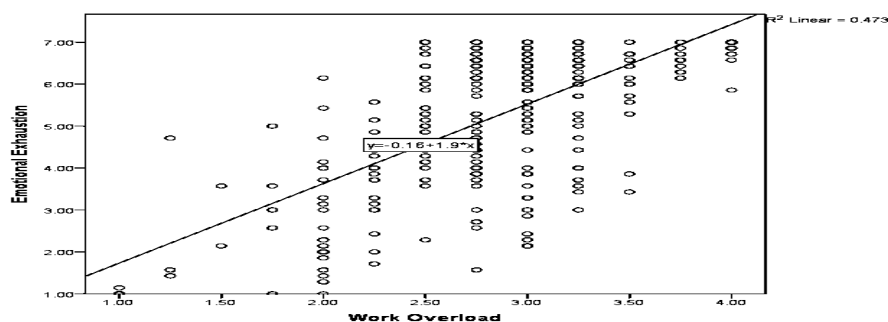
4.3.2 Regression Analysis for Hypothesis 2

Table 8. Residuals Statistics^a

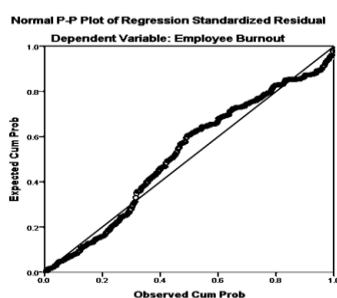
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.3443	5.7414	4.4954	1.25868	385
Residual	-3.01819	2.09086	.00000	.93886	385
Std. Predicted Value	-2.503	.990	.000	1.000	385
Std. Residual	-3.042	2.224	.000	.999	385

a: Dependent Variable: Employee Burnout

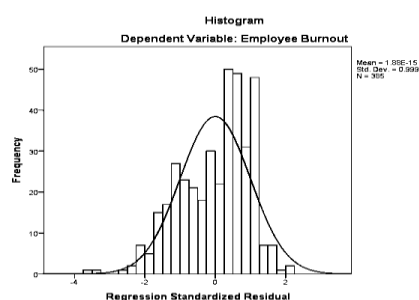
The linear regression analysis is performed to check the relationship between emotional exhaustion and employee burnout. In order to satisfy the assumption criteria required for running the linear regression, first scatter plot has been constructed on the SPSS. The results confirm that there is a linear relationship between the variables. The minimum standardized residual value is -3.042 and maximum one is 2.224, which implies the data does not have any outliers.

**Figure 5.** Scatterplot

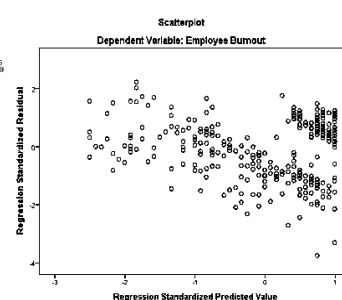
The Durbin Watson value is 1.145, so it can be assumed that data meets the criteria of independence of observations as the value is greater than 1 and less than 3. The normal P-P plot shows that dots are lined up along a 45-degree line that indicates that the data has normality of residuals. The histogram shows that employee burnout that is dependent variable is normally distributed. For normality, these three graphs were constructed i.e. histogram, normal P-P plot, and scatter plot.



Graph 6. Normal PP Plot



Graph 7. Histogram



Graph 8. Scatterplot

The Pearson Correlation is 0.802 which suggests that higher level of emotional exhaustion indicates increased chances of employee burnout, as both variables depicts an extremely strong positive correlation. The sign is positive which means that as the emotional exhaustion increases so does the employee burnout. The significance is 0.000 that implies the model is highly significant.

Table 9. Correlations for Emotional Exhaustion and Employee Burnout

	Employee Burnout	Emotional Exhaustion
Pearson Correlation	Employee Burnout 1.000	.802
	Emotional Exhaustion .802	1.000
Sig. (1-tailed)	Employee Burnout .	.000
	Emotional Exhaustion .000	.

Table 10. Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.802 ^a	.643	.642	.94008	1.145

a: Predictors: (Constant), Emotional Exhaustion

b: Dependent Variable: Employee Burnout

Table 11. ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	608.357	1	608.357	688.375	.000 ^b
	Residual	338.479	383	.884		
	Total	946.837	384			

a: Dependent Variable: Employee Burnout

b: Predictors: (Constant), Emotional Exhaustion

Table 12. Coefficients^a

Model		Unstandardized Coeff.		Standardized Coeff.	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.612	.156		3.930	.000
	Emotional Exhaustion	.733	.028	.802	26.237	.000

a: Dependent Variable: Employee Burnout

The R-Square is 0.643 that means that 64.3% variability in the employee burnout can be predicted or explained by the emotional exhaustion. The p value or significance value is 0.000 that means that the model is significant as p value is smaller than 0.005. The standardized coefficient beta is 0.802, this value indicates a highly strong relationship among emotional exhaustion and employee burnout. By looking at the value it can be said that for every one standard deviation increase in emotional exhaustion, employee burnout increases by 0.802 of a standard deviation.

The sign of unstandardized beta is positive, it means that employee burnout increases as the emotional exhaustion increases. Hence, it can be said that, for every 1 unit increase in the emotional exhaustion, the employee burnout increases by 0.733 points.

4.4 Mediation Analysis

The process model 4 of PROCESS macro by Andrew Hayes is run to test the mediation effect.

Model: 4

Y: Employee Burnout

X: Work Overload

M: Emotional Exhaustion

Table 13. Total effect of X on Y

Effect	se	t	p	LLCI	ULCI	c_cs
1.7052	.0949	17.9744	.0000	1.5187	1.8917	.6764

Table 14. Indirect effect(s) of X on Y

	Effect	BootSE	BootLLCI	BootULCI
Emotional Exhaustion	1.1062	.0854	.9459	1.2798

The above table (Indirect effect(s) of X on Y) demonstrates the indirect effect of work overload on employee burnout through emotional exhaustion. The effect (co-efficient) value is 1.1062, and that is significant. Because the bootstrap confidence intervals indicate that both values i.e. lower and upper bound do not include zero, both are higher than zero as the effect is positive. The values are 0.9459 to 1.2798. Thus, it concludes that mediation effect exists and it is significant. The significance value that is 0.0000 also confirms this conclusion.

The “Total effect of X on Y” table 13 shows the total value of co-efficient which is 1.7052. And the indirect effect is 1.1062. The indirect effect accounts for a certain percentage of the total effect that x has on y. In order to understand that, the calculation is done by dividing indirect effect from total effect ($1.1062/1.7052=0.6487$). The value computed after calculation is 0.6487 or 64.87%, it basically indicates that the proportion of the total effect of work overload on employee burnout that operates indirectly is 64.87%. The remaining percentage that is (100-64.87) 35.13% of the relationship operates directly. So the work overload accounts 35.13% of the outcome of the employee burnout but 64.87% is managed through the emotional exhaustion.

4.5 Moderation Analysis

In order to test the third hypothesis of the study, the moderation analysis was performed using PROCESS macro by Andrew F. Hayes.

Model: 1

Y: Employee Burnout

X: Emotional Exhaustion

W: Ethical Leadership

Table 15. Covariance matrix of regression parameter estimates

	Constant	Emotional Exhaustion	Ethical Leadership	Int_1
Constant	.2727	-.0414	-.0657	.0098
Emotional Exhaustion	-.0414	.0065	.0101	-.0016
Ethical Leadership	-.0657	.0101	.0170	-.0026
Int_1	.0098	-.0016	-.0026	.0005

Table 16. Model Summary

R	R-Square	MSE	F	df1	df2	p
.8864	.7857	.5325	465.7109	3.0000	381.0000	.0000

Table 17. Model

	Unstandardized Co-efficient	se	t	p	LLCI	ULCI
Constant	2.6478	.5222	5.0706	.0000	1.6211	3.6745
Emotional Exhaustion	.6453	.0809	7.9771	.0000	.4862	.8044
Ethical Leadership	-.2708	.1302	-2.0792	.0383	-.5268	-.0147
Int_1	-.0637	.0213	-2.9881	.0030	-.1056	-.0218

Int_1 : Emotional Exhaustion * Ethical Leadership

Table 18. Model Summary

	R2 Change	F	df1	df2	p
X × W	.0050	8.9286	1.0000	381.0000	.0030

The above tables show the results of regression that are generated after executing moderation analysis in SPSS. The value of R-Square is 0.7857 which basically means that 78.57% variance in employee burnout is explained by the interaction between emotional exhaustion and ethical leadership. The overall value of significance (p-value) is 0.0000 which implies that the model is significant.

To check the moderation effect, the interaction term is examined and individual values of coefficients and p are usually ignored. The interaction term indicates the interaction between emotional exhaustion and ethical leadership on employee burnout. The interaction term is significant which suggests that effect of emotional exhaustion on employee burnout is moderated by ethical leadership, thus confirming the hypothesis 3. The unstandardized coefficient is -.0637, negative sign implies that when the ethical leadership is practiced in the workplace, it weakens the relationship between emotional exhaustion and employee burnout. Hence again, it confirms our hypothesis. The same sign of LLCI and ULCI points out that our hypothesis of moderation effect is accepted.

4.6 Moderated Mediation Analysis

The process model 14 of Andrew Hayes is used to test the moderated mediation effect on the model of the study.

Model: 14

Y: Employee Burnout

X: Work Overload

M: Emotional Exhaustion

W: Ethical Leadership

OUTCOME VARIABLE:

Emotional Exhaustion

Table 19. Model Summary

R	R-Square	MSE	F	df1	df2	p
.6876	.4728	1.5592	343.5266	1.0000	383.0000	.0000

Table 20. Model

	Unstandardized Co-efficient	se	T	p	LLCI	ULCI
constant	-5.4626	.3015	-18.1170	.0000	-6.0555	-4.8698
Work Overload	1.8960	.1023	18.5345	.0000	1.6948	2.0971

OUTCOME VARIABLE: Employee Burnout

Table 21. Model Summary

R	R-Square	MSE	F	df1	df2	p
.8963	.8034	.4898	388.2479	4.0000	380.0000	.0000

Table 22. Model

	Unstandardized Co-efficient	se	t	p	LLCI	ULCI
constant	3.0475	.2366	12.8832	.0000	2.5824	3.5126
Work Overload	.4665	.0798	5.8465	.0000	.3096	.6233
Emotional Exhaustion	.3756	.0365	10.2916	.0000	.3039	.4474
Ethical Leadership	-.5754	.0409	-14.0743	.0000	-.6558	-.4950
Int_1	-.0723	.0205	-3.5280	.0005	-.1126	-.0320

Int_1 : Emotional Exhaustion x Ethical Leadership

The above given model table 22 shows that work overload emerged as a significant and positive predictor of employee burnout as value of significance (p-value) is 0.000. The unstandardized coefficient is 0.4665 which suggests that for every 1 unit increase in work overload, the employee burnout level rises by 0.4665 points. The significance value of emotional exhaustion and ethical leadership indicates that both variables are significant predictor of employee burnout as their p-value is 0.0000. The unstandardized co-efficient statistic for the interaction term is -.0723. The significance (p-value) is 0.0005 which is less than 0.05, thus indicates that the model is significant. This implies that it is evident from the co-efficient of the interaction term (-.0723) that ethical leadership is moderating the effect of emotional exhaustion on employee burnout.

