



LEVERAGE AI AND MACHINE LEARNING TO MODEL THE IMPACT OF ETHICAL LEADERSHIP ON FIRM PERFORMANCE

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ARTICLE INFO Keywords: Artificial intelligence, Machine Learning, Leadership, Firm, OCB Corresponding Author: Muhammad Tanveer Ahmad khan, Department of Computer Science and IT, Superior University 10 KM Sargodha Rd, Sargodha	ABSTRACT Examining the link between EL and FP is the goal of this study. The study also explores how OCB mediates the link between EL and FP. The research also explores whether OJ moderate the link between EL and FP. In this study a sample of 100 Toyota company respondents are used. The findings of reliability indicate that the Cronbach alpha of the instrument used in this study is 0.93 which shows that the instrument used in this study is reliable. The findings show that EL is positively and significantly related to OCB. In addition, EL and FP has a positive association which is significant. The result further indicates that OCB has a significant positive impact on FP. Moreover, OJ has an insignificant negative impact on FP. Further, the interaction between EL and OJ show that OJ does not moderates the link between EL and FP. Hence, the mediation between EL and FP is justified; concluding that our hypothesis “The link between EL and FP is mediated by OCB” is accepted. A test was conducted and found partial mediation in the model. The link between EL and FP was discovered to be partially mediated by OCB.
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INTRODUCTION

In today's complex and rapidly evolving business landscape, the role of ethical leadership in driving organizational success has garnered significant attention [9]. Ethical leadership, characterized by integrity, transparency, and a strong moral compass, is increasingly recognized as a critical factor in shaping corporate culture, employee behavior, and overall firm performance. As businesses strive to navigate ethical dilemmas, build trust with stakeholders, and enhance sustainability, understanding the impact of ethical leadership on firm outcomes becomes paramount [1]. Advancements in artificial intelligence (AI) and machine learning have revolutionized the way businesses analyze data, derive insights, and make informed decisions [8]. By leveraging these cutting-edge technologies, organizations can delve deeper into the intricate relationship between ethical leadership and firm performance. Through sophisticated modeling techniques and data-driven approaches, AI and machine learning offer a powerful toolkit to explore the nuances of ethical leadership and its implications for organizational success [2, 22]. The significance of this study lies in its innovative approach to examining the influence of ethical leadership on firm performance through the lens of AI and machine learning [7, 23]. While previous research has highlighted the importance of ethical leadership in shaping organizational culture and fostering stakeholder trust, the application of advanced computational methodologies provides a unique opportunity to uncover hidden patterns, predict future trends, and enhance decision-making in the realm of leadership ethics [3-6]. By harnessing the capabilities of AI and machine learning algorithms, this study aims to not only quantify the impact of ethical leadership practices on key performance metrics [5] but also to identify underlying factors, causal relationships, and potential moderating variables that contribute to this relationship. The integration of data analytics and predictive modeling techniques offers a novel perspective on how ethical leadership behaviors can drive organizational outcomes, paving the way for more informed and strategic leadership practices [4, 24]. The primary objective of this research is to leverage AI and machine learning tools to model the impact of ethical leadership on firm performance. Specifically, the study aims to:

- Develop a predictive model that quantifies the relationship between ethical leadership behaviors and key performance indicators within organizations.
- Identify key drivers and moderators that influence the strength of the association between ethical leadership and firm outcomes.
- Explore the potential role of contextual factors, such as industry dynamics, organizational size, and cultural norms, in shaping the impact of ethical leadership on performance.

Provide actionable insights and recommendations for leaders and decision-makers to enhance ethical practices and drive sustainable business growth. This research project represents a pioneering effort to leverage AI and machine learning technologies in the study of ethical leadership and firm performance. By harnessing the power of data analytics, predictive modeling, and natural language processing, the study seeks to illuminate the complex interplay between ethical leadership practices and organizational success. Through a multidimensional analysis of leadership behaviors, performance outcomes, and contextual influences, this research aims to provide valuable insights for leaders, managers, and stakeholders seeking to foster a culture of ethics and excellence within their organizations.

