Labour productivity and firm performance: evidence from certified firms from the EFQM excellence model

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Labour productivity is an ongoing topic in literature, specifically in developed economies where labour costs are higher. The main aim of this study is to examine the effects of labour productivity on firm performance. Using a sample of 311 Czech firms, including 18 certified firms from the European Foundation for Quality Management (EFQM) Excellence Model, the two-step system generalised method of moments (GMM) is performed to test the hypotheses. The current study results revealed that the quality certificates have a positive impact on the firm performance. The relationship between labour productivity and firm performance of certified firms is negative. However, the labour productivity of non-certified firms has a positive impact on the firm's performance. The present study's findings offer deeper insight into how labour productivity of the certified and non-certified firms relates to firm performance.

Keywords: Labour productivity, dummy variable, GMM, quality certificate, Czech firms

1. Introduction

EFQM Excellence Model is a non-profit Foundation that was functioned in October 1989 in Belgium. The key objective of the Foundation was to raise the competitiveness of European firms. Now the Foundation is famous worldwide for implementing total quality management. Numerous organisations obtain awards and certificates from the EFQM globally every year. According to **Espín et al. (2020)**, the Model can increase a holistic overview of any organisation and supports managers in diagnosing the main aspects to be improved for attaining excellence. **Asadi (2020)** claimed that there are a number of benefits and achievements to applying and establishing the EFQM Excellence Model in organisations.

Samuelson and **Nordhaus (2009)** defined productivity as 'output per unit of input.' A substantial literature observes the effect of labour productivity on several outcomes for employees and firms. Little attention has been paid to the effect on product quality and financial performance of the firm. **Gričar et al. (2021)** stated that the quality could not be measured by the number of stars or by investment in infrastructure, but the overall quality could be measured by productivity, income, loyalty, and output. According to **Heshmati and Rashidghalam (2018)**, labour productivity could be defined as overall productivity or sales per worker at the firm level. The labour productivity reflects on the capacity of a firm to produce higher production.

According to **Velnampy (2011)**, productivity and performance are closely related to each other. **Liu et al. (2021)** identified that the research on the firm's quality management performance is still inadequate. **Amutabi and Wambugu (2020)** claimed that profitability depends on labour productivity.

Therefore, we included labour productivity to investigate the impact on firm performance in the present study. We selected firms from the manufacturing sector as the sector contributes more than 20% of Czech's gross domestic product (GDP). The share of the manufacturing sector was around 20.84% in the Czech's GDP in 2020 (World Bank Statistics). **Griĕar et al. (2021)** argued that labour productivity had been widely studied for the manufacturing sector.

The main goal of the current study is to analyze the relationship between labour productivity and firm performance. There is rare empirical literature on firm performance and labour productivity, specifically for the quality award firms. However, the current study is going to fill this gap. To the best of our knowledge, this is the first study to investigate the effect of labour productivity on the firm performance of certified and non-certified firms. Additionally, the study explores the impacts of quality certificates on the firm's performance. We included a dummy variable to investigate the relationship between quality certificates and the firm' s performance, and an interaction term to explore the relationship between labour productivity and firm performance of the certified firms. Hence, the study also contributes to the existing literature in statistics and econometrics with more explanations about dummy and dummy interaction terms. To sum up, the current study contributes to the literature and practice in many contexts.

After the introduction section, the structure of the remaining paper is as follows. **Section 2** presented a theoretical framework and research hypotheses. **Section 3** described the research design and methodology. The results of this empirical research are presented in **section 4**. The final section discussed conclusions, further research, practical implications, and limitations of the current study.