Table 23. Test(s) of highest order unconditional interaction(s)

	R2-chng	F	df1	df2	p
M*W	.0064	12.4468	1.0000	380.0000	.0005

M = Focal predict: Emotional Exhaustion

W= Moderating variable: Ethical Leadership

Table 24. Conditional effects of the focal predictor at values of the moderator(s)

Ethical Leadership	Effect	se	t	p	LLCI	ULCI
-1.2388	.4652	.0524	8.8793	.0000	.3622	.5682
.0000	.3756	.0365	10.2916	.0000	.3039	.4474
1.2388	.2860	.0348	8.2274	.0000	.2177	.3544

INDIRECT EFFECT:

Work Overload -> Emotional Exhaustion -> Employee Burnout

Table 25. Conditional indirect effects of X on Y

Ethical Leadership	Effect	BootSE	BootLLCI	BootULCI
-1.2388	.8820	.0892	.7330	1.0875
.0000	.7122	.0658	.5965	.8533
1.2388	.5423	.0637	.4203	.6687

Table 26. Index of moderated mediation

	Index	BootSE	BootLLCI	BootULCI
Ethical Leadership	-.1371	.0331	-.2081	-.0773

The results shown in “index of moderated mediation” table 26 determine that whether the moderated mediation is taking place in the model or not. In order to confirm this, the bootstrap confidence intervals are examined. The values of LLCI and ULCI (confidence intervals) lies outside of the zero or are a nonzero values as the values are -0.2081 and -0.0773, which indicates that moderated mediation effect is significant. As the upper bound (ULCI) is negative it can be concluded that indirect effect through mediating variable is being negatively moderated by ethical leadership. The index value (which is co-efficient value) of moderated mediation effect is -0.1371. The negative sign of index indicates that indirect effect of work overload on employee burnout through emotional exhaustion decreases with higher levels of ethical leadership.

5. Conclusion

The main purpose of this study was to examine the moderating role of ethical leadership on the relationship between emotional exhaustion and burnout among employees. The primary data was collected and then examined in order to draw conclusions. The sample chosen for the study was teaching staff of public HEIs, as public universities’ teachers were assumed to be more prone to burning out because of the demanding and increased work load, and they exhibited lower levels of job satisfaction according to research (Ayub, 2010).

There were four variables in total in the study, and the conceptual model constituted moderated mediation relationship among variables. All four hypothesis were proven to be true after running regression analysis. The first hypothesis was confirmed by running simple linear regression, and it was deduced that work overload causes employees to feel emotionally exhausted. Both variables formed positive relationship, which suggested that when work load increases, so does levels of emotional exhaustion experienced by employees. Second hypothesis was also approved as the results of the simple linear regression for the second hypothesis implied that emotional exhaustion is positive significant predictor of employee burnout. For the third hypothesis, the mediation analysis using PROCESS macro was run. This hypothesis was also validated as both the confidence intervals (LLCI and ULCI) were non-zero (both were lower than zero), thus, the mediation effect of emotional exhaustion was significant. The moderation analysis confirmed that ethical leadership was acting as a moderator on the relationship between emotional exhaustion and employee burnout such that when ethical leadership was high it weakened the relationship between the two and when it was low the relationship was stronger. In order to test the conceptual model of the study, which was whether the indirect effect of work overload on employee burnout differs as the levels of ethical leadership varies, where ethical leadership is acting as a moderator on the relationship between emotional exhaustion and employee burnout, the moderated mediation analysis was performed. The test results indicated that the model was significant. So the conclusion can be made that indirect effect through emotional exhaustion was being moderated by ethical leadership.

5.1 Practical Implications

The findings of this study will help the managers to better understand the concepts of work overload and the direct and serious effect it has on the mental health of employees. It will allow them to take necessary steps i.e. practicing ethical leadership to avoid employees from burning out so their satisfaction and productivity can be enhanced. The managers can learn from these insights and can formulate better and effective strategies to make the workload more manageable for their employees so that they won’t feel stressed out.

5.2 Limitations

Like most studies, this research has certain limitations. First, the sample chosen for the study was teaching faculty working at public HEIs, and this restricts us from making generalizations about other occupations or professions. Then the data was collected from the public sector universities of two cities of Pakistan only i.e. Islamabad and Wah Cantt, this also imposes some limitations. As there was a time constraint and sample size could not be expanded. Future studies could try to be more inclusive of other occupations and they can reach other cities or countries as well.

5.3 Future Research and Recommendations

The future research can focus on including occupations other than teaching faculty of public HEIs. The future work should explore the conceptual model of this research in different work contexts so that external validity of the results of this research can be enhanced. The future studies could conduct research including the sample from all the cities of Pakistan to make the findings more generalizable. The future research should also explore other determinants of employee burnout i.e. ostracism, depersonalization etc. The future studies can be longitudinal study in nature. As the concepts of emotional exhaustion and employee burnout are difficult to assess, studying these behaviors at different points in time would allow to draw more significant and meaningful conclusions.

Funding: This research received no external funding.

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Matching Administration Impartiality, Technological Innovation and State Capacity with Environmental Sustainability: A Cross-Country Analysis of Two ASEAN States

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Abstract: This study aims to explore the relationship between state capacity variables, technological innovation, and environmental sustainability in two ASEAN members, namely, Vietnam and Singapore over the period of 2000 to 2020. The study employs the Auto-Regressive Distributed Lag model to examine the existence of a relationship, and a Granger causality analysis to capture the causal effect between the variables. The results reveal, a negative association between impartial administration, technological innovation, and environmental sustainability in the long run for both countries. Nevertheless, the granger test demonstrates a causality effect running from impartial administration to environmental sustainability and between technological innovation to environmental sustainability for Singapore. Moreover, a negative association emerges for the rule of law. Signifying, perhaps, stricter environmental legislation could hamper the state's sustainability mission by undermining potential stakeholders. On the other hand, the negative relationship between technological innovation and environmental sustainability, and the nonexistence of causal effect reveals Vietnam's still immature technological development. However, an effect running from environmental sustainability to technological innovation takes place in Vietnam's context, presumably, showing that embracing environmental sustainability will lead the market to invest in green technologies, hence, retroactively, establishing a market-oriented toward green competitiveness.

Keywords: Sustainability, Impartial administration, ARDL, Regulatory qualities, Technological innovation

Citation: Aden, K. (2023) Matching Administration Impartiality, Technological Innovation and State Capacity with Environmental Sustainability: A Cross-Country Analysis of Two ASEAN States. *Journal Of Economic and Business Issues*, 3(1), 33-50.

1. Introduction

Sustainability requires viewing the environment from a trust passed on, to us, by our ancestors for our collective welfare benefit, including the future generation, rather than regarding it from a potential source of profits perspective. Although, only a pro-environment and ecologist could utter such a thing. However, the magnitude of past year's events could perhaps urge states to consider embracing innovative sustainable standards. The year 2020 alone saw a number of profound climatic events, namely, the bushfires that ravaged Australia and California, several disastrous floods occurred in China, the first-ever highest temperatures recorded in Antarctica (above 20°), the discovery of marine debris in the Antarctic ice, and the loss of livelihood by locusts that swarmed throughout African countries, the Arab World, and part of Asia. Deforestation has its own fair share of sustainability deterioration when we recall the progressively increasing commercial commodities production, and at this pace of forest reduction, only approximately 10% of the ecosystems will be left by 2030 (Earth.Org, 2020). Carbon emissions are the third main environmental issue. According to world health organization estimates, between 4.2 and 7 million people globally pass away as a result of environmental pollution each year. According to research by the European Union environmental agency, there were almost 399,997 fatalities per year in the EU in 2012. Whereas the United Nations Children's Fund calculations suggest that; carbon emissions in Africa caused 258,000 mortalities in 2017.

Scholars contend that greater investment in sustainability can reduce such consequences, whereas governments and political institutions may play critical roles in implementing salient regulation that in turn facilitates sustainability procurement (Fredriksson and Svensson, 2003; Welsch, 2004; Muhammad and Long, 2021). A straightforward question would be, although civil services could contribute to such an achievement, however, when it's hampered by internalities issues,

Received: 31/12/2022

Accepted: 10/03/2023

Published: 27/03/2023

namely lack of impartiality, and poor bureaucratic efficiency, will the rate of environmental sustainability remain perfectly sustained, or tainted with such internalities?; Muhammad and Long (2021) emphasize that institutions with greater political and governmental efficiency are better at putting into practice and enacting sounder policies, and this might subsequently influence other entities within the national territories to adhere to such regulations. Nonetheless, tight environmental regulations might retroactively produce several negative unprecedented outcomes, which, could undermine economic development while simultaneously providing opportunities for the shadow economy to transpire, due to the excessive restriction on environmental activities degradation.

However, by re-structuring the market, balancing sustainability with economic growth, and shifting toward activities that have less of an adverse impact on the environment, effective governance models may be required as a server key component in the transition to a green economy. Indeed, a state's capacity could be a useful tool for fostering innovation in both the public and private spheres, utilizing both, either as an external policy mechanism to boost the competitiveness of the businesses environment in specific industries and revive economic growth or as a catalyst that contributes to domestic goals in order to addressee specific environmental challenges. More formally, achieving environmental quality would require incorporating public-private entities within the sustainability agenda, subsequently producing a market-oriented one that is based on greener innovation competitiveness. Nevertheless, the possibilities of the latter strategy to transpire, the role of the state is indeed cardinal.

Therefore, compared with previous papers the current article aims to explore how to match states' capacity with environmental sustainability. There is a potential likelihood presence of reverse causality running from environmental sustainability to state capacity. On one side, the state capacity factors contribute, somehow, to sustainability betterment or undermining an already fragile ecosystem. And improving environmental sustainability might not only be through enterprises and private sectors as had already been proved by considerable researchers, but also by further spurring impartiality among civil servants, bureaucratic efficiency, and embracing rule of law and sustainable regulatory qualities while taking into account the aftermath impact of such regulation. Moreover, to ensure novelty, we incorporate technological innovation alongside state capacity variables, in similar research (Dincă et al., 2022) incorporates educational level alongside governance capabilities on environmental performance. Therefore, states' capacity could be sufficient in the context of providing internal incentives, yet it is unlikely a mere regulation could alone promote sustainability without additional externalities. Moreover, Vietnam and Singapore are selected as a venue for the study. Notwithstanding, both selected countries have an economic, technological, and environmental gap, and while the latter might be well sustained the former is less developed. Therefore, comparing both countries in order to attend the maximum goal of this paper is perhaps adequate, regardless of their socio-economic differentiation. As a matter of fact, previous authors have respectfully focused on Organization for Economic Co-operation and Development (OECD), Latin, and Caribbean countries, making Asian countries understudied, particularly, the Association of Southeast Asian Nations (ASEAN); albeit their unique sustainable policies advancement. As for the estimation method, both an Autoregressive Distributed Lag (ARDL) approach will be performed in order to provide salient findings that capture the long-run relationship between the variables, simultaneously a granger causality analysis would later be employed to examine the causal effect of the factors.