METHODOLOGY

The research technique for the present study is included, and it details how the research topic will be investigated. The study paradigm, kind, and nature are all stated along with the research design. Also discussed were the demographic, sample, piloting of the data, data collecting, technique, and instruments.

Design of the Study

Research Paradigm: A paradigm is referred to be "shared understandings of reality" by Rossman and Rollis (2017). It is a view of an assumption and how the current circumstance is dominant. They further categorize 4 different paradigms, although positivism, which is linked to quantitative research and analyzes related hypotheses to learn about public perception, is the key paradigm relevant to the current study. As it is appropriate for this investigation, the positivistic quantitative paradigm is used. Before deciding on a research technique to test the hypothesis, one needs develop a hypothesis (or hypotheses) based on an existing theory.

The question of whether this relationship survived under more common conditions is answered using a deductive method. Hypotheses that can be deduced from the theory's premises can be used to describe the deductive process. Theoretical framework is used to generate and test the hypotheses that were developed for this study. In order to study the association between EL and firm performance, the present research utilize a positivistic quantitative paradigm.

Research Method: The optimal methodology for doing research has been the subject of extensive debate, but there is no one strategy that works especially well for dealing with research philosophy. Quantitative and qualitative techniques are two distinct schools of thinking on research systems. In this study, a quantitative research methodology is applied. In comparison to other methods, this strategy will aid the researcher in information collection more quickly and with a larger sample size.

Type of Study

This study's goal is to investigate how EL affects firm performance; as a result, causal research is employed in this examination.

Unit of Analysis

By and large unit of investigation is the most significant trademark in any examination study which is being broke down. In research study, unit of examination can go from an individual to various gatherings, associations, societies and so on. In order to explore factors affecting employee turnover intentions, the researcher approach employees of Toyota Company.

Population and Sampling

Population of the Study

A survey research design underlies the study. All employees of Toyota Company make up the study's population. Prior to serving a letter outlining all the logistical and ethical considerations of this study, all volunteers are first contacted through email. The researcher then meets the respondents alone after the meeting to get the primary data. A sample of 100 respondents is used in this study.

Sampling Techniques

Sampling is a typical data collection approach since it is challenging to collect data from the whole population due to resource constraints and other time constraints. In order to get the data from the selected samples, a convenience sampling strategy is employed, along with a self-administered approach.

Sample Characteristics

Sample characteristic's details are gender, age, marital status, education, and experience.

Data Collection Procedure

Data is gathered via a questionnaire. This study uses a cross sectional research design. Data is gathered from the Toyota Company, and the questionnaire is adapted from earlier work. The questionnaire is distributed personally to collect data. The questionnaire comprise of 41 items, measured on a Likert scale i.e. 1-strongly disagree, 2-disagree, 3-neutral, 4-agree, 5-strongly agree.

Data Analysis Tools

To test the hypothesis the researcher uses SPSS software version 20. It is verified in SPSS for calculate result findings to assess the statistical outcomes of the data gathered from respondents. Regression, correlation, and other tests that are relevant to the present study were applied to the data to determine the required results for the current study's goal. Scales' internal consistency is examined for reliability using Cronbach's alpha. To determine how closely and

significantly different variables are related to one another, or if there is a relationship or not, the correlation test was used. To calculate and thoroughly describe the results, a correlation matrix together with descriptive information was employed. In order to find the basis of the hypothesis, regression analysis is used.

Instrumentation

Since experiments, surveys, and statistics are frequently used in quantitative data, according to [10], the researcher employs a Likert scale for this study. By using research instruments designed for examining the issues in this study, data is managed. The survey therefore contained items that were rated on a five-point Likert scale: strongly disagree, disagree, neutral, agree, and highly agree.

Reliability of Questionnaire

In the analysis, Cronbach's alpha is used to measure the survey's consistency. A measure of internal consistency, or how closely something's are connected to one another as a whole, is called Cronbach's alpha. It is thought to be a measure of scale reliability. The objects have typically excellent internal consistency if the alpha coefficient is 0.70 or more notable. Each technique for the present study is included, and it details how the research topic will be investigated. The study paradigm, kind, and nature are all stated along with the research design. Also discussed were the demographic, sample, piloting of the data, data collecting, technique, and instruments.

