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THE INFLUENCE OF R&D ON ORGANIZATIONAL PERFORMANCE: EVIDENCE FROM PAKISTAN'S TEXTILE INDUSTRY

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Abstract

Innovation plays a critical role in enhancing competitiveness and fostering economic growth, particularly in developing economies such as Pakistan. Despite the acknowledged importance of research and development (R&D), its influence on the performance of textile firms in Pakistan remains underexplored. This study investigates the relationship between R&D investment and firm performance in the Pakistani textile industry. Using regression analysis, the study examines the return on assets (ROA) for 55 textile companies listed on the Pakistan Stock Exchange (PSX) over the period 2010–2018. Findings reveal that R&D investment significantly improves firm performance, with emerging firms benefiting more than established companies. Conversely, larger firms exhibit comparatively lower profitability, potentially due to operational inefficiencies. These results provide valuable insights for policymakers and industry stakeholders, emphasizing the need to encourage innovation and support smaller enterprises as drivers of growth in emerging markets.

1. INTRODUCTION

Innovation is vital in driving corporate growth, facilitating entry into new markets, enhancing existing market share, and securing a competitive edge. Investigation and innovation are essential to economies, businesses, and organizations. Consequently, corporate and public innovation positively contribute to society (Bednyagin & Gnansounou, 2012). With the progression of technology, the significance of research and development has grown substantially for a company's survival, success, and growth. Innovation emerges as a result of research and development efforts. Innovation primarily stems from the capacity for research and development (Wang et al., 2013). Innovation determines a company's success (Mone et al., 1998). Renko's (2011) study indicates that innovation is crucial in ROA. Organizations that demonstrate superior financial performance and profitability will likely maintain more environmentally sustainable manufacturing facilities, provide enhanced products to their customers, and increase employee compensation (Mirza & Javed, 2013). The overall performance of an organization is the key factor in setting organizational goals and attaining success in a competitive market (Rehman, Mohamed, & Ayoub, 2018a, 2019). Moreover, it is a significant signal for stakeholders, shareholders, investors, and economic development (Khan & Ali, 2017). The overall success of an employer encompasses both financial and non-monetary performance (Rehman, Mohamed, & Ayoub, 2018b; Rehman et al., 2019).

In Pakistan, the topic of innovation has been notably overlooked, particularly in the context of assessing employer innovation (Sajjad, Rai, Shafique 2019). This observation addresses that gap by concentrating on textile firms in Pakistan and assessing their innovation practices. Like numerous other sectors,

the textile industry has experienced significant expansion in recent years. The global textile and apparel exports rose from $482 billion in 2005 to $797 billion in 2014. In the same timeframe, Pakistan's fabric exports rose from $10.7 billion to $14 billion (US dollars).

In contrast to global trends, Pakistan's textile sector has shown limited progress, as evidenced by a decrease in its share of worldwide fabric exports over the past decade. Textiles represent a crucial sector in Pakistan's economy, contributing to one-fourth of the overall commercial value and employing 40% of the labor force in the commercial domain. Significantly, the global debt constitutes an average of 56% of total country exports. Due to its lack of competitiveness in global markets, it necessitates ongoing innovation to sustain its portion of global trade. The fabric industry in Pakistan is encountering difficulties related to organizational innovation, which notably affects its overall performance (Khan et al., 2019).

Furthermore, it is asserted that organizational innovation serves as a function that elucidates a company's assets and performance (Khan et al., 2019). Moreover, in Pakistan, there has been a notable lack of focus on organizational innovation in assessing organizational effectiveness (Hussain, Hanif, and Hamid, 2018). The extensive scope and production network of textiles in Pakistan presents opportunities and challenges for enhancing innovation and competition. Initially, although textiles represented 56% of national exports, their contribution to global trade was under 2% (1.8% in 2014). There could be a more effective capacity to enhance this global share through resistance and creativity. Considering the recent supply of GSP plus reputation from Europe and the upward wage trend in China, the world's foremost textile exporter, an increase in the number of assertive textile organizations is anticipated. The fabric industry features an extensive production chain, presenting value opportunities at each processing phase—from cotton cultivation to ginning, spinning, fabric creation, processing, finished products, and garments.