2. Review of literatures

The role of the state in achieving a healthier sustainable environment is becoming obsolete if not dwindling. And by this, alternative actors, including citizens have emerged as potential stakeholders. Albeit, this shrinking of states' capacity in addressing environmental issues, the government still maintains its sparkle by interfering in the sustainability agenda either directly or through indirect processes, and, depending on this particular practice, it could either assist in improving the environment or deteriorate what was an already fragile ecosystem. Similarly, it is important to note that sustainability covers a larger scope, and the fact of an absence specific delineation mechanism provides academicians to implement the latter concept in different environmental fields, from energy, CO₂ emissions, and waste management, to public health.

2.1. State Capacity and Environmental Sustainability

Several authors accentuate the negative impact of administrative biases when civil servants stray away from impartiality. Welsch (2004) and Cole et al. (2006), stress the relationship between the lack of impartiality and environmental pollution. Their study reveals how, poor impartiality reduces the efficiency of environmental policies, then, retroactively affects quality deliverance. In fact, better regulatory quality upgrades sustainability within the state, however, ironically, stringent environmental regulation aimed at improving sustainability would hamper the state's economy by further introducing shadow economics. Chen et al. (2018) demonstrate how stricter control of

environmental regulations would reduce pollution and ameliorate ecological qualities but at the expense of providing opportunities for shadow economy activities to expand. Elgin and Mazhar (2013), build a double-sector model between the official economy and the shadow economy, they discover that depending on how severe environmental regulations were implemented, certain shadow economy sectors may eventually end up becoming a major cause of environmental pollution leakage, as a result, impeding state's sustainability effort. More formally, this excessive execution of eco-friendly policies, without practical reappraisal of its aftermath effect would certainly increment the scale of the shadow economy. Certainly, without repercussion motives, these authors are genuinely warning of the negative effect of greater propensity toward sustainability policies when the collective posterior impact hasn't been fully taken into consideration.

In a similar scenario, Kuehn (2015) argues that due to the high economic and political stakes involved in many controversies, accusations of bias in administrative sustainability judgments are becoming more frequent recently, and, indeed, appear to be growing. To exemplify this, parties in environmental proceedings allege ethical violations, discrimination in forms of favoritism, prejudging of outcomes, complaining of irregular prosecutorial and judicial functions, and illegal political influence, particularly, in legal cases that require higher impartiality and integrity by the competent organs. Interestingly such as scenario transpires in every corner of the globe from high-profile oil conglomerates to CO₂ emission effect on locals' well-being. Only recently, opponents of a 1,700-mile Keystone XL oil pipeline have alleged that the environmental decision-making process has been sullied by State Department cronyism of the pipeline's construction company, further reinforcing the blatant bias and favoritism among civil servants. see (Rosenthal and Frosch, 2011).

While the point (Kuehn, 2015) should be treated as a particular case, Romano et al. (2021), also applies the lack of impartiality and ineffectiveness in Italy by considering waste management performance as a point of illuminating the state's maladministration. The outcome of the causality framework demonstrates that urban disposal production per capita is higher in municipalities with relatively high amounts of corruption and poor governance. Reasonably, the following outcome is justified by the author as the presence of possible, biased activities, while simultaneously pursuing personal interest at the expanse of the conferred mission to them by abusing their titles which are mostly defined by their professional positions, thus, Ironically, providing irrational immunity. The significance of the link between waste management and unlawful actions and the absence of impartiality has also been emphasized by (Gumisiriza and Kugonza, 2020; Cesi et al., 2019; Agovino et al., 2018), according to their theory, Corrupt businesses entities, local governments, and oversight agencies frequently collaborate in the context of environmental violations to create illicit networks that jeopardize effective waste disposal and the flow of sustainable management. For instance, these networks, have a significant impact on contractors and subcontracts who handles garbage collection, transportation, and disposal, by exerting substantial control, thus carrying out their well-orchestrated extortion activities, in turn undermining the public health. Generally, ineffective waste disposal produces health problem D'Alisa et al. (2010) reveals how organized crime is a key contributor to environmental offenses, including the disposal of dangerous waste. therefore, contributing to health issues including asthma, respiratory issues, tumors, and circulatory system abnormalities, notwithstanding, perpetrators continue to pursue their sustainable degradation, given, the low attention provided to environmental infractions.

Highlighting how ineffective state capacity affects sustainability (Fredriksson and Svensson, 2003), explores the effect of government stability and absence of corruption on environmental policies by collecting data from 60 countries. They conclude that the degree of corruption may have been what determines the association between political risk and the strictness of environmental regulations. In particular, political stability has a detrimental influence on the effectiveness of environmental legislation when the amount of corruption is low; yet, once the level of corruption is at its peak, political stability has a favorable influence on environmental legislation. Additionally, corruption can reduce the effectiveness of environmental regulation, but the impact will vanish with greater political stability.

Chen et al. (2019) and Pang et al. (2019), analyze a way of achieving sustainable development by reducing air pollution. Based on their conclusion; Car exhaust is one of the major sources of air pollution in China, because of the country's ongoing urbanization and rising living standards, which has led to an increase in the number of families; owning to several fuel-powered vehicles. The authors suggest that pushing electric vehicles over gasoline-powered ones will assist in tackling the problem of urban air pollution. On the other hand, some scholars support maximizing the involvement of the government in the environment by enhancing environmental protection legislation, boosting environmental rules, and tightening environmental inspection procedures in order to reduce air pollution (Song et al., 2020).

An interesting case about ecological issues can be linked to the famous case of (Oposa Minors Case, 1993). According to the Philippines Chief Justice, the petitioners filed a lawsuit on

behalf of future generations. According to the court's reasoning, intergenerational standing is helpful when environmental harm is long-lasting and worsens with time, posing a greater hazard to coming generations than to the current. However, in order for the rights of coming generations to be really convincing, they must be completely incorporated into constitutional and international human rights law. Following this verdict, several countries have already set agendas of integrating future-generation values into constitutional environmental rights, see (Commonwealth, Robinson Tp, 1993). Another German case has rejected to consider condemning a CO₂ emission industry. according to the plaintiff's argument, the CO₂ emitted by these industries was infringing his fundamental rights. After finding unsubstantiated human rights violations, the court decided to discard the plaintiff's appeal, however, the court shifted its verdict to proportionality scope, in which, excessive consumption of CO₂ from the current generation would cause future sustainability damages for the upcoming generation, while simultaneously leaving little quantities of CO₂ emission to experience (Winter, 2022).

Muhammad and Long (2021) highlight the critical role of institutional components like political stability, anti-corruption measures, and the rule of law in reducing carbon emissions and enhancing environmental quality. Further providing support for Muhammad's institutional variation, Salman et al. (2019), contends that the strength of a nation has a significant impact on how well the Paris Agreement and other environmental pollution-related regulations are implemented. On the other hand, industries wouldn't think twice about breaking pollution control regulations to maximize profit if there are defects and weak institutions. Welsch (2004) and Aden (2022), also argue that robust institutions have the potential to reduce pollution not only at the national level but also at an international level through a mechanism based on a spatial institutional spillover effect. On the other hand, ineffective institutions, which are viewed as the primary cause of the low-income trap, are the main barriers to further reaching sustainable societies and adopting sophisticated energy structures generated by greener technologies (Salman et al., 2019).

Geller et al. (2006) also look at how 123 different countries' levels of governance affected the quality of their environments. The findings demonstrate that effective policies, judiciary fairness, and accountability favorably impact water quality. On the other hand, judiciary fairness, and bureaucratic efficiency have a positive effect on air quality. However, the six governance indices are adversely affected by forests, and there is no indication that governance indicators have an influence on biodiversity.

2.2 Sustainability and Innovation

An institution must purchase or create a new product, service, or platform that requires technical innovation in order to attain Sustainability; yet, specific characteristics of procurement authorities affect such activities. Although, public strategies that are innovative and sustainable can be implemented at several levels. And when deeply ingrained and widely accepted these groundbreaking technological tools, achieving sustainability through an innovation-driven agenda becomes further plausible, while, simultaneously, producing potential benefits for society (Nijboer et al., 2017). Hence, embracing these smart technological innovation policies by governments has a crucial role in fostering the adoption of environmental technologies by business entities, thus boosting sustainability levels and indirectly contributing to the major social problem of climate change through the business-government collaboration mechanism. Therefore, in order for economies to achieve a decarbonized and controllable development path that is compatible with competitiveness goals; technological innovation may be crucial, in the context of implementing and disseminating greener manufacturing technology, and lesser dependence on CO₂ emission.

Khan et al. (2020b) employ a fully modified ordinary least square (FMOLS) model, a dynamic ordinary least square (DOLS), a generalized least square (GLS), and chronical cointegration regression (CCR) method to show the relationship between innovation, and private and public partnership energy investment. The results yield that technological innovation (TIN) infuses higher energy consumption generated through renewables. The findings also underline the important role of reducing CO₂ emissions when the state embraces technological tools, subsequently contradicting the general belief of the negative effect of technological advancement on the environment. Additionally, the favorable effect of TIN on cleaner production is revealed by (Alvarez-Herranz et al., 2017), the empirical results indicate that spending on technological innovation lowers Carbon footprints and enhances the climate's overall health. The authors also point out that while the impact of innovation and technological expenditure varies among nations, these tools might be leveraged to reach salient sustainability.

Sun et al. (2008) examine the connection between greenhouse gas emissions (GHG) and patent technologies. The researchers conclude that technological progress considerably lowers CO₂ emissions. Additionally, their comparative research indicates that, in contrast to other geographical regions, Eastern counties are more effective at implementing innovations and eco-friendly

technology. This pivotal finding might suggest, perhaps, comparing the development status between the North and the East; developed nations had already at their peak of progress, although their mission of achieving sustainability could be easier but still growing nations possess the upper hand in transforming their economy to better match sustainability goals, with less, inconvenience vis-à-vis the northern. In a similar case, the effects of advancements in technologies, environmental laws, and urbanization on ecological performance were investigated using the generalized method of moments GMM technique by (Yasmeen et al., 2020). The findings show that the eastern area had the greatest ranking in terms of ecological effectiveness, preceded by the middle and western regions, correspondingly. On a national scale, the urbanization index has a detrimental effect on ecological effectiveness. While the results in the western and middle areas are inconsequential as they are favorably significant in the eastern region.