Feature Engineering:

Identify relevant features that may influence the impact of ethical leadership on firm performance. Create new features, transform variables, and encode categorical data for model input.

Model Selection

Choose appropriate machine learning algorithms based on the nature of the data and research objectives. Consider regression models, decision trees, ensemble methods, or neural networks for predictive modeling.

Model Development

Split the data into training and testing sets to train and evaluate the AI models. Implement algorithms to learn patterns and relationships between ethical leadership and firm outcomes. Tune hyperparameters and optimize the models for better performance.

Model Training and Evaluation

Train the AI models on the training data to predict firm performance based on ethical leadership variables. Evaluate model performance using metrics such as accuracy, precision, recall, and F1 score. Validate the models on the testing data to assess generalization and robustness.

Interpretability and Explainability

Use techniques like SHAP (SHapley Additive exPlanations) values or feature importance analysis to interpret model predictions. Provide insights into which ethical leadership behaviors have the most significant impact on firm performance.

Deployment and Application:

- Implement the trained AI models in real-world scenarios to predict the impact of ethical leadership on firm performance.
- Monitor model performance and update as needed to ensure relevance and accuracy.

RESULTS AND DISCUSSION

Examining the link between EL and FP is the goal of this study. The study also explores how OCB mediates the link between EL and FP. The study also explores whether OJ moderate the link between EL and FP. However, primary quantitative data has been used for this purpose. Through the use of SPSS software, descriptive, reliability, correlation, regression, moderation, and mediation analyses were employed to analyze the data. Finally, it offers a chapter summary based on the results of the most recent investigation.

Reliability Analysis

To assess the consistency and stability of measuring instruments, questionnaires, and surveys, a statistical method known as reliability analysis is utilized. It entails determining how closely linked test or measure items are and how well they give consistent findings over time or across many samples. Likely, [11] employed reliability analysis in their study to evaluate the internal consistency of their questionnaire and discovered that it was adequate. Similar to [12-13] reported that a tool for evaluating the quality of life among cancer patients was consistent, reliable, and valid after using reliability analysis to test its consistency. In this study, Cronbach's alpha is also used to assess the scale's reliability; the findings are shown in Table 1. The reliability analysis shows that the instrument employed in this study has a Cronbach alpha of 0.93, indicating that it is a reliable instrument.

Table 1

Results of Cronbach's Alpha

Cronbach's Alpha	N of Items

.939	41
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Variable of Study	No. of Items	Cronbach's alpha
Ethical Leadership	15	.924
OCB	13	.824
OJ	7	.858
FP	6	.735

The value of Cronbach's alpha for firm performance, ethical leadership, and Organizational justice and organizational citizenship behavior is greater than 0.7%. This value shows that variables are reliable and fulfill the requirements of standard reliability. The Cronbach's Alpha value of ethical leadership variable is above 0.7 % at 0.924 and value of Cronbach's Alpha of firm performance variable is at 0.735 which is also higher than 0.7% and the value of Cronbach's Alpha of OCB is at 0.824 which is also higher than 0.7% and Cronbach's alpha of OJ is 0.858. So in this regard, the Reliability results show Cronbach's Alpha values of both 4 variables are reliable and fulfill the requirements of standard reliability.

Table 2 Gender

<i>Frequency of Gender</i>		Frequency	Percent	Valid Percent	Cumulative Percent
	Male	82	82.0	82.8	82.8
	Female	17	17.0	17.2	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

The frequency of the demographic variable gender is shown in Table 2. The data show that there were 82 men who responded. Male replies make up 82.0 percent of the total. Additionally, 17 responders, or 17.0%, were female. Figure 2 shows the graph of demographic gender.