2. Literature review and hypotheses development

The previous studies discussed the effect of labour productivity on numerous outcomes for employees and firms. **Heshmati and Rashidghalam (2018)** argued that labour is the most common factor of production to measure productivity. The authors discussed that labour productivity is a measure of efficiency in the production procedure, which states the generation of a firm of higher value-added per unit of a worker. By using the macroeconomic data of 28 countries of the European Union (EU), **Kersan-Škabic (2015)** stated that the labour costs increased faster than labour productivity in the pre-crisis period in the EU-28 by average (the financial crises period was during 2007-2009). However, most countries experienced growth rates a bit higher in labour productivity during 2010-2014, but it was significantly lower than in the pre-crisis period. **Hintzmann et al. (2021)** also argued that the rate of labour productivity growth in Europe has been declining since 1995.

Labour productivity, firm performance, benefits of quality certificates/awards, the role of firm size, and firm age are discussed in the following sub-sections to formulate research hypotheses based on previous studies.

2.1. Labour productivity and firm, performance

Various authors measured labour productivity by different methods. For example, **Csáfordi et al. (2020)** measured it as a value-added per worker; Hintzmann et al. (2021) measured it as real value-added per hour worked. However, **Anderson et al. (1997); Velnampy (2011); Abad et al. (2013); Liu et al. (2021)** measured it as sales per worker. Based on prior studies and available data from the Albertina database, we also measured labour productivity as sales per worker in the current study.

The relationship between firm performance and productivity has been explored by many researchers (**Bøler et al., 2015; Datta et al., 2005; imrohoroglu & Tuzel, 2014; Liu et al., 2021**). Ceteris paribus, rises to product quality and labour productivity leads to additional revenues, hence a firm earns more profits (**Farnham & Hutchinson, 2011**). **Anderson et al. (1997)** explored a positive relationship between productivity and the firm's return on investment. **Belderbos et al. (2004)** used the data from two consecutive Community Innovation Surveys conducted in 1996 and 1998 in the Netherlands. The authors explored that labour productivity has a positive influence on the firm's innovation efforts. Palia and Lichtenberg (1999) discovered that productivity raises firm value. **Liu et al. (2021)** investigated that labour productivity has a positive relationship with firm performance. On the other hand, **Imrohoroglu and Tuzel (2014)** explored a negative relationship between productivity and firm performance.

A mixed relationship between labour productivity and firm performance has been reported in the earlier studies. Therefore, we formulated the following hypotheses separately for certified and non-certified firms.

> H_1: Labor productivity has a significant impact on the firm's performance of non-certified firms.
>
> H_3: Labor productivity has a significant impact on the firm performance of certified firms.

2.2. Quality awards/certificates and firm performance

The first time, **Hendricks** and **Singhal (1996)** explored the firm market reaction to quality award announcements (**Zhang et al., 2021**). Using a sample of 91 Malcolm Baldrige National Quality Award (MBNQA) firms, the authors found positive stock returns on the declaration day. Later on, **Hendricks and Singhal (2001)** estimated the long-term financial performance of winning quality award firms. The findings revealed that the quality award winner firms perform better than non-award firms. Afterward, numerous studies showed that the firms with quality awards perform better than their comparison firms (**Abad et al., 2013; Asadi, 2020; Augustyn et al., 2021; Boulter et al., 2013; Starke et al., 2012; Zhang et al., 2021**). Similar to the quality awards, the firms with different quality certificates from the EFQM Model also perform better (**Yousaf, 2021; Yousaf & Bris, 2020; Yousaf & Bris, 2021**).

A few studies reported opposed findings. By using the data of 112 Iranian companies, **Safari et al. (2020)** investigated a weak link between quality winning awards and their financial performance. **Yousaf et al. (2021)** used the data of 332 Czech firms, where the 20 firms were certified from the EFQM Model, to study the relationship between working capital management and firm profitability. The study results exposed that having a quality certificate from the EFQM Model decreases the firm' s profitability.

Due to the mixed findings in the previous literature, the following hypothesis is formulated about the impact of quality certificates on firm performance.

> H_2: The quality certificates from the EFQM Excellence Model have a significant impact on firm performance.