Zhou et al. (2018) reveal that technological progress in green fields might encourage an increase in anticipated production. Therefore, developing green technologies is a crucial approach for China to increase its ecological efficiency. Nevertheless, these authors contend; at the current time, China's eco-friendly technological innovations are somehow lacking and indeed at some point need to be addressed. Furthermore, China's technological evolution exhibits a "U"-shaped environment Kuznets curve. Indicating, that advanced technology before 2010, somewhat decreased ecological efficiency. In a similar context, Shahbaz et al. (2016) reveal that technological innovation may lower carbon emissions and assist in addressing the difficulties associated with environmental sustainability by coping with unexpected climate damages while at the same time playing a major key in the betterment of environmental quality. Another ground-breaking study conducted by Bouzguenda et al (2019), aimed to explore the role of communications and technology on enhancing engagement among citizens toward sustainable cities. The author's main purpose is to investigate in deep the incorporation of digital citizen participation in sustainable smart cities, the result suggests that emphasizing Information and Communications Technology (ICT) will direct to better social sustainability and produce human-based interconnection than a robotic administrated platform which in most cases interferes at delivering acceptable feedbacks. Adebayo and Kirikkaleli (2021), also analyze the effect of renewable energy, globalization and technological innovation in Japan's environmental sustainability. The wavelet statical tools show an increase in the level of CO₂ emission when technological innovation has been embraced, further creating discrepancy between the positive impact and the negative scope when technological tools deployed in climate mitigation context.

3. Methods

In this study, environmental sustainability (our dependent variable) is proxied by adjusted net savings, excluding particulate emission damage, adopting the famous work of (Ganda, 2020), whereas, technological innovation is adopted by (Rafique et al., 2020). Moreover, A period of twenty years was selected starting from 2000 to 2020. The period could have been extended, however, to avoid biases in a format of missing data the study contends to carry on within this interval period. Furthermore, the study is built by collecting several variables interlinked with the country's governments and civil servants. The collected variables are taken from the world bank development except for impartial administration which was taken from the global state of democracy indices. More formally, we are anticipating that greater states' characteristics improve, to some extent, the level of sustainability, thus, establishing a positive compromise between the host country and the quality of the environment. All the variables and their assessments including their respective sources can be seen in Table 1.

Table 1. Variables Summary

Variables	Description	Sources
Adjusted net savings, excluding particulate emission damage (ENS)	Adopted as environmental sustainability	World Bank
Impartial Administration (IMP)	The government and the public administration more generally should implement official public policies in an impartial manner. Scaled to range from 0 (lowest score) to 1 (highest score).	The Global State of Democracy Indices
Regulatory Quality (RQ)	Perception of state to formulate sound policies. Ranging from -2.5 to 2.5	World Bank Governance
Rule of law (RL)	Quality of law enforcement, trust toward agents for their rule abiding. Ranging from -2.5 to 2.5	World Bank Governance
Government effectiveness (GE)	Quality of public and civil services and the credibility of commitment to their formulated policies.	World Bank Governance
Total Patent application (TIVN)	Adopted as a proxy for technological innovation	World bank

3.1. Econometric model

To explore factors enhancing environmental sustainability within Singaporean and Vietnamese territories the following model is proposed:

$$\ln ENS = \beta_1 + \beta_1 IMP + \beta_2 RL + \beta_3 RQ + \beta_4 GE + \beta_5 \ln TIVN + \epsilon_t \quad (1)$$

$\frac{\ln ENS}{IMP} > 0$	→	higher impartiality among public officials improves environmental quality
$\frac{\ln ENS}{RL} > 0$	→	Greater emphasis on rule of law introduces higher sustainability at the national level
$\frac{\ln ENS}{RQ} > 0$	→	Embracing favorable policies toward the environment produces salient sustainable frameworks
$\frac{\ln ENS}{GE} > 0$	→	An effective bureaucratic system leads to environmental improvement by turning to alternative substantial measures, that in turn, promote sustainability.
$\frac{\ln ENS}{\ln TIVN} > 0$	→	Technological innovation infuses higher sustainability by reducing the level of CO2 emissions

First, the following techniques have been applied to the collected data in order to obtain the desired estimates. Accordingly, the unit root test was performed on the dataset (Variables) to examine the stationarity series.

$$y_t = \theta y_{t-1} + \epsilon_t \quad (2)$$

where ϵ_t is the error term.

Assumingly, it is likely certain variables could be stationary at level or becomes stationary at the first difference if such as stationarity explosion can't be detected, hence the termination of the model is most probable or perhaps seeking other adequate alternatives. In doing so, we used the Dickey-fuller test to investigate the variables (Dickey and Fuller, 1979), i.e..

$$\begin{aligned}
\Delta \ln \text{ENS}_t &= \alpha + \beta \text{TIME} + \gamma \ln \text{ENS}_{t-1} + \delta \Delta \ln \text{ENS}_{t-1} + \dots + \delta_{p-1} \Delta \ln \text{ENS}_{t-p} + \varepsilon_t \quad (3) \\
\Delta \text{IMP}_t &= \alpha + \beta \text{TIME} + \gamma \text{IMP}_{t-1} + \delta \Delta \text{IMP}_{t-1} + \dots + \delta_{p-1} \Delta \text{IMP}_{t-p} + \varepsilon_t \\
\Delta \text{RL}_t &= \alpha + \beta \text{TIME} + \gamma \text{RL}_{t-1} + \delta \Delta \text{RL}_{t-1} + \dots + \delta_{p-1} \Delta \text{RL}_{t-p} + \varepsilon_t \\
\Delta \text{RQ}_t &= \alpha + \beta \text{TIME} + \gamma \text{RQ}_{t-1} + \delta \Delta \text{RQ}_{t-1} + \dots + \delta_{p-1} \Delta \text{RQ}_{t-p} + \varepsilon_t \\
\Delta \text{GE}_t &= \alpha + \beta \text{TIME} + \gamma \text{GE}_{t-1} + \delta \Delta \text{GE}_{t-1} + \dots + \delta_{p-1} \Delta \text{GE}_{t-p} + \varepsilon_t \\
\Delta \ln \text{TIVN}_t &= \alpha + \beta \text{TIME} + \gamma \ln \text{TIVN}_{t-1} + \delta \Delta \ln \text{TIVN}_{t-1} + \dots + \delta_{p-1} \Delta \ln \text{TIVN}_{t-p} + \varepsilon_t
\end{aligned}$$

where ‘ α ’ is the constant, ‘ β ’ can be interpreted as the time trend coefficient, and ‘ p ’ displays the lag process.

Adopting the approach proposed by (Pesaran et al., 2001) for our ARDL model, in which their theories was based on employing different lag operators within the ARDL model to avoid simultaneity issue, while simultaneously carrying on with a mixed unit root intermingled variables $I(0) I(1)$.

$$\begin{aligned}
\ln(\text{ENS})_t &= \beta_0 + \sum_{i=1}^P \phi_{1i} \Delta \ln(\text{ENS})_{t-i} + \sum_{i=1}^I \beta_{1i} \Delta (\text{IMP})_{t-i} + \sum_{i=1}^L \beta_{2i} \Delta (\text{RL})_{t-i} \quad (4) \\
&+ \sum_{i=1}^Q \beta_{3i} \Delta (\text{RQ})_{t-i} + \sum_{i=1}^G \beta_{4i} \Delta (\text{GE})_{t-i} + \sum_{i=1}^T \beta_{5i} \Delta \ln(\text{TIVN})_{t-i} + \varepsilon_t
\end{aligned}$$

Where β_0 is the constant, β_1 to β_5 are the coefficients of variables. Δ shows the first difference, and ε is the white noise. After the short-run verification, the long-run cointegration was verified using Wald F-statistics. The test assumes a null hypothesis denotes non-integration. Accordingly, by looking at the F statistics we can conclude if the model is worth for a long-run estimation. in this agenda, we only kept assuming the existence of long-run relations between the variables hence proceeding with an error correction.

$$\begin{aligned}
\ln(\text{ENS})_t &= \beta_0 + \sum_{i=1}^P \phi_{1i} \Delta \ln(\text{ENS})_{t-i} + \sum_{i=1}^I \beta_{1i} \Delta (\text{IMP})_{t-i} + \sum_{i=1}^L \beta_{2i} \Delta (\text{RL})_{t-i} + \sum_{i=1}^Q \beta_{3i} \Delta (\text{RQ})_{t-i} \quad (5) \\
&+ \sum_{i=1}^G \beta_{4i} \Delta (\text{GE})_{t-i} + \sum_{i=1}^T \beta_{5i} \Delta \ln(\text{TIVN})_{t-i} + \lambda \text{ECT}_{t-1} + \varepsilon_t
\end{aligned}$$

where the λECT is the error correction term.

The granger causality was lastly performed to examine the existence of causal effect between the candidate factors. Hence, the F-test and the P value were used to assess if the factors are significantly affecting each other. Nevertheless, this depends on the causality direction, whether it is a one-way causality, a bidirectional relation, or a neutral relationship in spite of the strong association. Therefore, we take into account the following effect-relationship:

$$\begin{aligned}
\text{ENS}_t &= c_1 + \sum_{i=1}^2 \beta_1 \text{ENS}_{t-i} + \sum_{i=1}^2 \beta_2 \text{IMP}_{t-i} + \sum_{i=1}^2 \beta_3 \text{RL}_{t-i} + \sum_{i=1}^2 \beta_4 \text{RQ}_{t-i} + \sum_{i=1}^2 \beta_5 \text{GE}_{t-i} + \sum_{i=1}^2 \beta_6 \text{TIVN}_{t-i} + \varepsilon \\
\text{IMP}_t &= c_1 + \sum_{i=1}^2 \beta_1 \text{IMP}_{t-i} + \sum_{i=1}^2 \beta_2 \text{ENS}_{t-i} + \sum_{i=1}^2 \beta_3 \text{RL}_{t-i} + \sum_{i=1}^2 \beta_4 \text{RQ}_{t-i} + \sum_{i=1}^2 \beta_5 \text{GE}_{t-i} + \sum_{i=1}^2 \beta_6 \text{TIVN}_{t-i} + \varepsilon \\
\text{RL}_t &= c_1 + \sum_{i=1}^2 \beta_1 \text{RL}_{t-i} + \sum_{i=1}^2 \beta_2 \text{IMP}_{t-i} + \sum_{i=1}^2 \beta_3 \text{ENS}_{t-i} + \sum_{i=1}^2 \beta_4 \text{RQ}_{t-i} + \sum_{i=1}^2 \beta_5 \text{GE}_{t-i} + \sum_{i=1}^2 \beta_6 \text{TIVN}_{t-i} + \varepsilon \\
\text{RQ}_t &= c_1 + \sum_{i=1}^2 \beta_1 \text{RQ}_{t-i} + \sum_{i=1}^2 \beta_2 \text{RL}_{t-i} + \sum_{i=1}^2 \beta_3 \text{IMP}_{t-i} + \sum_{i=1}^2 \beta_4 \text{ENS}_{t-i} + \sum_{i=1}^2 \beta_5 \text{GE}_{t-i} + \sum_{i=1}^2 \beta_6 \text{TIVN}_{t-i} + \varepsilon \\
\text{GE}_t &= c_1 + \sum_{i=1}^2 \beta_1 \text{GE}_{t-i} + \sum_{i=1}^2 \beta_2 \text{RQ}_{t-i} + \sum_{i=1}^2 \beta_3 \text{RL}_{t-i} + \sum_{i=1}^2 \beta_4 \text{IMP}_{t-i} + \sum_{i=1}^2 \beta_5 \text{ENS}_{t-i} + \sum_{i=1}^2 \beta_6 \text{TIVN}_{t-i} + \varepsilon \\
\text{TIVN}_t &= c_1 + \sum_{i=1}^2 \beta_1 \text{TIVN}_{t-i} + \sum_{i=1}^2 \beta_2 \text{GE}_{t-i} + \sum_{i=1}^2 \beta_3 \text{RQ}_{t-i} + \sum_{i=1}^2 \beta_4 \text{RL}_{t-i} + \sum_{i=1}^2 \beta_5 \text{IMP}_{t-i} + \sum_{i=1}^2 \beta_6 \text{ENS}_{t-i} + \varepsilon \quad (6)
\end{aligned}$$