The textile industry faces stagnant growth, a decline in global market share, and an urgent need for continuous innovation to maintain its competitiveness. Empirical studies reveal a notable deficiency in understanding how R&D investments influence business performance in developing nations like Pakistan. The sector, crucial for Pakistan's GDP and job creation, has faced challenges in organizational innovation, as noted by Khan et al. (2019), and there has been a reduced focus on innovation when assessing organizational success. Recent studies have predominantly concentrated on progress in wealthy nations or different sectors, resulting in a significant void in comprehending how innovation and development can enhance the performance of textile firms in Pakistan. This analysis explores the connection between investment in innovation and business outcomes, as measured by Return on Assets (ROA), utilizing a dataset of 55 textile companies listed on the Pakistan Stock Exchange from 2010 to 2018. This study deepens the comprehension of innovation and company performance by presenting empirical evidence from a developing country, delivering important insights for managers in the textile sector, policymakers, and stakeholders.

The results demonstrate that allocating resources to research and development positively and significantly impacts business performance, as evidenced by Return on Assets (ROA). It underscores the importance of investigation and innovation in improving a company's competitive stance, economic results, and enduring viability. This study provides valuable insights for decision-making by emphasizing the importance of innovation in enhancing performance, especially in a developing economy like Pakistan, where research and development and innovation frequently lack sufficient focus. The findings indicate that the age of a business influences the connection between R&D investments and performance, implying that younger firms might gain more advantages from these investments than their older counterparts. It deepens our insight into the impact of particular firm characteristics on this relationship.

This paper is further organized as follows: We begin by explaining the institutional background of our study, followed by a literature review, hypothesis development, and methodology. Finally, we present regression results and a conclusion.

1.1 Institutional Background

There were three stock exchanges in Pakistan up till 2015. They linked the Karachi, Lahore, and Islamabad stock exchanges on March 10, 1949, October 5, 1970, and October 25, 1989, respectively. On January 11, 2016, this vast number of freely overseen stock trades was consolidated into a single stock exchange, the Pakistan Stock Exchange (PSX). Every one of the three stock trades worked as a revenue-driven association. They had no shared association among them at this point. Their possession structures were comparable, permitting their individuals to exchange freedoms like proprietorships. Accepted this construction to compromise the financial backer's advantage, making them helpless by causing irreconcilable circumstances. Thus, the public authorities presented the Stock Exchange Act 2012 to solidify the three stock trades and isolate the exchanging freedoms from the proprietorship. Security and Exchange Commission of Pakistan (SECP) added overall organizational performance in Pakistan in 2002, and researchers have observed little or no literary contribution to the company's overall performance mechanism (Javid & Iqbal, 2008). In Pakistan, company innovation and the organization's overall performance have begun to scratch the surface (Ameer, 2013). As a result, there is nevertheless a large number of people who want to work in Pakistan.

The textile industry is the largest manufacturing sector in Pakistan and is a vital part of the nation's economy (Asad et al., 2018). Pakistan is the foremost producer and exporter of textiles worldwide, with annual sales amounting to PRs. 1446.86 billion (Rehman et al., 2019). The textile sector accounts for over 63 percent of Pakistan's exports and contributes 8.5% to its GDP (Rahman et al., 2019). In Pakistan, 40% of the industrial labor force is involved in the textile sector, constituting a substantial one-fourth of the nation's industrial value-added. Fifty-six percent of national exports originate from this sector. Continuous innovation is crucial, as competition in global markets necessitates it to maintain a share of world trade. Pakistan is estimated to possess less than 1% of the global textile market share; however, economists predict growth in this sector (S. N. Khan, Hussain, Maqbool, Ali, & Numan, 2019). Pakistan has 954 officially registered organizations, including the all-Pakistan Textile Mills Association and the all-Pakistan Bed Sheets and Upholstery Manufacturers Association (APBUMA).