2.3. Firm age (FRAG), firm size (FRSZ), and firm performance

Many authors included FRAG and FRSZ in their research, such as **Okoyeuzu et al. (2021); Csáfordi et al. (2020); Saini and Singhania (2018); Heshmati and Rashidghalam (2018); Abad et al. (2013)**. Some

authors investigated a positive relationship between FRAG and the firm's performance (**Kuntluru et al., 2008; Shamsuzzoha & Tanaka, 2021**). On the other hand, **Li et al. (2021); Park et al. (2010); Charoenrat and Harvie (2013)** reported a negative relationship between the variables. In the same way, **Chandrapala and Knápková (2013); Khan et al. (2018); Ahmed** and **Bhuyan (2020); and Li et al. (2021)** explored the positive impact of FRSZ on firm performance. **Conversely, Yousaf (2021); Ullah et al. (2020); Masnoon and Saeed (2014)** found a negative impact of FRSZ on firm performance.

To summarise the above discussion, various researchers reported that the firms with quality awards perform better. However, the quality certificates from the EFQM Model also play a significant role in improving firm performance. But there are only a few studies about quality certificates and firm performance. Moreover, the studies reported mixed results. For example, **Yousaf (2021) and Yousaf and Bris (2021)** investigated a positive relationship between quality certificates and firm performance. On the other hand, **Yousaf et al. (2021)** reported a negative impact of quality certificates on the firm's performance. Hence, further studies are needed to investigate the impacts of the quality certificates on the firm' s performance. Meanwhile, previous literature showed that labour productivity decreased in European firms. These findings encourage us to explore comprehensively the labour productivity of the non-certified and certified firms from the EFQM Excellence Model.

The above relationships among variables and research hypotheses are described in **Figure 1**.

3. Methodology

We selected 18 certified firms and 293 non-certified firms from the manufacturing sector. The number of samples is enough to draw analysis (**Israel, 1992; Krejcie & Morgan, 1970**). The information of the certified firms was retrieved from the EFQM recognition database. The financial unbalanced dynamic panel data was gained from the Albertine database over the period 2015-2019. Many authors gained the secondary data from the Albertina database (**Camska et al., 2021; Chandrapala & Knápková, 2013; Činčalová & Hedija, 2020; Kučera et al., 2021; Náglová & Pechrová, 2019; Pivoňková & Tepperová, 2021; Vrbka, 2020; Yousaf et al., 2021**). All estimations in the current study were performed using STATA 16.0.

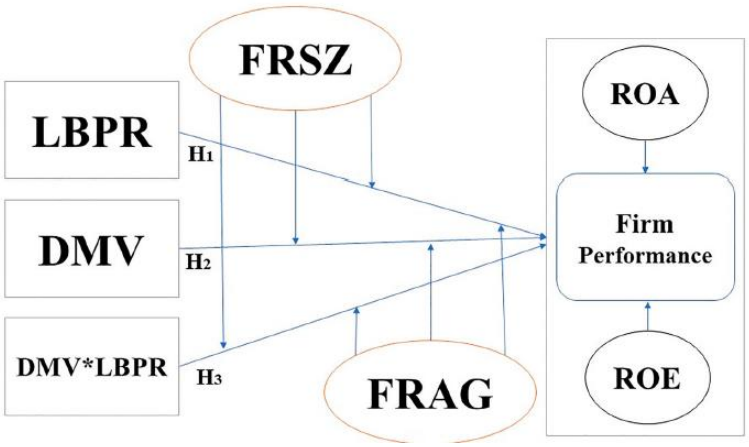

Figure 1. The Conceptual Framework (Source: Author).