4. Results

The Augmented Dickey-Fuller test (ADF) is used for this study, it is worth noting that ADF determines the presence of stochastic stationery in the dataset and it is the most renowned Unit root test used by most studies (Morshed & Hossain, 2022; Pula & Elshani, 2018; Wen & Dai, 2020). Interestingly, Vietnam has a mixture of stationary series at level I(0) and at 1st level; I (1). The Rule of law (RL), regulatory quality (RQ), Technological innovation (TIVN) and environmental sustainability (ENS) are stationary at level. Meanwhile, Impartial administration (IMP) and Government effectiveness (GE) became stationary at 1st level, Table no. 2. On the other hand, Singapore's variables are stationary at the first difference, although bureaucratic effectiveness (GE), technological innovation, and regulatory quality (RQ) are stationary at level. Overall, these combinations of series provide strong convincing arguments for the parameters to proceed with an ARDL approach.

Table 2. Unit Root test

Vietnam					
Variable	Dickey-Fuller test				
	Level		At 1 st difference		
	Constant	Trend and constant	Constant	Trend and constants	Integration order
ENS	-1.618*	-2.040	- 4.157***	-4.300**	I(0)
IMP	0.929	-2.827	- 4.419***	-4.494***	I(1)
RL	- 3.532***	-3.521**	- 2.812***	-3.315*	I(0)
RQ	- 2.702***	- 4.537***	- 8.846***	-8.327***	I(0)
GE	-0.367	-2.050	- 4.387***	-4.096**	I(1)
TIVN	4.088***	-2.935	-2.352**	-3.856**	I(0)
Singapore					
Variable	Dickey-Fuller test				
	Level		At 1 st difference		
	Constant	Trend and constant	Constant	Trend and constants	Integration order
ENS	-0.538	-1.601	- 4.196***	-4.239**	I(1)
IMP	0.192	-2.987	- 4.638***	-4.275***	I(1)

RL	0.224	-2.514	--	-4.389***	l(1)
			4.549***		
RQ	-1.566	-4.093**	-	-5.834***	l(0)
			6.150***		
GE	-1.828*	-1.971	-	-6.378***	l(0)
			6.140***		
TIVN	3.439***	-2.206	-	-4.465***	l(0)
			3.006***		

* p<0.01, ** p<0.05, ***p<0.1

Source-Author's Calculation

The correlation matrix tables display a positive association between environmental quality, rule of law, regulatory quality, and government effectiveness within the socialist Vietnamese context with a value of 0.52, 0.72, and 0.077, respectively Table no. 3 On the other hand, impartial administration and innovation displays a negative sign. Comparing this correlation with Singapore, effective bureaucratic systems appear to have the strongest association with environmental quality, whereas the aforementioned factor seems to be the lowest for Vietnam. The outcome of this result transpires that regimes attributive characteristics seldom play a key role in enhancing environmental quality, owing to the fact of both regimes' non-democratic standing point.

Table 3. Correlation results

Vietnam							
	ENS	IMP	RL	RQ	GE	TIVN	
ENS	1						
IMP	-0.5411	1					
RL	0.5271	0.0159	1				
RQ	0.7274	-0.5274	0.3868	1			
GE	0.0776	0.1267	0.2037	0.1619	1		
TIVN	-0.7915	0.7904	-0.4627	-0.7352	-0.0171	1	

Singapore							
	ENS	IMP	RL	RQ	GE	TIVN	
ENS	1						
IMP	-0.2186	1					
RL	0.1825	-0.4879	1				
RQ	0.322	0.4014	0.0201	1			
GE	0.6936	0.1241	0.0081	0.4776	1		
TIVN	0.1977	0.4739	-0.3212	0.7918	0.5792	1	

Source-Author's Calculations

The result also indicates a unique cointegration among the selected variables. accordingly, environmental sustainability is normalized and the remained variables can be treated as a long-run forcing for the explanation of environmental quality. It can be seen from the F-statistics table no 4, all the variables are cointegrated and fail under the upper bound. likewise, we estimate the model's diagnostic. The diagnostic results can be found in table no 5.

Table 4. Bound test estimates

Vietnam			Singapore	
Test statistics	Value		Test statistics	Value
F statistics	5.867 is		F statistics	6.678
Significance level (Critical)				
Significance	I (0) Bound	I (1) Bound	I (0) Bound	I (1) Bound
10	2.26	3.35	2.26	3.35
Source-Author's Calculations				

Further, we estimated the diagnostic of the model, all the residual shows no autocorrelation, and they are regularly distributed. Moreover, the model projects no issues of heteroskedasticity, while the outcome of the Ramsey test demonstrates that the current model does not have any misspecification errors, hence, the ARDL bounds test produces unbiased and consistent estimates. Finally, the stability of the parameters was tested, as a result, it can be drawn from the CUSUM and CUSUMQ graphs that all the statistics are in the critical bounds, meaning the coefficients of the model are stable, observe table no. 5 and figure 2,3.

Table 5. Diagnostic estimates of both models

	Test	(p-value)	Results
Vietnam	Durbin-Watson d-statistic	3.3504	No autocorrelation
	Jarque-Bera test	0.5343	Estimated residuals are normal
	White's test	0.3918	The model is Homoskedastic
	Breusch-Pagan / Cook-Weisberg	0.8244	
	Ramsey RESET Test	0.6123	The model has no misspecification
	Breusch-Godfrey Serial Correlation LM Test:	0.2097	No serial correlation exists
	Test	(p-value)	Results
Singapore	Durbin-Watson d-statistic	3.3594	No autocorrelation
	Jarque-Bera test	0.7318	Estimated residuals are normal
	White's test	0.3799	The model is Homoskedastic
	Breusch-Pagan / Cook-Weisberg	0.9896	
	Ramsey RESET Test	0.1182	The model has no misspecification
	Breusch-Godfrey Serial Correlation LM Test:	0.8816	No serial correlation exists
Source-Author's Calculations			

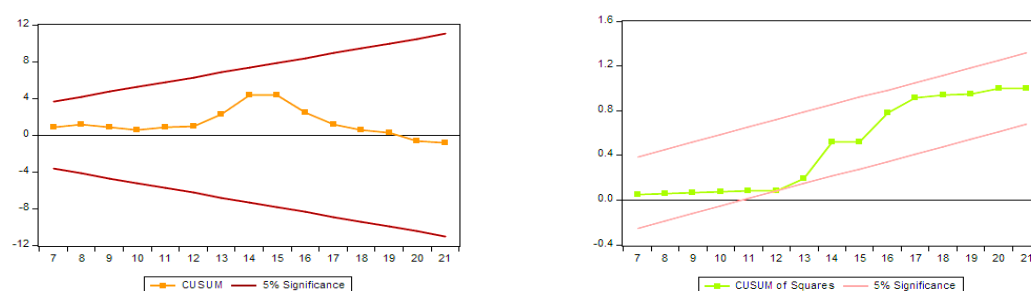


Figure 1. Cusum and Cusum Square for Vietnam

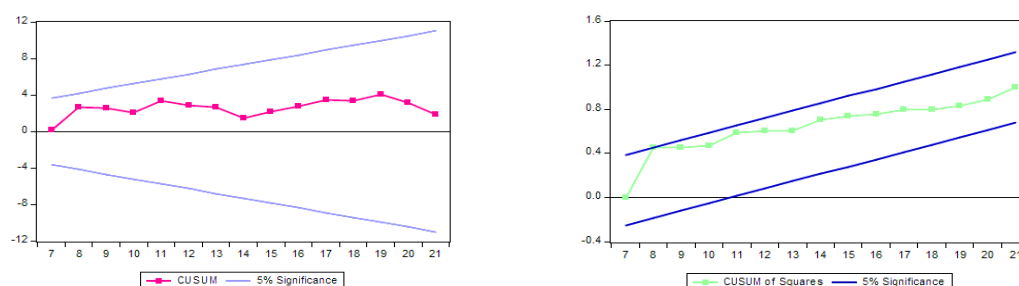


Figure 2. Cusum and Cusum Square for Singapore

The ARDL estimation for both countries can be seen in Table no. 6, Table no. 7, The short-run and long run estimations appear to differ for both countries, for instance, impartial administration (IMP) at the national level shows a positive association in the short-run for both countries, $0.076 p < 0.01$ and $0.012 p < 0.05$ respectively. Nevertheless, this perfectly corresponding association lasts only in the short run for Vietnam. This sudden transformation could have been expected, considering Vietnam's late economic openness and other social aspects of life restrictions (Compared with Singapore, Vietnam adopted a state market-oriented, only, recently, which explains the country's rapid development and further attraction of foreign markets). In addition, further administration (Private or Public) interferences in the public environment could undermine the mutual partnership between the administration and the government. Alternatively, a different explanation could be provided from an ineffective facet, in which, administrative bodies' engagement toward a more sustainable environment has been impeded, perhaps, by external factors (corruption, unfavorable environmental policies, lack of collective participation, favoring economic profits over environmental issues), and reasonably, the latter seems more plausible.

Noticeably, an effective bureaucratic system increases environmental quality in the short run for both countries $0.076 p < 0.01$, $0.007 p < 0.05$. Which translates; an increase of 1% in effectiveness among public officials boosts sustainability at 95% in the Vietnamese context, meanwhile it increases by 53% for Singapore. These findings are supported by the long-run estimates $0.250 p < 0.1$ for Singapore, although a negative elasticity can be discerned for Vietnam $-0.17 p < 0.01$ (Observe both countries coefficient). Recalling, Vietnam's emphasis on strong restrictions toward fundamental rights and macroeconomic factors, which in the worst case, embodied as an ineffective government, in the sense of failing to produce a collective engagement toward the environment. Compared with Vietnam, all the variables are significant for Singapore.