Figure 2

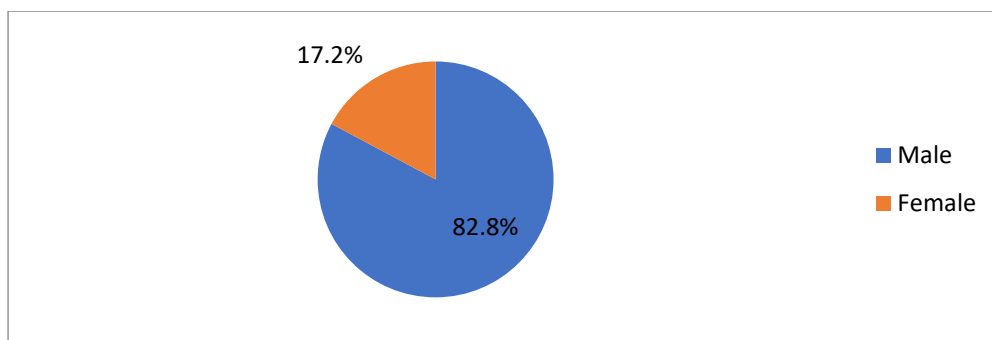


Table 3

Table 3 Age

<i>Frequency of Age</i>		Frequency	Percent	Valid Percent	Cumulative Percent
	18-25	14	14.0	14.0	14.0
	26-35	52	52.0	52.0	66.0
	36-50	20	20.0	20.0	86.0
	Above 50	14	14.0	14.0	100.0
	Total	100	100.0	100.0	

According to Table 3, there are 14 responders, or 14%, in the 18-25 age range. In addition, there are 52 responders, or 52.0 percent, in the 26-35 age range. 20 respondents, or 20 percent, are between the ages of 36 and 50, and 14 respondents, or 14 percent, are above the age of 50 and. Figure 3 shows the graph of Age status.

Figure 3

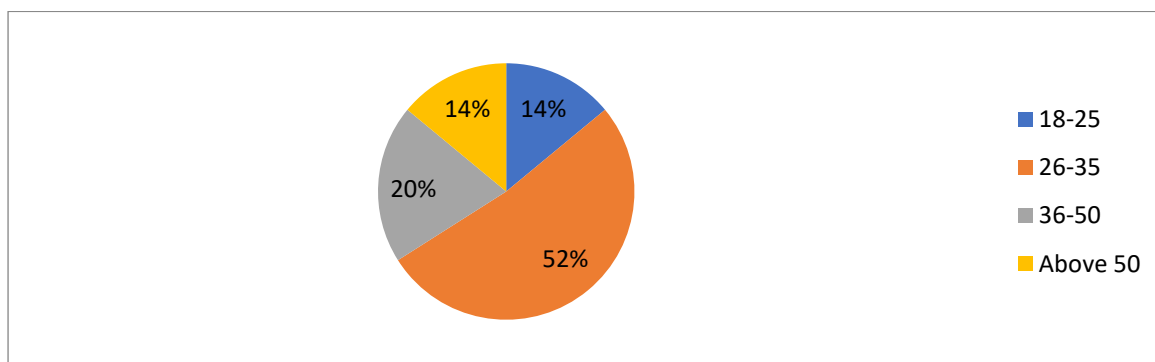


Table 4 Qualification

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<i>Frequency of Education</i>	Frequency	Percent	Valid Percent	Cumulative Percent
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	Bachelor	23	23.0	23.0	23.0
	Masters	64	64.0	64.0	87.0
	MPhil	8	8.0	8.0	95.0
	Other	5	5.0	5.0	100.0
	Total	100	100.0	100.0	

Table 4 displays the frequency distributions for the demographic variable qualification. The findings show that 23 percent of respondents had Bachelor levels, while 64 percent had masters' levels. 8 respondents (8%) have bachelor's degrees, making up the group. Similarly, 5 people, or 5 percent, have other degrees. Figure 4 shows the graph of demographic education. Figure 4