Return on equity (ROE) and return on assets (ROA) are the dependent variables used as proxies to measure the firm's performance. Many authors used ROA and ROE as proxies of firm performance (**Akgun & Memis Karatas, 2021; Bawazir et al., 2021; Jyoti & Khanna, 2021; Yousaf & Bris, 2021**). The independent variables are labour productivity, dummy variable, and a dummy interaction term. Firm size and firm age are the control variables. The complete detail about the variables is presented in **Table 1**.

$$FRP_{it} = \beta_0 + \beta_1(FRP_{it-1}) + \beta_2(\mathrm{LBPR}_{it}) + \beta_3(DMV_{it}) + \beta_4(DMV * LBPR_{it}) + \beta_5(Contl_{it}) + \eta_i + \varepsilon_{it} \quad \text{Model 1}$$

After putting the proxies of firm performance and control variables, **Model 1** can be written in the following.

$$ROA_{it} = \beta_0 + \beta_1(\mathrm{ROA}_{it-1}) + \beta_2(\mathrm{LBPR}_{it}) + \beta_3(DMV_{it}) + \beta_4(DMV * LBPR_{it}) + \beta_5(\mathrm{FRSZ}_{it}) + \beta_6(\mathrm{FRAG}_{it}) + \eta_i + \varepsilon_{it} \quad \text{Model 2}$$

$$ROE_{it} = \beta_0 + \beta_1(\mathrm{ROE}_{it-1}) + \beta_2(\mathrm{LBPR}_{it}) + \beta_3(DMV_{it}) + \beta_4(DMV * LBPR_{it}) + \beta_5(\mathrm{FRSZ}_{it}) + \beta_6(\mathrm{FRAG}_{it}) + \eta_i + \varepsilon_{it} \quad \text{Model 3}$$

In the above Models, i = 1, 2, ... N signifies the number of firms, t represents the time from 2015 to 2019. β_0 is intercept, from β_1 to β_6 are coefficients of the independent variables. ε_{it} and η_i denote error terms and unobserved firm-specific effects for firm i at time t, respectively.

4. Empirical results

The descriptive statistics are presented separately for certified and non-certified firms in **Table 2**. The mean and standard deviation (S.D.) of ROA of the certified firms are 6.982 and 7.493. The mean and S.D. values of ROA and ROE are slightly different from each other in both types of firms.

Table 1. Summary of selected variables (Source: Author)

Variables	Proxy	Measurements
Dependent variables		
Firm performance	ROA (Return on Asset)	(Earnings before interest and tax) / (total assets)
	ROE (Return on equity)	(Earnings before interest and tax) / equity
Independent variables		
Labour productivity	LBPR	Natural log (Sales / number of employees)
Dummy variable	DMV	DV = 1, if a firm has a quality certificate from the EFQM Model, DMV will be zero otherwise.
Dummy interaction term	DMV*LBPR	Labour productivity of certified firms
Control variables		
Firm size	FRSZ	Natural log of total assets
Firm age	FRAG	Natural log of the number of years since firm registered

Table 2. Descriptive statistics.

Stats	Mean	S.D.	Maximum	Minimum	Observations
For certified firms					
ROA	6.982	7.493	19.020	−7.9	86
ROE	15.885	12.915	38.330	−13.26	86
LBPR	7.319	3.546	9.121	0	86
DMV	1	0	1	1	86
DMV*LBPR	8.705	4.444	14.993	0	86
FRSZ	14.232	1.026	15.416	11.941	86
FRAG	3.164	0.304	3.401	2.303	86
For non-certified firms					
ROA	4.869	6.481	19.02	−7.9	1312
ROE	9.299	13.193	38.33	−18.61	1312
LBPR	6.653	2.499	9.121	0	1311
DMV	0	0	0	0	1312
DMV*LBPR	0	0	0	0	1312
FRSZ	13.192	1.040	15.416	11.534	1312
FRAG	3.117	0.316	3.401	2.303	1312

The positive signs of mean values of ROA and ROE show that the selected firms earned profits during 2015-2019. In the same way, the positive signs of LBPR and DMV*LBPR mean values indicate that the labour productivity was positive of the selected firms during the study period. However, S.D. values of ROA and ROE are higher than mean values. On the other hand, S.D. values of LBPR, DMV*LBPR, FRSZ, and FRAG are lower than their mean values. Most of the selected variables' values of the certified firms are the same as non-certified firms.