Table 6. ARDL estimates for Vietnam; Dependent variable Environmental sustainability

VIETNAM						
Optimal lags: (2,2,2,2,1,2)						
Short run relationship						
	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
$\Delta(\text{IMP})\ t$	7.44753	2.214104	3.31	0.076*	-2.078991	16.97405
$\Delta(\text{IMP})\ t-1$	13.09024	3.528523	3.71	0.066*	-2.091765	28.27225
$\Delta(\text{RL})t-1$	-0.0013352	0.0828228	-0.02	0.989	-0.357693	0.3550227

$\Delta(\text{RL})t-1$	0.2490529	0.1211267	2.06	0.176	-0.2721131	0.7702189
$\Delta(\text{RQ}) t$	-0.0013352	0.0828228	-0.02	0.989	-0.357693	0.3550227
$\Delta(\text{RQ}) t-1$	0.2490529	0.1211267	2.06	0.176	-0.2721131	0.7702189
$\Delta(\text{GE})$	0.9470064	0.2818846	3.36	0.078*	-0.2658451	2.159858
$\Delta \ln(\text{INVIN})T$	-0.1690391	0.2196779	-0.77	0.522	-1.114237	0.7761588
$\Delta \ln(\text{INVIN}) t-1$	-0.6895188	0.3234377	-2.13	0.167	-2.081159	0.7021211
$\text{Ecm} (-1)$	-4.991728	1.811627	-2.76	0.110	-12.78653	2.803073

Long Run Estimates

Variables	Coefficient	Std. Error	t-Statistic	Prob.	[95% Conf. Interval]	
(IMP)	-0.2597011	0.2463651	-1.05	0.402	-1.319724	.8003222
(RL)	0.1995538	0.0162665	12.27	0.007***	.1295646	.2695431
(RQ)	0.2713976	0.0415055	6.54	0.023**	.0928139	.4499813
(GE)	-0.1787914	0.0203297	-8.79	0.013**	-.2662629	-.0913199
$\ln(\text{TIVN})$	-0.0609309	0.013631	-4.47	0.047**	-.1195803	-.0022815
_cons	2.085394	0.5271841	3.96	0.058*	-.1828956	4.353684

* p<0.01, ** p<0.05, ***p<0.1

Note that in the ARDL lags, the first lag (2) is for the dependent variable (ENS)

Source: Author's findings

Additionally, the long-run estimation reveals several prominent findings, according to Singapore's results; as technological innovation, and greater favorable regulation refined, the quality of the national environment improves alongside those variables. On the other side, if the rule of law (RL) improves (Vietnam) public values improves simultaneously Table no. 6, then, the tendency of creating a sustainable environment led by governmental efforts based on a greater adherence to the rule of law will increase public officials' credibility of value creation, on the other hand, a deteriorating rule of law (notice the negative value for Singapore) Table no. 7; affects both the environment and citizens, by bearing the responsibility of a fractured system. Another explanation might be, perhaps, stricter protection of the environment through national laws would reduce foreign companies' attraction, subsequently, affect the host country's foreign direct inflows (FDI), therefore tighter laws could impede Singapore's environmental sustainability in the long run, through an unprecedented macroeconomic dimension. Similarly, the positive threshold of achieving greater sustainability in the national territory, led by governmental incentives is uncommon in the Vietnamese context according to its negative (-0.17) value.

Table 7. ARDL estimates for Singapore, Dependent variable Environmental sustainability

Singapore						
Optimal lags: (2,2,2,2,2,2)						
Short run relationship						
	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
$\Delta(\text{IMP}) t$	21.7479	0.4012416	54.20	0.012**	16.64964	26.84616
$\Delta(\text{IMP}) t-1$	11.14372	0.2270015	49.09	0.013**	8.259389	14.02804
$\Delta(\text{RL})t-1$	0.4910717	0.0150468	32.64	0.020**	0.2998844	0.6822589
$\Delta(\text{RL})t-1$	-0.1793619	0.0050395	-35.59	0.018**	-0.2433952	-0.1153286
$\Delta(\text{RQ}) t$	0.3553445	0.0070716	50.25	0.013**	0.2654912	0.4451978

$\Delta(\mathbf{RQ})\ t-1$	0.2233212	0.0030063	74.29	0.009***	0.1851229	0.2615194
$\Delta(\mathbf{GE})t$	0.5349998	0.0062327	85.84	0.007**	0.4558054	0.6141941
$\Delta(\mathbf{GE})\ t-1$	0.0314902	0.0058693	5.37	0.117	-0.0430861	0.1060666
$\Delta\ln(\mathbf{TIVN})T$	-0.6337894	0.0082869	-76.48	0.008***	-0.7390842	-0.5284946
$\Delta\ln(\mathbf{TIVN})\ t-1$	-1.606035	0.0157271	-102.12	0.006***	-1.805867	-1.406204
Ecm (− 1)	-1.775159	.0342853	-51.78	0.012	-2.210795	-1.339524

Long Run Estimates

Variables	Coefficient	Std. Error	t-Statistic	Prob.	[95% Conf. Interval]	
(IMP)	-24.54189	0.1688933	-145.31	0.004***	-26.68788	-22.39589
(RL)	-0.5849351	0.0038727	-151.04	0.003***	-0.6341425	-0.5357277
(RQ)	0.1848949	0.0081828	22.60	0.028**	0.0809222	0.2888675
(GE)	0.2507237	0.001129	222.07	0.003***	0.2363778	0.2650696
ln(TIVN)	-0.067511	0.0063894	-10.57	0.060*	-0.1486955	0.0136735
_cons	39.43943	0.5979719	65.96	0.010***	31.84147	47.03738

* p<0.01, ** p<0.05, ***p<0.1

Note that in the ARDL lags, the first lag (2) is for the dependent variable (ENS)

Source: Author's findings

Similarly, technological innovation (TIVN) displays a negative value for Vietnam (-0.060), therefore, a decrease in innovation, indeed, impacts negatively environmental quality, Table no. 6. This can be explained in a more formal way, considering the fact of Vietnam's growing economy in comparison with Singapore, hence, according to this process of a so-called economic boom period, we, therefore, assume, because of the country's still technological immaturity and its slow advancement process toward higher innovative measures, will, in turn, have a long-run negative relationship, unless, Vietnam attained a threshold where the county matches sustainability agenda with their innovative measures.

Within the granger causality estimates Table no. 8, we aimed to explore if indeed either of the selected factors considerably affects each other. Table 8 shows a bidirectional causality between impartial administration and a sustainable environment. Thus, in order to reach a sustainable environment, taking into account administration impartiality by eradicating administrative biases within the environmental context is perhaps a prerequisite step. Meanwhile, Singapore fails to project such as effect. Explaining the country's already low corruption among public officials, interestingly the following noteworthy effect can be perceived in developed and advanced societies in which factors such as state's characteristics becomes unworthy as time elapses, particularly, in providing an explanation for the socio-economic or environmental issues.

One reason for such a case, is probably the country in question has already reached a certain threshold of development, subsequently, scarcely, contributing to the overall aimed sector. On the other hand, the effect of regulatory quality on enhancing environmental performance transcends the singular impact and produces two-way causality for Singapore Table no. 8, where the formulation of friendlier environmental policies spillovers the states for higher environmental improvement, meanwhile the bidirectional effect of environmental sustainability on governmental regulatory can be viewed for Vietnam, implying the promotion of sustainable environment generates long-standing sustainability by implementing favorable roots in legislators formulation, but only this is possible if the state has achieved certain environmental performance. Similarly, both effective bureaucratic systems and technological innovation affect the environment in the Singaporean context. Putting the spotlight on the necessary requirement of reevaluating the government's efficiency in addressing environmental issues, while allocating innovative incentives toward the national environment would facilitate their sustainability mission.

Table 8. Granger Causality estimates for both Vietnam and Singapore

Vietnam Granger causality test					
Variables	Effect	Variables	F-statistics	P value	decision
IMP	→	ENS	6.178	0.036	Bidirectional
ENS	→	IMP	7.984	0.018	causality
RL	→	ENS	6.248	0.040	Unidirectional
ENS	→	RL	0.471	0.799	Non-causality
RQ	→	ENS	2.856	0.244	Non-causality
ENS	→	RQ	8.996	0.004	Unidirectional
GE	→	ENS	9.096	0.003	Unidirectional
ENS	→	GE	2.093	0.351	Non-causality
TIVN	→	ENS	0.205	0.871	Non-causality
ENS	→	TIVN	9.135	0.001	Unidirectional
Singapore Granger Causality test					
Variables	effect	Variables	F-statistics	P value	decision
IMP	→	ENS	3.272	0.195	Non-causality
ENS	→	IMP	2.288	0.318	Non-causality
RL	→	ENS	4.901	0.051	Unidirectional
ENS	→	RL	3.544	0.132	Non-causality
RQ	→	ENS	7.919	0.007	Bidirectional
ENS	→	RQ	9.105	0.001	causality
GE	→	ENS	7.211	0.010	Unidirectional
ENS	→	GE	2.936	0.233	Non-causality
TIVN	→	ENS	9.180	0.000	Unidirectional
ENS	→	TIVN	1.935	0.388	Non-causality
Source-Author's findings					

5. Discussion and Summary

The current paper explores the relationship between state capacity variables and environmental sustainability in the Singaporean and the Vietnamese context. In doing so, we employ an ARDL approach to catch the long-run & short-run association. The finding shows a positive association between impartial administration and environmental sustainability for both countries, nevertheless, this considerable impartiality among public & private administrations remains at this rate only in the short run for Vietnam, whereas starting to shift to insignificance in the long run. Many interpretations and conclusions can be drawn from this point. First, this estimation can be explained by the state's level of corruption, in which, Vietnam has a certain fair share of corruption in public institutions (According to the international transparency index, Vietnam scores 32%); yet, corruption might not have a direct effect on sustainability, although such an effect can impede civil servants' abilities to deliver the appropriate measures that could have addressed environmental issues.

Second from a legal spectrum; courts-for-example, are similarly, affiliated to the administration's scope, and have a decent portion of opinion on the environment. Albeit their independent standing ground, courts, especially tribunals dealing with environmental issues have become too political. Refereeing to the famous argument of (Breyer, 2021) in which, jurists are not different from politicians—and their allegedly impartial judicial belief is a mere disguise of their higher political affiliation, which, transpires, as time elapses, alongside their verdicts in a more form of a conservative or liberal conviction. The accuracy of this reasoning lies on the ground, for

instance—a person's condition is more likely to affect the subjective choice, particularly, when administrative workers perceive available details of the interested person, hence, this undefined social status interferes in their professional judgments, as a result, reinforcing their unspoken biases. Furthermore, claimed economic victims through environmental deterioration, are typically identifiable individuals who lose their employment in the process, and, this human predisposition has prejudiced public policy and environmental law rather than appearing as ecological and environmental perseverance regulations.

However, in a country such as Vietnam, the case of matching public administration impartiality with environmental agenda in terms of establishing a compromise between two variables might take longer. In other words, the long-run relationship would not be able to manifest in a presence of high corruption and poor impartiality (Fredriksson and Svensson, 2003). Although the situation, is justifiable when looking at the state's income position, compared with Singapore, Vietnam is a middle-income country and this could have driven the aforementioned poor performance (Treisman, 2000). Interestingly, the granger causality validates our assumption of a future effect of impartial administration in further directing to a more sustainable environment. Therefore, it is possible to raise the degree of voluntary adherence to environmental legislation by improving the perception of justice in the rulemaking process.