2. Literature review and Hypothesis development

Many scholars and executives have targeted innovation as an essential resource for agencies to triumph over the marketplace because of the top vital thing of an agency strategy (Hitt, Ireland, Camp, & Sexton, 2001). Organizational innovation, social innovation, advertising innovation, open innovation, eco-innovation, and product innovation are some classes of innovation that have been utilized in advanced studies to a degree of how nicely an agency performs (Nemlioglu & Mallick, 2017; Rauter, Globocnik, Perl-Vorbach, & Baumgartner, 2019). Menu and Auh (2006) described innovation because of the organizational propensity and openness to executing thoughts that leave the traditional course of business. Innovation calls for dedication to surrender vintage workouts and check out novel concepts (Tsai & Yang, 2014). Organizational performance is closely encouraged through innovation (Zaefarian, Forkmann, Mitra, & Henneberg, 2017; Uzkurt, Kumar, Semih Kimzan, & Eminolu, 2013). Innovation has a massive effect on overall organizational performance, which aligns with advanced studies (Naala, Nordin, & Omar, 2017; Turulja & Bajgoric, 2018). Despite this, studies suggest that innovation has little effect on how nicely an agency performs (Darroch, 2005). The well-known studies show that a small quantity of research compares their overall performance using each monetary and non-monetary sign (Hofmann, 2001; Kaplan & Norton, 1996).

Alternatively, few researchers (Henri, 2006; Kariyawasam, 2014) rent monetary overall performance signs to quantify overall organizational performance and push aside overall non-monetary performance. However, if agencies need to enhance their long-term overall performance, one of the authors of the latest look advises that overall non-monetary performance is crucial (Rehman et al., 2018a). Literature has proven that businesses with extra innovation abilities are geared higher to create aggressive advantages, obtain company rejuvenation, and improve overall organizational performance

(Hurley & Hult, 1998). In 2019, Yin and Sheng studied the connection between overall performance and innovation in China and the effect of government incentive applications on enterprise overall performance.

Innovation and different commercialization efforts have a high-quality effect at the fee of going back, considering that they show the corporation's ability for aggressive increase and product expansion (Sood & Tellis, 2009). As a result, in step with innovation indicators, a progressive organization sends an excellent sign due to its miles displaying that it can compete. Innovation has an aggressive edge; accordingly, groups that use it will also see a value advantage (Artz, Norman, Hatfield, & Cardinal, 2010). According to an analysis by Sorescu and Spanjol (2008), innovation relates to better corporate income. An innovative commercial enterprise will maintain its excessive overall performance function and generate better income than its rivals (Roberts, 1999).

Research studies consistently demonstrate that research and development investment drives innovation, enhancing a company's competitiveness, market share, and profitability. Sougiannis (1994) found that R&D investments significantly increase business income, while Hassan et al. (2013) demonstrated a clear relationship between innovation and improved firm performance in Pakistan's industrial sector. Ghaffar and Khan (2014) identified a significant positive correlation between research and development and firm performance in Pakistan's pharmaceutical sector, suggesting that increased R&D expenditures lead to enhanced business outcomes. The findings align with signal theory principles, indicating that innovation reflects a company's growth and competitiveness potential, attracting investors and improving financial performance. Given the empirical and theoretical foundations, it is reasonable to expect that investment in R&D positively influences firm performance, particularly in the textile industry in Pakistan, where innovation is crucial for maintaining global competitiveness. A hypothesis is proposed based on the current literature.

H1: A significant relationship exists between R&D investment and firm performance.

3. Methodology

This study examined a sample of Pakistan stock exchange textile companies. In their financial accounts, public firms must report R&D spending. The data was thoroughly gathered from 2010–2018 annual reports. ROA, the ratio of net profit to total assets, measures a company's asset use efficiency. Capital-intensive businesses like textiles require efficient asset usage; hence, return on assets (ROA) provides a complete performance review. ROA highlights the economic benefits of innovation-driven efficiency improvements, making it a key statistic for R&D's impact on corporate success. This study uses the net income and total assets technique of Zhang et al. (2015) to compute the return on total assets for profitability. A person or group recognizes a new thought, activity, or object as innovation (Rogers, 1971). According to Mukherjee, Singh, and Žaldokas (2017), innovation is assessed by the R&D expenditure-to-sales revenue ratio. Research and development costs are included in the annual report. Research and development intensity is independent. The study controlled for company size, age, and liabilities ratio.