Table 3 displays the correlation coefficients and variance inflation factor (VIF) test of the selected variables of all firms. All the independent variables are positively correlated with ROA and ROE except FRAG. FRAG is also positively correlated with ROA; on the other hand, FRAG is negatively correlated with ROE. Most of the selected variables are significant at the 0.05 significant level. We performed the VIF test to identify the multi-collinearity in explanatory variables. If the values of VIF are lower than 10 then there is no multicollinearity issue between the explanatory variables (**Gujarati & Porter, 2009; Nachane, 2006**). **Table 3** shows that all the VIF test values are lower than 10; hence, there is no multicollinearity between the explanatory variables.

Table 3. Correlation Coefficients (Source: Authors' calculation).

	ROA	ROE	LBPR	DV	DV*LBPR	FRSZ	FRAG
ROA	1						
ROE	0.859*	1					
LBPR	0.077*	0.099*	1				
DMV	0.077*	0.119*	0.062*	1			
DMV*LBPR	0.077*	0.123*	0.206*	0.886*	1		
FRSZ	0.113*	0.076*	−0.003	0.234*	0.209*	1	
FRAG	0.056*	−0.065*	0.022	0.036	0.022	0.116*	1
VIF			**1.12**	**5.05**	**5.20**	**1.07**	**1.02**

*Note: *represents $p < 0.05$*

One of the key assumptions of linear regression is that there should be no heterosce-dasticity of residuals. The Breusch-Pagan test is employed to test the heteroskedasticity in the fitted values of ROE

and ROA. The null hypothesis of the test is: constant variance. For ROA, the p-value of the test is 0.198 and for ROE is 0.529. Both values are not statistically significant as both p-values are higher than 0.05. Therefore, we can conclude that there is no heteroskedasticity in the data, and the variance for all observations is constant (**Poi & Wiggins, 2001**).

The Fisher-type unit-root test was employed to check the stationarity of the selected variables. **Maddala and Wu (1999)** argued that the Fisher-type test requires the specification of the Dickey-Fuller test to diagnose the unit-root. The Fisher-type unit-root test is more useful than any other unit root test, as the test can also apply at unbalanced panel data (**Hlouskova & Wagner, 2006**). The null hypothesis of the test is: all panels contain unit root. We employed two options to check the unit-root, i.e. with time trend and without time trend. **Table 4** displays the results of the test.

According to **Table 4**, the data of the variables are stationary as p-values of most of the variables are zeroes.

To estimate **Model 2** and **Model 3**, a two-step system GMM estimation is employed to avoid the unobserved heteroskedasticity, endogeneity, and autocorrelation problems. Various authors suggested that the two-step system GMM should be preferred among dynamic panel data models, specifically when time is small, and observations are large (**Abdmoulah, 2021; Baltagi, 2008; Grohmann, 2015; Roodman, 2009**). Two-step system GMM was also employed by many scholars in the most recent studies (**Abdmoulah, 2021; Garfatta & Zorgati, 2021; Okoyeuzu et al., 2021; Yousaf & Bris, 2021**). Hence, we also performed the two-step system GMM in the present study to explore the relationship between labour productivity and firm performance.

If DMV = 1 for the certified firms, then DMV and DMV*LBPR will become zeroes for non-certified firms. **Model 2** and **Model 3** for non-certified firms can be written as follows:

$$ROA_{it} = -7.701 - 0.458(ROA_{it-1}) + 0.385(\mathrm{LBPR}_{it}) + 6.503(FRSZ_{it}) - 1.978(FRAG_{it}) + \eta_i + \varepsilon_{it}$$

$$ROE_{it} = 2.660 - 0.235(ROE_{it-1}) + 0.399(\mathrm{LBPR}_{it}) + 2.491(FRSZ_{it}) - 3.165(FRAG_{it}) + \eta_i + \varepsilon_{it}$$

Table 4. Fisher Type Unit Root Tests (Source: Authors' calculations).