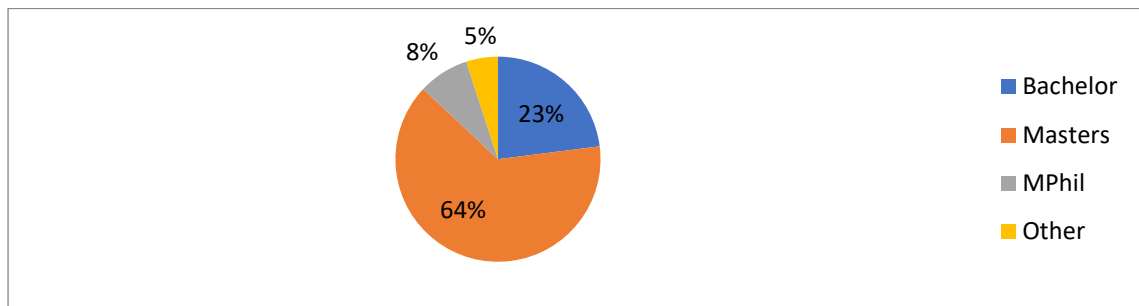


Table 5 Marital Status

<i>Frequency of Marital Status</i>		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	56	56.0	56.0	56.0
	Single	44	44.0	44.0	100.0
	Total	100	100.0	100.0	

According to Table 5, 56 respondents, or 56%, are married. Similar to this, there are 44 responders who are single. Figure 5 shows the graph of demographic marital status.

Figure 5

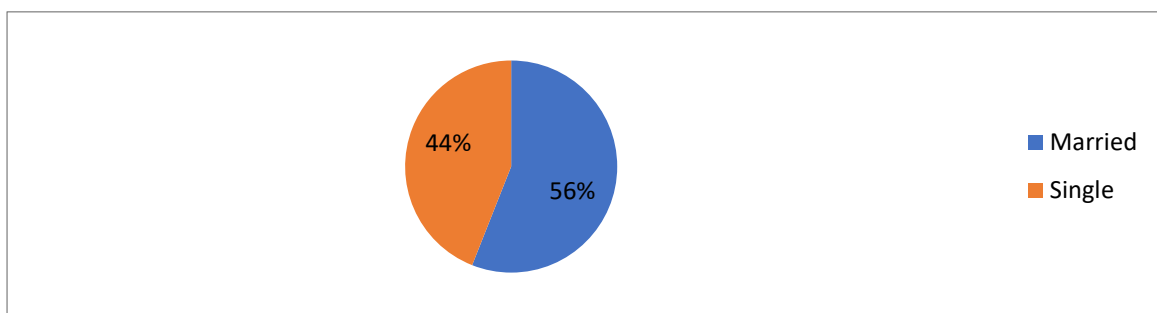
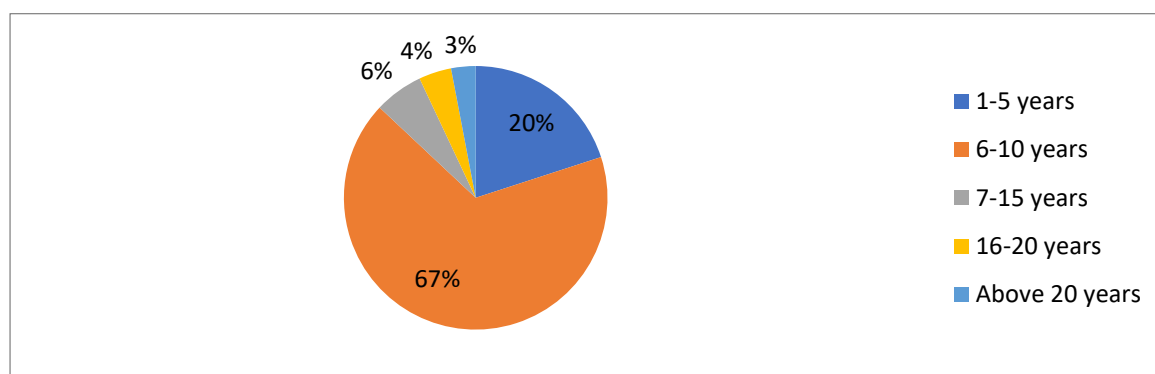