The natural logarithm of asset book value defines firm size. Larger firms may have more R&D resources; hence, this indicator is provided. These firms may lose out on innovation due to inefficiencies or excessive operational costs. Innovation must improve in large companies (Kansal, Joshi, and Batra, 2014). Firm Age (FA), total assets, and years since inception indicate firm age. This technique was chosen because younger companies can be more agile and innovative, allowing them to capture more value from R&D. Leverage affects research and development spending and performance; hence, the Liability Ratio (DAR) was created to evaluate the firm's financial structure. Divide liabilities by assets to calculate. Organization size, maturity, and financial risk affect research and development and firm success. This technique aims to understand better how R&D affects Pakistan's textile industry.

3.1 Analytical Techniques

A statistical model was developed for this study to analyze the impact of R&D investment on corporate performance. This work constructs a regression

model including a single dependent variable. A model was developed for the sample. This study employs the subsequent statistical model:

Control variable, which encompasses firm size (FS), firm age (FA), and the liability ratio (DAR). "Ɛ" represents an error term. It is expected to stay unchanged and maintain a mean of zero throughout the duration. The objective of Eq. (1) is to analyze the relationship between corporate innovation and the current operating performance of an enterprise.

$$ROA_{it} = \beta_0 + \beta_1 R\&D_{it} + \beta_2 FS_{it} + \beta_3 FA_{it} + \beta_4 DAR_{it} + Industry\ Fixed\ Effect + Year\ Fixed\ Effect + \varepsilon_{it} \quad \text{(eq.1)}$$

Table 1. Variable Measurement Summary

	Variable	Acronym	Measurement
Dependent variables	Profitability	ROA	Net income divided by total assets (Zhang et al., 2015)
Independent variables	R&D Intensity	R&D	Annual R&D amounts/Total annual revenue.
Control variables	Liability Ratio	DAR	Total liability is divided by total assets.
	Firm Size	FS	Natural log of total assets.
	Firm Age	FA	Number of years since incorporation.

3.2 Empirical Analysis and Discussion

3.2.1 Descriptive Analysis

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	495	1.3	2.1	0.0	9.9
R&D	495	2.1	2.2	0.0	9.9
FS	495	17.1	2.5	12.6	23.7
FA	495	37.3	14.8	8.0	71.0
DAR	495	0.2	0.2	0.0	0.9

Descriptive statistics analysis uncovers the fundamental patterns and variability of the examined variables. The standard deviation of 2.1 indicates significant variety in profitability, while the average return on assets (ROA) is recorded at 1.3%, demonstrating a moderate level of profitability among the firms. The average expenditure on research and development (R&D) represents 2.1% of total sales, with a standard deviation 2.2, signifying substantial variability across various organizations. The natural logarithm of total assets reveals that the average firm size (FS) is 17.1, ranging from 12.6 to 23.7. The firm age (FA) in the dataset comprises organizations aged between 8 and 71 years, with a mean age of 37.3 years, demonstrating a varied mix of younger and older entities. Some organizations function entirely without debt (Minimum = 0), while others display varying degrees of leverage (Maximum = 0.9). The sample demonstrates a moderate level of leverage, indicated by an average debt-to-asset ratio (DAR) of 0.2. Descriptive statistics demonstrate the influence of business characteristics on R&D activities and overall firm performance.

Correlation

Table 3. Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)
(1) ROA	1.00				
(2) R&D	0.16 (.000)	1.00			
(3) FS	-0.43 (.000)	-0.32 (.000)	1.00		
(4) FA	0.07 (.086)	-0.03 (.504)	-0.06 (.155)	1.00	
(5) DAR	0.19 (.000)	0.14 (.001)	-0.42 (.000)	-0.13 (.003)	1.00

The correlation matrix illustrates the relationships among the primary variables of the study. A modest positive correlation (0.162, $p < 0.001$) is observed between research and development expenditures (R&D) and return on assets (ROA), indicating that higher investment in R&D is associated with improved business performance. ROA exhibits a notable negative correlation with firm size (FS) (0.438, $p < 0.001$), indicating that larger firms might experience diminished profitability as a result of inefficiencies or increased operating costs. It has been observed that larger firms tend to allocate fewer resources to research and development (R&D), evidenced by an inverse correlation with Firm Size (FS) of -0.329 ($p < 0.001$). Established corporations frequently achieve greater profits with minimal investment in research and development. Firm age (FA) exhibits a weak positive relationship with return on assets (0.077, $p = 0.086$) and a weak negative association with R&D (-0.030, $p = 0.504$). Firms that utilize leverage demonstrate superior performance and allocate greater resources to research and development. The debt-to-asset ratio (DAR) shows a positive correlation with ROA (0.198, $p < 0.001$) and R&D (0.140, $p = 0.001$). The relationship between research and development and a firm's success is significantly influenced by the size and age of the company, while leverage appears to have no impact.