Variables	Without time trend	p-value	With time trend	p-value
ROA	−15.01	0.000	−6.12	0.000
ROE	−12.84	0.000	−6.02	0.000
LBPR	−10.38	0.000	−2.29	0.006
DMV	–	–	–	–
DMV*LBPR	−2.44	0.000	−2.77	0.005
FRSZ	−10.10	0.000	−10.79	0.000
FRAG	−17.91	0.000	−8.26	0.000

If DMV = 1 for the certified firms, then **Model 2** and **Model 3** for certified firms can be written as follows:

$$ROA_{it} = (-7.701 + 3.293) - 0.458(ROA_{it-1}) + (0.385 - 1.091)LBPR_{it} + 6.503(FRSZ_{it}) - 1.978(FRAG_{it}) + \eta_i + \varepsilon_{it}$$

$$ROA_{it} = (-4.408) - 0.458(ROA_{it-1}) - 0.706(LBPR_{it}) + 6.503(FRSZ_{it}) - 1.978(FRAG_{it}) + \eta_i + \varepsilon_{it}$$

In the same way,

$$ROE_{it} = (2.660 + 8.462) - 0.235(ROE_{it-1}) + (0.399 - 8.888)LBPR_{it} + 2.491(FRSZ_{it}) - 3.165(FRAG_{it}) + \eta_i + \varepsilon_{it}$$

$$ROE_{it} = 11.122 - 0.235(ROE_{it-1}) - 8.489(LBPR_{it}) + 2.491(FRSZ_{it}) - 3.165(FRAG_{it}) + \eta_i + \varepsilon_{it}$$

Table 5 shows the findings of the two-step system GMM estimation. The coefficients of lag dependent variables (ROA and ROE) are very statistically significant at the 0.01 level of significance. Both coefficients' signs of the variables are negative, which means that the relationship between dependent variables and the lag of dependent variables is negative.

The coefficients of LBPR are statistically significant at the 0.05 significance level for non-certified firms. The signs of both coefficients are positive, which revealed a positive relationship between LBPR and the firm's performance. The result supported Hj, i.e. labour productivity has a significant impact on the firm's performance of non-certified firms. This positive relationship between the variables is also supported by **Liu et al. (2021)**.

Table 5. Two-step system GMM estimation results (Source: Authors' calculations).

	ROA (Model 2)	ROE (Model 3)
Lag of ROA/ROE	−0.458*** (0.100)	−0.235***(0.071)
LBPR	0.385**(0.160)	0.399**(0.506)
DMV	3.293**(20.879)	8.462**(6.866)
DMV*LBPR	−1.091*(0.649)	−8.888**(5.773)
FRSZ	6.503*(3.806)	2.491***(27.134)
FRAG	−1.978(24.592)	−3.165(42.060)
Constant	−7.701(9.490)	2.660(6.468)
Number of observations	1352	1378
Number of instruments	8	10
AR(1)	−5.15	−1.37
p-value	0.003	0.011
AR(2)	0.08	−0.132
P-value	0.336	0.812
Hansen test	0.16	5.28
p-value	0.703	0.152

*Note: Standard errors are in parentheses, * p <0.1, ** p < 0.05, *** p < 0.01*

Both coefficients of DMV (3.293 in **Model 2** and 8.462 in **Model 3**) are statistically significant at the 0.05 significance level. The positive signs of both coefficients of DMV stated that the quality certificates from EFQM Excellence Model have a positive impact on firm performance. The firms with quality certificates perform 3.293 units (**Model 2**) and 8.462 units (**Model 3**) better than non-certified firms. The findings are consistent with **Yousaf (2021) and Yousaf** and **Bris (2021)**, as the scholars also found a positive impact of the quality certificates on the firm's performance. These significant results supported H_2.