Furthermore, both rules of law and regulatory quality improve environmental performance, and the granger causality provides further validation for our results. The following results are in line with (Khan et al., 2020a; Ali et al., 2019). Certainly, favorable regulations toward the environment counter negative impacts that are coming from the economy which further stimulates higher environmental deterioration. Although, greater emphasis on stricter regulation might retroactively harm the pace of economic growth unless a certain threshold of economic strength has been achieved, in which the government is able to coincide environmental agendas with macroeconomic factors. On one side, further tightening environmental legislation such as imposing high CO₂ taxation, and emphasizing only renewable energy consumption, would reduce potential investors and FDI inflows, such a scenario is possible for Singapore.

Additionally, it is thought that nations that support the rule of law and embraces positive sustainable regulations will incentivize their citizens to create groups with a shared objective of addressing environmental sustainability. This is likely for Singapore, but as a rapidly developing country, it would be hard for Vietnam to reach an impressive environmental performance, while maintaining its economic flows, assumingly, later, after reaching a satisfactory economic development it might eventually become difficult for the state to formulate healthier environmental measures, due to the plausibility of an already ecological depletion.

The variable government effectiveness brings to light the famous assumption that a nation's institutional factors greatly influence its economic performance, and nations with higher-quality institutions are better able to control environmental damage. Singapore shows a positive relationship both in the short run and the long run. Providing us, that, regardless, of the country's regimes whether the country in question leans toward democracy or authoritarian, the effectiveness of bureaucratic is indeed an internal structure embodied within the heart of the civil servants, thus, transforming the general stereotypical trend that constitutes comparative study between democratic and non-democratic countries, as a mere, ineffective metric, when the case involves environmental protection. at the same time, the negative relationship that appears in the Vietnamese context can provide us with a larger explanation of an ineffective government albeit the country's recent economic growth.

On the other hand, investing in technological innovation displayed a negative interconnection with environmental sustainability in the long run. Many authors have shown that technological innovation could not transpire the general trend of sustainable development, through a mechanism led by technological progress (Adebayo, Kirikkaleli, 2021), unless the concept has been applied with a fundamental goal of sustainability attainment (Jaffe et al., 2005). On one side, the granger causality reveals a causality effect between technological innovation and sustainability, providing us with an alternative threshold of believing, that technological progress improves environmental sustainability, however, this is validated for the Singaporean context, whereas, a causality running for sustainability to the technological sector had been detected for Vietnam. This implies, that emphasizing on improving sustainability would have a direct effect on technological innovation, which, in turn, could stimulate the market to propose certain technological products in order to accommodate the high sustainability demand. Overall, technology and nature are interdependent within, whilst, technology is formed to provide means, equipment, and machinery for safeguarding the environment and conserving its resources from climatic changes and damage, in retrospect, the environment offers raw materials required to produce technology. Overall, matching administration bodies with environmental sustainability will offer higher opportunities for the ASEAN countries to achieve rapid sustainability. Although some Asian states would transit faster toward more

environmentally sustainable societies, others, due to their economic boom and immature technological innovation, the question of prioritizing the environment would be unlikely to be on the table.

Finally, the current study has certain limitation; to begin with, we merely focused on two Association of Southeast Asian Nations (ASEAN) namely Singapore and Vietnam, therefore the generalization of this findings toward other ASEAN states should be avoided, with that in mind, upcoming researches could consider incorporating other countries within the regional framework in their studies. Additionally, it will also be an enrichment if future authors could compare Eastern Asian states with ASEAN countries, considering how some potential countries such as South Korea have been growing in the past thirty years at an unprecedented rate; in the context of adopting advanced technological innovation with sustainability deliverance, while competing with China, Japan and Singapore. It will also be interesting if future studies could examine sustainability from an infrastructure threshold. It is also worth noting, the current study only uses ARDL and granger test, therefore future scholars could employ a VAR model with impulse responses and variance decomposition and other models to further analyze future shock while providing robustness for future effect predictions.

Funding: This research received no external funding.

Data Availability Statement: Data availability is not tied to this article as all the data are available online and can be accessed through the mentioned sources in the study.

Conflicts of Interest: The authors declare no conflict of interest.

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Researching the Relationship between Health and Financial Development: Case of Low-Income African Countries

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Abstract: Today, human capital is of vital importance to all countries. However, human capital is more important for underdeveloped and developing countries. In order to be a developed country, there must be a very solid infrastructure, especially in the field of health. Health is accepted as an important element of human capital along with education. For the reason that individuals can both receive education and participate in economic activities by putting their education into practice, only if they are healthy. The aim of this study is to investigate the relationship between financial development and health in low-income countries in Africa. In order to carry out the study, data collected from 11 African countries between the years 2001-2017 was used. The causality research was investigated with the Dumitrescu and Hurlin test, which cares about the cross-section dependence. The variables of the study have cross-section dependence. Also, they are stationary at the first level according to the unit root test. As a result of the causality research, a bidirectional relationship was found between financial development and health variables. With financial development, employment areas expand, and the wage gap between skilled and unskilled labor decreases. On the other hand, it becomes possible for the state to make more health expenditures for the poor. The health levels of individuals are important in order to transform the education they receive into economic output. In this context, a bidirectional relationship is expected between financial development and health. In this study, the analysis was carried out using the data of 11 low-income African countries. As a result of the research, a strong relationship was found between health and financial development, supporting the literature.

Keywords: Life Expectancy; Financial Development; Low-Income African Countries

Citation: Ergun, K.; Öncü, E. (2023) Researching the Relationship between Health and Financial Development: Case of Low-Income African Countries. *Journal Of Economic and Business Issues*, 3(1), 51-57.

1. Introduction

One of the important indicators that determine the quality of life of individuals and societies is health. In this context, health expenditures are one of the concepts that are frequently used in determining the welfare levels of countries. Economic development is expressed as continuous growth in production and per capita income in comparison to the previous year (Todaro and Smith, 2003).

The development of economic process, that is accepted jointly of the foremost vital indicators of financial aid and development, is among the most economic science goals that area unit tried to be achieved in terms of developed and developing countries. The qualitative and quantitative development of labor, which is the basic production factor needed in the first stage, is of great importance for feasible economic development, which is the ultimate aim of every economy. Today, the main target on economic process is on however long-run growth are often achieved, however it are often sustained, and growth policies that increase the quality of living (Silver, 2007).

The qualitative development of the workforce primarily depends on its being healthy and educated. There is a close and mutual causality relationship between a society's health level and economic development. The resources allocated for health are increasing in societies that have brought their economic development to a certain level. Thus, health awareness is formed in individuals. The development of services offered to individuals in the health sector provides economic development (Mazgit, 2002). Many studies have also found a two-way relationship between health

Received: 13/02/2023

Accepted: 21/03/2023

Published: 27/03/2023

services and economic development (Ye and Zhan, 2018; Erdil and Yetkiner, 2009). The two-way relationship is explained as the economy will increase welfare after health services provide people with a higher standard of living; healthy people increase both their productivity and information exchange with the people around them and contribute to the productivity of other production factors.

In recent years, there has been a lot of study and debate over the link between health spending and economic growth. Economists and policymakers agree that there is a favorable relationship between the two. In other words, investing in health can lead to greater long-term economic consequences. One rationale for this association is that health expenditures might act as a buffer between macroeconomic measures such as labor productivity, workforce participation rates, and human capital accumulation. A healthy workforce, for example, is more likely to be productive and less prone to absenteeism, which may contribute to better productivity and economic growth (Aghion et al., 2010). Furthermore, investment in health may lead to advances in education and training, which can further strengthen human capital (Mushkin, 1962). The "health-based growth hypothesis" is one theoretical paradigm that attempts to explain the positive benefits of health-care investment on economic growth (Admane and Slimani, 2021). According to this idea, health expenditures, like investments in physical infrastructure or research and development, constitute a type of productive capital. Health expenditures may boost a society's total productivity and contribute to long-term economic growth by increasing the health of its people. Health expenditures should not be considered as an expense in the budget but as an investment expenditure. Although health expenditures are considered an expense in the short term, they should be considered as an investment expenditure in the long term (Raghupathi and Raghupathi, 2020). The return of education and similar services are given to healthy individuals will be higher, and it is expected that people will benefit more effectively with increasing life expectancy. Theoretical discussions within the literature on specialize in the role of human capital within the process of economic development. Considering that the 2 foundations of human capital measure education and health, investments in these 2 fields measure expected to extend the human capital levels of people.

It is possible to define the concept of human capital as a qualified workforce (Mincer, 1984). Especially today, the theory of human capital has become very important both in terms of the development of nations and regional development and has attracted the attention of economists. Many studies and analyses have shown that investments in people accelerate the development process. As investments in human capital increase, so does individual income and the number of goods and services produced. Socio-economic development takes place depending on human capital investments as well as physical capital investments. Because it is the human capital that will provide technical development and marginal benefit by using resources effectively. In order to accelerate the economic development process, it is necessary to increase human capital investments that increase the quality of labor. In this context, it is thought that all kinds of investments made for people will contribute to economic development. Thus, the health capital stock of developing humans will constitute an important part of human capital. As a result, health facilities and medical investments that expand the health capital stock will play a significant role in the country's economic success by assuring the continuous improvement of human capital (Cooray, 2013).

In order to catch up with each other in terms of welfare levels, countries need to be similar in terms of human and physical capital. The relationship is expected to be more effective in low-income countries than in others (Souzakis and Cravo, 2008).

It is argued that money mediation through the banking industry plays a very important role in allocating savings, up productivity, technical amendment, and therefore the rate of economic development (Schumpeter, 1911). The event of monetary markets and establishments may be an essential and integral a part of the expansion method, and therefore the level of monetary development of nations may be a sensible predictor of future rates of economic development, capital accumulation, and technological amendment (Levine, 1997).

The connection among monetary improvement and financial growth can be defined through 4 one-of-a-kind perspectives. The primary view argues that monetary boom leads to economic development (Kar and Pentecost, 2000). It is believed that as a result of the new demand, countries will also develop financially. First, economic growth emerges, and the funding requirements of economic growth lead to the development of the financial system and financial markets. According to the second approach, financial development supports economic growth (Ahmed and Ansari, 1998). This relationship is described as a "supply leading" relationship. The fact that financial institutions are developed ensures that savings are gained as an input to the economy. Thus, economic growth occurs with the support of the financial system. Third approach clarifies; there is a bidirectional causality relationship between financial progress and economic growth (Calderon and Liu, 2003). The remaining view, not like previous perspectives, argues that there is a negative between economic development and financial progress (Ahmed, 2013).

According to the findings of studies in the fields of economics and finance, the economic development of countries is strongly dependent on their financial development. However, a financial structure with a high level of development reduces transaction and monitoring costs and increases the efficiency of intermediary activities. This has a positive effect on economic performance. Economic growth, on the other hand, will bring improvements in meeting basic human needs such as income growth, education, and health.

