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Technology, Innovation, and Gender Diversity: Determinants of Performance in South American Manufacturing Firms

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Abstract

This study investigates the relationships between technological strategies, technological innovation, women managers, and firm performance in South American manufacturing firms. Using a dataset comprising 1,712 manufacturing firms from seven South American countries in 2017, the study employs Ordinary Least Squares (OLS) regression analysis to test the proposed hypotheses. The findings reveal that both internal research and development (R&D) activities and technology licensing are positively associated with firm performance, highlighting the importance of combining internal and external knowledge sources to enhance competitiveness. Regarding innovation outcomes, product innovation demonstrates a positive relationship with profitability, whereas process innovation does not exhibit a significant direct association with firm performance. The results further indicate that firms with a higher presence of women in middle management positions tend to achieve superior performance outcomes, while the presence of female top managers does not show a significant positive effect. These findings suggest that balanced innovation strategies and inclusive managerial structures play an important role in improving organizational performance in emerging economies. The study contributes to the strategic management and innovation literature by providing evidence on the complementary effects of technological strategies, distinguishing the performance implications of product and process innovation, and offering new insights into how gender diversity at different managerial levels is associated with firm performance in South American manufacturing firms.

Keywords: Technological Strategies; Product Innovation; Process Innovation; Women Managers; Firm Performance

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1. Introduction

Technological upgrading has increasingly become a strategic priority for firms operating in emerging economies, as sustainable performance is largely determined by their capacity to create, acquire, and utilize knowledge effectively (Cirera & Muzi, 2020). In Latin America, where manufacturing represents one of the most important contributors to economic activity, persistent challenges related to productivity and organizational performance are frequently associated with weaknesses in innovation capabilities and knowledge accumulation processes (Economic Commission for Latin America and the Caribbean [ECLAC], 2022). To address these issues, governments across the region have implemented a variety of innovation-support initiatives, including research and development (R&D) incentives, technology transfer programs, and collaborative innovation platforms (Crespi & Zúñiga, 2012). Despite these efforts, evidence regarding their effectiveness remains inconclusive, and their contribution to firm performance is not yet fully understood (Goedhuys & Veugelers, 2012). Given the growing importance of knowledge-intensive competition, understanding how firms formulate technological strategies and how these strategies affect performance outcomes has become increasingly relevant.

Prior studies suggest that firms can pursue innovation through two primary technological strategies: internal knowledge generation through in-house R&D activities and external knowledge acquisition through mechanisms such as technology licensing (Itami & Numagami, 1992; Cassiman & Veugelers, 2006). From the perspective of the knowledge-based view, competitive advantage is derived not only from possessing valuable knowledge resources but also from the ability to integrate, deploy, and exploit those resources effectively (Grant, 2006). Similarly, organizational ambidexterity theory argues that firms can achieve superior outcomes by simultaneously exploring new knowledge while exploiting existing capabilities (Junni et al., 2013). These perspectives imply that Internal R&D and Technology Licensing may function as complementary strategies whose effectiveness depends on organizational and environmental conditions. Nevertheless, empirical evidence remains heavily concentrated in developed economies, providing limited insight into how these relationships operate within emerging-market environments characterized by financial constraints, institutional instability, and limited absorptive capacity (Crespi & Zúñiga, 2012; Elia et al., 2020).

Another important yet underexplored factor in the Latin American context is Gender Diversity within organizations. Although female participation in the labor market has increased across the region, women continue to be underrepresented in managerial and executive positions, particularly at middle- and upper-management levels (Avella et al., 2024). Evidence from developed countries indicates that gender-diverse teams contribute to stronger innovation capabilities, more effective problem-solving, and improved organizational performance (García-Martínez et al., 2017). However, empirical research examining these relationships in Latin America remains limited, especially regarding the distinct effects of female representation across different managerial hierarchies. Women occupying leadership positions may influence technological adoption and innovation management by shaping strategic priorities and fostering more collaborative and inclusive organizational environments (Wu et al., 2022). As firms in Latin America face increasing competitive pressures, understanding the strategic value of Gender Diversity becomes essential for explaining differences in Firm Performance and developing more comprehensive frameworks of competitiveness in emerging economies.