3.2.2 Baseline Regression

A regression analysis in STATA is performed to evaluate the impact of the independent variable on the dependent variable. The variable being influenced or measured in this investigation is research and development (R&D). The effect of additional variables influences the connection between dependent and independent variables. The regression analysis results are comprehensively outlined in Table 4. The current assessments examine the relationship between corporate innovation and organizational performance. Corporate innovation is represented by a singular indicator, research and development (R&D), whereas company performance is measured through return on assets (ROA). Furthermore, a range of standard control variables has been incorporated. The table presented here demonstrates the outcomes of ROA concerning R&D activities.

Table 4. Baseline Regression

Variables	Co-efficient	T-Values	P-Values
R&D	0.06	4.95	.000
FS	-0.04	-8.81	.000
FA	0.00	1.72	.061
DAR	0.00	0.14	.880
Observations	495		
R-squared	0.44		
Industry FE	Yes		

Year FE	Yes		

The baseline regression results reveal a notable relationship between investment in research and development and overall corporate performance. A statistically significant positive coefficient of 0.061 ($p < 0.001$) for research and development (R&D) indicates a correlation between increased R&D investment and improved business performance. The data supports the theoretical assertion that improving profitability through innovation leads to greater efficiency and competitiveness. The findings indicate that business size (FS) has a notable negative effect (-0.04, $p < 0.001$). This indicates that larger organizations face inefficiencies that diminish the advantages of their research and development investments. Firm age (FA) shows a moderately positive effect (0.008, $p = 0.061$), while the debt-to-asset ratio (DAR) reveals no significant impact. We also control for year and industry to remove biasedness. The findings validate the hypothesis and underscore the significance of innovation in boosting profitability, confirming that research and development is an essential component of business performance.

3.3 Robustness Tests

A typical exercise in empirical studies is "robustness analysis," the researcher examines how specific "basic" estimates of the coefficient of change work as a specification of change or change by adding or removing repressors. If the coefficients are reliable and robust, they are often interpreted as proof of structural validity. Here, we study when and how structural validity can be considered based on the coefficient of strength and reliability. As we have shown, there are many pitfalls because routine strength tests are not required as sufficient evidence for structural validity. Stability tests can be wholly uninformative or completely misleading if not done correctly. The robustness test is used to evaluate the strength of the statistical model. In other words, it evaluates the impact of medication on repressors in the overall model.

Moreover, the robustness test includes changes in error and resistance, which is the desired input if the environment is changed or modified. Quantitative research results differ in different states and environments, so errors are expected. It is the prime reason for performing robustness tests besides correlation and regression.

3.4 Alternative Variable Measurements

We alter the measurement of some variables. We will measure firm performance by Return on Equity (ROE), calculated as net income divided by total equity. For the research and development expenditures (R&D), we used measuring tools such as annual R&D amount divided by total assets, which is an alternate approach to assess the robustness of our regression results.

$$ROE_{it} = \beta_0 + \beta_1 R\&D_{it} + \beta_2 FS_{it} + \beta_3 FA_{it} + \beta_4 DAR_{it} + Industry\ Fixed\ Effect + Year\ Fixed\ Effect + \varepsilon_{it} \quad \text{(eq.2)}$$

Table 5. Alternative Variable Measurements for the Dependent Variable ROE

Variables	Co-efficient	T-Values	P-Values
R&D	0.01	17.90	.000
FS	-0.19	-5.99	.000
FA	0.01	1.87	.06
DAR	0.00	0.14	.890
Observations	495		
R-squared	0.515		
Industry FE	Yes		
Year FE	Yes		

Table 5 presents the results of a robustness test that employs an alternative measurement. The findings suggest a notable positive correlation between organizational performance and investment in

research and development. The findings support this theory, as R&D shows a positive and highly significant coefficient (0.015, $p < 0.001$), suggesting that an increase in ROE is linked to greater R&D investment. The results correspond with the outcomes of the initial regression analysis, thereby strengthening the idea that R&D influences company performance—now assessed in terms of shareholder returns rather than asset efficiency. Firm age (FA) demonstrates a slightly positive effect (0.008, $p = 0.06$), while firm size (FS) continues to have a notable negative effect (-0.19, $p = 0.001$). It suggests that larger enterprises face difficulties in achieving profitability. The model exhibits a strong fit, explaining 51.5% of the variance in ROE (R-squared = 0.515). We also control for year and industry to remove biasedness. The robustness test supports the premise by showing that R&D improves firm performance across different performance metrics, thus validating the baseline regression findings.