The financing of health services is carried out in two different ways, the direct financing method and the indirect financing method (Uga and Santos, 2007). The direct financing method means that those who request health services pay the price of the service they receive directly. The service produced by the public and private sectors is purchased by the consumer, provided that the price is paid. In the indirect financing method, there is a third-party payer between the service provider and the requestor. In this financing method, the health system is financed by general taxes, special taxes, and consumer contributions. One of the most important problems experienced in health services is the problem of financing. This problem arises in both developed and developing countries, but its economic reflections are different in each country. Especially in low-income countries, there are deficiencies in the financing of health services (Coovodia et al., 2009). In this context, the relationship between financial development and health will be investigated in low-income African countries.

2. Materials and Methods

The study used data from 11 African countries that can be accessed to investigate the relationship between health and financial development. The available data of the countries used in the study is shown in Table 1. Data acquired from 11 African countries between 2001 and 2017 were utilized to carry out the study. As for the health variable, the life expectancy index was taken from the World Bank data pool. For financial development, the average of financial development indicators was taken from the financial structure data pool made by the World Bank.

Table 1. Countries

Burundi	Guinea
Burkina Faso	Mali
Congo, Dem. Rep.	Uganda
Chad	Togo
Ethiopia	Sudan
Gambia	

In the research part of the study, the cross-section dependency test, unit root tests, and causality tests were applied, respectively.

Considering the cross section dependency between the series has a considerable impact on the outcomes (Breusch and Pagan, 1980; Pesaran, 2004). Before commencing the analysis, it is required to verify for the presence of cross section dependency within the variables. When deciding which unit root and relationship tests to run, cross section dependence should be considered. Otherwise, the analysis may produce skewed findings. When the time dimension of the panel is bigger than the cross section dimension, the existence of cross-sectional dependency is determined using the Breusch-Pagan (1980) Lagrange Multiplier (LM) test; when both are of comparable size, they can be explored with the Pesaran test (2004). The mentioned tests are given below.

$$LM = T \sum_{i=j}^{N-1} \sum_{j=i+1}^N \hat{p}_{ij}^2 \square X_{N(N-1)/2}^2 \quad (1)$$

$$CD_{lm} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=j}^{N-1} \sum_{j=i+1}^N (T\hat{p}_{ij}^2 - 1) \square N(0,1) \quad (2)$$

First found unit root tests are supported the notion that the move phase elements that body the panel are freelance which all crosswise gadgets are equally suffering from a surprise to 1 of the gadgets that body the panel. But, it is a further sensible technique if a surprise to one of the pass segment units that frame the panel impacts the other elements at definitely different degrees. With a purpose to remove this deficiency, the contemporary unit root tests are evolved that examine the

stationarity by using thinking about the dependence between go phase elements. The second era unit root test Pesaran CADF that cares concerning the move section dependency is given below.

$$t_1(N, T) = \frac{\Delta Y_i' \bar{M}_w Y_{i-1}}{\hat{\sigma}(Y_{i-1}' \bar{M}_w Y_{i-1})^{1/2}} \quad (3)$$

The mean t statistical value found per cross-section is called CIPS. The mathematical model of CIPS is given below.

$$\bar{t} = N^{-1} \sum_{i=1}^N t_i(N, T) \quad (4)$$

The Dumitrescu and Hurlin test can take into account both the cross-sectional dependence and heterogeneity between the countries that make up the panel. Another feature of the Dumitrescu and Hurlin test is that it can be used both in the presence and absence of a cointegrated relationship (Dumitrescu and Hurlin, 2012).

$$W_{N,T}^{Hnc} = \frac{1}{N} \sum_{i=1}^N W_{i,T} \quad (5)$$

3. Results

To identify which unit root test will be used, the cross-section dependency of priorities must be examined. As a result, the Breusch Pagan and Pesaran Cross-Section De-pendence tests were carried out. It can be seen in Table 2.

Table 2. Breusch Pagan and Pesaran Cross Section Dependency

Variables	Breusch Pagan Statistics	Breusch Pagan Probability	Pesaran Statistics	Pesaran Probability
FD	594.0611	0.000*	16.5392	0.000*
Health	923.4887	0.000*	30.3882	0.000*

Note: *, **, *** show significance at the level of 1%, 5%, 10%, respectively.

According to the results of Breusch Pagan and Pesaran Cross-sectional dependency tests, it is seen that all variables have cross-section dependence. Because of this situation, the unit root test to be applied to these variables should also take into account the cross-sectional dependence. The results of the Pesaran CADF Unit Root Test, which takes into account the cross-sectional dependence, can be seen in Table 3.

Table 3. Pesaran CADF Unit Root Test

Variables	Model Statistics (CIPS)
FD	-2.027
Health	-0.261
D(FD)	-3.332*
D(Health)	--2.224***

Note: *, **, *** show significance at the level of 1%, 5%, 10%, respectively.

The first difference between the series is represented by D(FD), which represents the first difference between the series. In the unit root test results, it is seen that the variables are not stationary at the first level, but become stationary together at the first differences level.

Table 4. Var Lag Selection

	FPE	AIC	SC	HQ
0	0.200271	4.067668	4.120094	4.088880
1	1.36e-05	-5.528.285	-5.371.005	-5.464.650
2	8.85e-07*	-8.262190*	-8.000056*	-8.156130*
3	9.48e-07	-8.194.123	-7.827.136	-8.045.640
4	9.05e-07	-8.241.127	-7.769.287	-8.050.220
5	9.23e-07	-8.221.979	-7.645.286	-7.988.648
6	9.67e-07	-8.176.160	-7.494.613	-7.900.405
7	9.29e-07	-8.218.117	-7.431.717	-7.899.938
8	9.60e-07	-8.187.716	-7.296.463	-7.827.113

Note: *, **, *** show significance at the level of 1%, 5%, 10%, respectively

As a result of the var model lag length estimation analysis, it was determined that the appropriate lag length should be 2.

Table 5. Pedroni Cointegration

	Statistic	Probability
Panel PP	-1.578006	0.0573**
Panel ADF	-2.181715	0.0146**
Group PP	-1.402001	0.0805***
Group ADF	-2.265914	0.0117**

Note: *, **, *** show significance at the level of 1%, 5%, 10%, respectively

Consistent with the Pedroni cointegration take a look at, the H0 hypothesis (there's no cointegration) is rejected. In step with the results of the assessments that make up both panel and organization information inside the Pedroni cointegration check, a cointegration relationship is observed between the variables.

Table 6: Dumitrescu and Hurlin Causality Test

Causality Direction	W-Stat	Z-Bar Stat	Probability
FD->Health	12.7977	10.5822	0.0000*
Health->FD	6.88073	4.50172	0.0000*

Note: *, **, *** show significance at the level of 1%, 5%, 10%, respectively.

The Dumitrescu and Hurlin causality test shows that a bidirectional relationship was found between financial development and health variables. In other words, the change in financial development causes the change in the health variable, and the change in the health variable causes the change in the financial development.

4. Discussion

Financing health services has been a very difficult and important issue in every country. Healthcare financing has three important and interrelated pillars. The first of these is raising sufficient funds to finance health services. The second is the pooling of funds based on risk-sharing between payers and the third is the appropriate use of funds to purchase or provide necessary health care. Especially in low-income countries, health services cannot be provided by the public due to

priorities. Individuals have to meet their health needs themselves. Individuals in low-income countries also have limited resources to spend on their health needs. The link between impoverishment and health issues and shorter lifetime is understood. Impoverishment adversely affects health in several aspects, particularly deficiency disease and unsuitable housing conditions. For example, a study was conducted on the affordability of public hospitals' emergency delivery and newborn care costs between October 2007 and January 2008 in Mahojango province of the Boeny region in the northwest of Madagascar. While newborns cost an average of 59 dollars, drugs and medical devices accounted for 40% of that cost. The results show that the amounts paid for the health services received far exceed the paying capacity of middle and low-income households (Honda et al., 2011). A similar study was conducted on health expenditures in Burkina Faso. Families in Burkina Faso consist of an average of 8 people. The average monthly expenditure of a family is 23 dollars, and 43% of this expenditure is food. At the end of the study, the ratio of families that allocated 40% of non-food expenditures to health expenditures was found to be 8.66% (Su et al., 2006).

The health impact of poverty becomes more evident in economic crises. The economic crisis and the recession negatively affect public health not only due to health-specific conditions such as reductions in health expenditures but also for reasons related to social determinants of health, such as increased unemployment.

Nowhere in the world is there a society in which income and wealth are perfectly evenly distributed among individuals. However, the existence of people who are too poor to meet their needs, even at the lowest level, draws attention as a source of unrest in society. The financial development of countries both provides economic growth and increases the health quality of individuals. In this study, as a supporting finding, a bidirectional relationship was found between health and financial development.

5. Conclusions

Technological developments that accelerated in today and the increases in per capita income deeply affected the financial services sector as well as many economic sectors and paved the way for modern changes in both private sector organizations and the regulatory institutions of the state. With the effect of globalization, national financial systems are connected with developed transaction networks and integrated around the world.

The link between financial development and health development is a hot issue among politicians, scholars, and practitioners worldwide. Financial development is a measure of financial systems' success in providing access to financial services and goods, whereas health development is the process of increasing health outcomes and healthcare services. In many aspects, financial development is projected to boost the development of the health sector. The purpose of this research is to look at the link between financial development and health development.

The development and effective use of human capital are very important, especially for underdeveloped and developing countries. For this, an educated and healthy society is needed. On the other hand, the degree of satisfaction of individuals in terms of financial opportunities and social relations is also an indispensable condition. The success of societies in their economic development processes depends on the development of their human capital as well as their physical capital. In this sense, it is not possible for countries that do not invest in human and social capital to show a high performance in the economic field.

Especially in developing low-income countries, the necessary investment in human capital cannot be made. Failure to make the necessary investments is a problem that affects the welfare of the country and individuals. Many studies in the literature have examined the relationship between financial development and human capital (Outreville, 1999; Monaceli et al., 2011). In these studies, it is seen that human capital is strongly related to financial development. Similar findings were obtained in this study on low-income countries. Several studies in the literature have found a link between economic growth and health (Mehrra and Musai, 2011; Nasiru and Usman, 2012). Unfortunately, financial development has not been included as a variable in this context. Financial development affects the health level of individuals living in low-income countries. At the same time, the financial development rate of economically growing countries is also affected by the health quality of individuals. To summarize, there is a bidirectional relationship between financial development and the health level of individuals. The study's findings are consistent with those found in earlier investigations (Mehrra and Musai, 2011; Nasiru and Usman, 2012). In the future, studies in this topic will be able to draw various conclusions by investigating countries of varying economic sizes.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, EO and KE; methodology, EO and KE; software, EO and KE; validation,

EO and KE; writing—review and editing, EO and KE”; All authors have read and agreed to the published version of the manuscript.

Funding: “This research received no external funding”

Conflicts of Interest: “The authors declare no conflict of interest.”

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