Table 6 Stay in Organization

<i>Frequency of Stay in the Organization</i>		Frequency	Percent	Valid Percent	Cumulative Percent
	1-5 years	20	20.0	20.0	20.0
	6-10 years	67	67.0	67.0	87.0
	7-15 years	6	6.0	6.0	93.0
	16-20 years	4	4.0	4.0	97.0
	Above 20 years	3	3.0	3.0	100.0
	Total	100	100.0	100.0	

The respondents' experiences inside the present company are displayed in Table 6. The results indicate that 20 respondents, had experience of 1-5 year. Additionally, 67 percent respondents have experience ranging from 6 to 10 years. There are 6 respondents with 7-15 years of experience. 4 respondents have 16-20 years of experience. Figure 6 shows the graph of demographic experience.

Figure 6



Descriptive Statistics

One of the first crucial phases in empirical research is descriptive statistics, which aids in identifying the salient features of the variables under study. It is likely that descriptive statistics are employed as a tool to describe the huge and complicated data set, as Mishra et al. (2019) highlighted in their study. However, the major factors in the current research are outlined in the following table of descriptive statistics.

Table 7 displays the data for the study variables. Ethical leadership, OCB, organizational justice and firm performance mean values were all displayed. The findings show that the EL has a

mean value of 3.49, a range of 2 lowest and 4.8 maximum values, and a standard deviation of 0.89. Additionally, the OCB has a mean value of 3.52 and a standard deviation of 0.71. The dependent variables FP and the moderator variable OJ have respective mean values of 3.47 and 3.66

Table 7

	Min	Max	Mean	Std. Deviation
EL	2.0000	4.8000	3.498000	.8969561
OCB	2.1538	4.7692	3.525385	.7156185
OJ	1.5714	5.0000	3.665714	.6841312
FP	1.8333	4.8333	3.476666	.8388772

Correlation analysis

The association between EL, OCB, OJ and FP is investigated in the current study using correlation analysis. Table 8 displays the Pearson Correlation between the study's variables. The results show a substantial positive link between EL and OCB ($r=.91$, $p<0.01$). Additionally, EL shows a strong positive link with FP ($r=.89$, $p<0.01$) and an insignificant negative relationship with OJ ($r=-0.08$, $p>0.01$). The results revealed an insignificant link between OCB and OJ ($r=-0.04$, $p>0.01$) and a significant positive correlation between OCB with FP ($r=.92$, $p>0.01$). The results indicated that there is an insignificant association between OJ and FP.

Table 8

		EL	OCB	OJ	FP
EL		1			
OCB		.918**	1		
		.000			
OJ		-.084	-.046	1	
		.404	.653		
FP		.898**	.928**	-.117	1

		.000	.000	.247	
At the two-tailed significance threshold of 0.01, correlation is significant.					

At the two-tailed significance threshold of 0.01, correlation is significant.

Regression Analysis

A regression test was used to identify the relationship between Dependent and Independent variables. Regression analysis identifies the direct effect of Ethical leadership on organizational performance, to check the hypothesis relationship.

Table 9, shows that R is a cumulative correlation coefficient. There is a relationship between independent and dependent variables. The value of R is (.898) and R square value is 80.7% (0.807×100) % which shows the variation in ethical leadership (EL) because of organizational performance (OP). Furthermore, the value of the (.807) model explains 80.7 % of Organizational Performance because of the independent variable EL.

Table 9

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.898 ^a	.807	.805	.3704142
a. Predictors: (Constant), EL				

We have run a multiple regression to study the link between EL and FP and further to study whether OJ moderates the relation between EL and FP. Further, the study investigates whether OCB mediates the association between EL and FP. ABOVE TABLE presents the final results. The model significance as indicated by the p value is reported by the F value in the model summary table. The model summary contains the P-value, R, R-sq, and F statistics for the model. Summary of the model for the outcome variable OCB is presented. The R-square results show that EL explain 84% variation in OCB. The results giving us some relations EL with Mediator OCB with the values ($\beta = .73$, $p < .01$), showing that EL is positively and significantly related to OCB. Further Furthermore, model summary for the outcome variable FP is presented. The R-square value is 87%. The model is significant as shown by the p-value of 0.000. It also demonstrates how directly EL affects FP. FP is significantly impacted positively by EL ($p < 0.01$) ($\beta = .26$). The impact of perceived OCB on FP is represented and the