3.5 Heterogeneity Test

Heterogeneity within a dataset refers to the variability in the relationships between variables across different groupings. This study employs two unique subgroups categorized by firm age (FA) to address heterogeneity: firms older than 37 years and those 37 years or younger. This distinction enables us to assess whether the influence of research and development on company success, given the return on assets, varies between new and old enterprises.

Table 6 Subgroup Analysis

Firms Age >37 (a)				Firms Age <=37 (b)		
Variables	**Co-efficient**	**T-Values**	**P-Values**	**Co-efficient**	**T-Values**	**P-Values**
R&D	-0.04	-2.69	.090	0.07	1.37	.171
FS	-0.37	-5.53	.000	-0.32	-6.52	.000
FA	0.00	0.38	.706	0.02	1.32	.180
DAR	0.13	0.20	.843	0.12	0.26	.792
Observations	211			284		
R-squared	0.19			0.20		
Industry FE	Yes			Yes		
Year FE	Yes			Yes		

When comparing younger and older companies, the subgroups based on company age show notable disparities in the causal link between R&D and firm performance (ROA). The analysis indicated a negative, albeit somewhat significant, impact of R&D on ROA (-0.044, $p = 0.09$) for firms that have been in operation for over 37 years (Table 6). This indicates that investments in research and development may not produce instant economic advantages for more established firms, possibly because of inefficiencies or a more gradual approach to adopting innovation. On the other hand, the analysis indicates a positive but statistically weak correlation between ROA (0.07, $p = 0.17$) for firms that are 37 years old or younger (Table 6), suggests that younger firms may derive greater benefits from R&D. However, the effect is insufficient to be definitive. In both groupings, firm size (FS) shows a notable negative effect on return on assets (ROA), indicating that larger companies often reveal diminished profitability irrespective of age. We also control for year and industry to remove biasedness. The results indicate that a firm's age affects the connection between innovation efforts and overall performance; younger companies may experience more significant advantages from their innovative activities. This variability underscores the necessity of considering firm-specific factors when evaluating the influence of R&D on company performance.

4. Conclusion

This study investigates the relationship between corporate performance and R&D expenditures within Pakistan's textile industry, utilizing return on assets (ROA) as a key metric. This study analyzes data from 55 textile companies listed on the Pakistani Stock Exchange (PSX) from 2010 to 2018, emphasizing the significant impact of research and development (R&D) on corporate performance and providing important insights for policymakers, investors, and managers.

Allocating resources to research and development significantly enhances organizational performance. An increase of 1% in R&D intensity leads to a 0.061% rise in return on assets, highlighting the profitability advantages linked to innovation. The impact varies based on the company's age: younger firms (under 37 years) show a modest positive relationship between R&D and ROA. In comparison, older firms (over 37 years) generally face a decrease in ROA, which may be linked to inefficiencies or a diminished ability to adapt to innovation. The decline in profitability seen in larger companies indicates potential operational challenges. The findings highlight the importance of implementing specific policies, including tax incentives, subsidies, and government grants, to boost R&D spending, especially in small and medium-sized enterprises. Alongside awareness campaigns, partnerships between textile companies, educational institutions, and research laboratories can significantly boost global competitiveness in the industry and promote innovation. The results support signal theory, indicating that innovation improves corporate competitiveness and performance.

The emphasis on Pakistan's textile industry restricts the broader applicability of the study, even though it offers significant insights. Future studies could broaden to include more sectors or countries and integrate additional measures of innovation, such as patents and product development, to enhance comprehension. Moreover, although the age of a company is important, further investigation is necessary to clarify the connection between R&D and performance, especially considering industry trends and external market factors. Addressing these limitations could improve understanding of how innovation impacts organizational performance in different settings.

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