Based on the existing literature, two major research gaps can be identified. First, most studies examining Internal R&D and Technology Licensing focus on large firms operating in developed economies (Stettner & Lavie, 2014; Lokshin et al., 2008), providing limited evidence regarding their effects in SMEs within emerging markets. Furthermore, although previous research has consistently linked innovation outputs, particularly Product

Innovation, to Firm Performance (Cho & Pucik, 2005; Kendall et al., 2010), relatively few studies have simultaneously evaluated the distinct contributions of Product Innovation and Process Innovation to organizational performance.

Second, the role of Gender Diversity remains largely overlooked in studies investigating technological strategies and innovation-related performance outcomes. Emerging evidence suggests that managerial gender composition can influence innovation performance through its effects on team interactions, strategic decision-making, and risk-taking behavior (García-Martínez et al., 2017; Moreno-Gómez et al., 2018). In emerging regions such as Latin America, where gender inequalities remain prevalent and institutional support mechanisms are relatively weak (Avella et al., 2024), understanding how Gender Diversity shapes innovation and performance outcomes is particularly important, yet remains insufficiently explored.

Addressing these gaps is crucial for advancing knowledge regarding the determinants of Firm Performance and for providing insights relevant to both policymakers and business leaders operating in environments where innovation constraints remain significant. Accordingly, this study seeks to answer two key research questions. First, how are different technological strategies, namely Internal R&D and Technology Licensing, as well as technological innovations represented by Product Innovation and Process Innovation, associated with the performance of manufacturing firms in South America? Second, how does Gender Diversity within top management teams independently influence Firm Performance beyond the effects of technological strategies and innovation activities?

To address these questions, the study utilizes firm-level data collected in 2017 from manufacturing firms located across seven South American countries. The results obtained from Ordinary Least Squares (OLS) regression analyses provide several important findings. First, both Internal R&D and Technology Licensing are positively associated with Firm Performance, supporting the argument that a combined "make-and-buy" knowledge strategy can be beneficial for firms operating under resource limitations and environmental uncertainty (Junni et al., 2013). Second, Product Innovation emerges as the only innovation type that demonstrates a consistent positive relationship with firms' profitability levels. In contrast, Process Innovation does not exhibit a significant direct association with Firm Performance, suggesting potential challenges in implementation or commercialization, a finding consistent with previous studies conducted in emerging economies (Goedhuys & Veugelers, 2012). Finally, the presence of women in middle-management positions is positively related to Firm Performance, contributing to the growing debate regarding the strategic and organizational implications of workforce composition (Lafuente & Vaillant, 2019).

This study contributes to the strategic management literature in three important ways. First, it enhances understanding of how South American firms employ technological strategies to improve organizational performance. Second, it extends prior empirical research by distinguishing the performance implications of Product Innovation and Process Innovation. Third, it introduces Gender Diversity within managerial teams as an important contextual factor influencing the relationship between technological strategies, innovation activities, and Firm Performance. The analysis is based on a sample of 1,712 manufacturing firms of different sizes, including small, medium-sized, and large firms, across seven South American countries. Consequently, the proposed hypotheses are developed for manufacturing firms in general, while additional analyses are conducted separately for SMEs and large firms to account for potential heterogeneity related to firm size.

2. Materials and Methods

Technological capability has become a critical determinant of competitiveness and sustainable growth among manufacturing firms, particularly in emerging economies

where firms often face resource limitations, institutional constraints, and rapidly changing market conditions. Drawing upon the Knowledge-Based View (KBV), firms generate superior performance when they effectively create, acquire, integrate, and exploit valuable knowledge resources (Grant, 2006). In this perspective, technological strategies represent mechanisms through which firms enhance their knowledge base and develop competitive capabilities. Organizational Ambidexterity Theory further suggests that firms achieve superior outcomes when they simultaneously explore new knowledge and exploit existing competencies (Junni et al., 2013). Internal research and development (R&D) activities represent the exploration of internally generated knowledge, whereas technology licensing allows firms to access and exploit external knowledge resources developed by other organizations.