Similar to the findings of LBPR, both coefficients of DMV*LBPR are also statistically significant at 0.10 (in **Model 2**) and 0.05 (in **Model 3**) level of significance for the certified firms. However, both coefficients' signs are negative, which means that the relationship between LBPR and firm performance of certified firms is negative. The significant results supported H_3, i.e. labour productivity has a significant impact on firm performance of the certified firms. Additionally, the relationship between the variables for non-certified firms is significantly larger than certified firms (0.385 $>$ -0.706 in **Model 2** and 0.399 $>$ -8.489 in **Model 3**).

Concerning the control variables, the coefficient of FRSZ is statistically significant at 0.10 (in **Model 2**) and 0.01 (in **Model 3**) significance levels. Both coefficient signs are positive, which signifies that the relationship between FRSZ and the firm's performance is positive. Large Czech firms perform better than small and medium enterprises (SMEs). The results of FRSZ are consistent with **Okoyeuzu et al. (2021); Farhan et al. (2021); Al-Gamrh et al. (2020)**, as the scholars also reported the positive relationship between FRSZ and firm performance. The coefficients of FRAG are statistically insignificant as the p-values are higher than the level of significance.

Considering the post estimation findings, many authors recommended that first-order autocorrelation (AR(1)) should be significant at the 5% significance level, whereas second-order autocorrelation (AR(2)) p-value should be higher than 0.05 to confirm the absence of second-order autocorrelation (**Abdmoulah, 2021; Gupta et al., 2021**). Additionally, the Hansen test findings should be statistically insignificant, implying that the instruments are valid or over-identification restrictions are appropriate. **Table 5** displays that AR (1) results are significant, AR(2) are insignificant, and the Hansen tests are insignificant in both Models. Therefore, the post estimation results of the current research are the same as suggested in the empirical studies.

5. Conclusion

In high labour costs economies, boosting labour productivity is an important issue to increase performance at the firm level. The current study aims to examine the effects of labour productivity on firm performance. Using the data of 311 Czech manufacturing firms, including 18 certified firms, a two-step system GMM estimation was employed to test the proposed hypotheses. The dummy variable was employed to explore the impact of the quality certificates on firm performance. The dummy interaction term was used to examine the relationship between labour productivity and firm performance of the certified firms. The findings revealed that all the selected variables are significant except firm age. Labour productivity, dummy variable, and firm size have a positive impact on the firm's performance. On the contrary, labour productivity of the certified firms (dummy interaction term) has a negative relationship with firm performance. The dummy variable is significant and positive, illustrating a positive impact of the certification on the firm's performance. Hence, similar to the quality awards firms, the quality certified firms from the EFQM Model also perform better than non-certified firms.

The relationship between labour productivity and firm performance of non-certified firms is positive, but the same relationship is negative in the context of certified firms. These conflict findings offer further research. Future research could be conducted by taking more variables, increasing the length of the study period, including other quality awards/certificates, considering other sectors, and extending different regions and countries. In future research, we also suggest to the researchers to use other definitions to measure labour productivity and other techniques to explore the relationship between labour productivity and firm performance.

The findings of the current research offer theoretical and practical implications. Theoretically, the research contributes to the existing literature on labour productivity. The study's results will extend the literature of the certified and non-certified firms in the context of labour productivity and firm performance. The present research extends the literature about the impacts of quality certificates on the firm' s performance that mainly emphasise quality awards and does not discuss quality certificates from the EFQM Model, even though these certificates are important to obtain global quality awards. Practically, the study' s findings will motivate the managers and directors of firms to participate and implement the EFQM Model in their firms. Moreover, the findings are useful for academics and researchers as we explained dummy variables and dummy interaction terms step by step.

Some limitations warrant consideration to the current study. (i) The coronavirus disease (COVID-19) impacts were excluded in the current research as the available data was from 2015 to 2019. (ii) Due to the availability of data, a short time period was considered. (iii) Only two proxies of firm performance were included in the present study. (iv) There are only 18 firms that have quality certificates from the EFQM Model. Hence, the number of certified firms is small in the sample. (v) Many variables and factors affect the firm's performance. However, we selected the two most important control variables based on the available data and prior literature.

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