result indicates that OCB has a significant positive impact on FP ($\beta = .77, p < 0.01$). Moreover, Table 12 shows that OJ has an insignificant negative impact on FP ($\beta = -0.07, p > .01$). Further, The interaction between EL and OJ (EL*OJ) was added to the model, the values ($\beta = 0.015, p > .01$), show that OJ does not moderates the link between EL and FP as shown by the p-value of .77. Hence, the interaction effect is insignificant. Furthermore, as previously mentioned the direct impact of EL on FP is significant in presence of the mediator OCB. However; the indirect effect is also significant. Hence, in this case we have partial mediation because the direct effect is also significant. Hence, the mediation between EL and FP is justified; concluding that our hypothesis “The link between EL and FP is mediated by OCB” is accepted. A test was conducted and found partial mediation in the model. It was discovered that the link between EL and FP was partially mediated by OCB. Examining the link between EL and FP is the goal of this study. The study investigates the role of OCB in mediating the connection between EL and FP. The study also explores whether OJ moderate the relationship between EL and FP. The reliability analysis indicates that the Cronbach alpha of the instrument used in this study is 0.93 which indicates that the instrument used in this study is reliable. The findings show that EL is positively and significantly related to OCB. In addition, EL and FP has a positive association which is significant. The result further indicates that OCB has a significant positive impact on FP. Moreover, OJ has an insignificant negative impact on FP. Further, the interaction between EL and OJ show that OJ does not moderates the link between EL and FP. Hence, the interaction effect is insignificant. Moreover, the direct impact of EL on FP is significant in presence of the mediator OCB. However; the indirect effect is also significant [14-17]. Hence, in this case we have partial mediation because the direct effect is also significant. Furthermore, as previously mentioned the direct impact of EL on FP is significant in presence of the mediator OCB. However; the indirect effect is also significant. Hence, in this case we have partial mediation because the direct effect is also significant [18-21]. Hence, the mediation between EL and FP is justified; concluding that our hypothesis “The link between EL and FP is mediated by OCB” is accepted. A test was conducted and found partial mediation in the model. It was discovered that the link between EL and FP was partially mediated by OCB.

Conclusion

Examining the link between EL and FP is the goal of this study. The study also explores how OCB mediates the link between EL and FP. The study also explores whether OJ moderate the link between EL and FP. Ethical leadership is conduct that adheres to the norms and values that are in place via personal and interpersonal interactions between leaders and subordinates. Additionally, it establishes employee ethics and fines or punishes transgressors. A work climate

that is fair, honest, trustworthy, and compassionate is also created through ethical leadership. It makes sensible judgments and acts with integrity, tenacity, and authority. In order to study the association between EL and firm performance, the present research will utilize a positivistic quantitative paradigm. Data is gathered via a questionnaire. This study uses a cross-sectional research design. The reliability analysis indicates that the Cronbach alpha of the instrument used in this study is greater than 0.7 which indicates that the instrument used in this study is reliable. The findings show that the EL has a mean value of 3.49, a range of 2 lowest and 4.8 maximum values, and a standard deviation of 0.89. Additionally, the OCB has a mean value of 3.52 and a standard deviation of 0.71. The dependent variables FP and the moderator variable OJ have respective mean values of 3.47 and 3.66. Additionally, EL shows a strong positive link with FP and an insignificant negative relationship with OJ. The findings showed a significant positive association between OCB and FP and an insignificant correlation between OCB and OJ. The findings showed that there is insignificant negative correlation between OJ and FP. Furthermore, as previously mentioned the direct impact of EL on FP is significant in presence of the mediator OCB. However; the indirect effect is also significant. Hence, in this case we have partial mediation because the direct effect is also significant. Hence, the mediation between EL and FP is justified; concluding that our hypothesis “The link between EL and FP is mediated by OCB” is accepted. A test was conducted and found partial mediation in the model. The link between EL and FP was discovered to be partially mediated by OCB.

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