Previous studies have consistently identified internal R&D as a major driver of technological advancement and firm performance (Crepon et al., 1998; Conte & Vivarelli, 2014). Through continuous investment in research activities, firms can generate proprietary knowledge, develop new technologies, and strengthen their innovation capabilities. Similarly, technology licensing provides access to advanced technologies and specialized knowledge that may be difficult or costly to develop internally (Becker & Dietz, 2004; Fey & Birkinshaw, 2005). Accessing external technological resources may complement internal capabilities and accelerate organizational learning, ultimately contributing to superior firm performance. Based on these arguments, this study proposes that internal R&D activities and technology licensing are positively associated with firm performance.

Technological innovation represents another important mechanism through which firms transform knowledge into economic value. According to the Oslo Manual (OECD & EUROSTAT, 2018), technological innovation encompasses both product innovation and process innovation. Product innovation refers to the introduction of new or significantly improved goods and services, whereas process innovation relates to improvements in production methods, operational procedures, and business processes. Existing literature indicates that innovation enhances organizational competitiveness by enabling firms to satisfy customer needs, differentiate their offerings, and improve operational efficiency (Cho & Pucik, 2005; Crespi & Zúñiga, 2012). Product innovation has frequently been associated with increased sales growth and profitability, while process innovation contributes to efficiency gains and cost reductions. Therefore, both forms of innovation are expected to contribute positively to firm performance.

In addition to technological factors, this study considers gender diversity in managerial positions as an important organizational characteristic influencing firm outcomes. Drawing upon the Resource-Based View (RBV), workforce diversity constitutes a strategic resource capable of enhancing organizational effectiveness through the integration of diverse perspectives, experiences, and problem-solving approaches. Previous studies have shown that female participation in managerial positions contributes to improved innovation, decision quality, and organizational performance (Chowdhury et al., 2024; Gligor et al., 2024). Female leaders often promote collaborative leadership styles, encourage knowledge sharing, and foster inclusive organizational cultures that support innovation and adaptability. Accordingly, both women in top management positions and women in middle management roles are expected to positively influence firm performance.

Based on the theoretical arguments and empirical evidence discussed above, the following hypotheses were formulated:

H1a: Internal R&D activities are positively associated with firm performance.

H1b: Technology licensing is positively associated with firm performance.

H2a: Product innovation is positively associated with firm performance.

H2b: Process innovation is positively associated with firm performance.

H3a: The presence of women in top management positions is positively associated with firm performance.

H3b: The presence of women in middle management positions is positively associated with firm performance.

This study utilized secondary data obtained from the World Bank Enterprise Survey (WBES) conducted in 2017. The WBES provides comprehensive firm-level information collected through structured interviews with business owners and senior managers regarding operational activities, innovation practices, business performance, and organizational characteristics. The final sample consisted of 1,712 manufacturing firms operating across seven South American countries, namely Argentina, Bolivia, Colombia, Ecuador, Paraguay, Peru, and Uruguay. The sample included firms of various sizes, ranging from small and medium-sized enterprises (SMEs) to large manufacturing organizations. These countries represent a significant proportion of South America's economic activity and industrial output, providing a suitable context for examining the relationship between technological strategies, innovation, gender diversity, and firm performance.

Table 1. Sample Characteristics

Country	Total	%	R&D (%)	Licensed Technologies (%)	Product Innovation (%)	Process Innovation (%)	Women in Top Management (%)
Argentina	475	28.07	24.63	11.58	50.94	38.11	8.63
Bolivia	87	5.14	35.63	35.63	72.41	52.87	14.94
Colombia	468	27.66	36.32	13.03	71.58	57.69	23.07
Ecuador	88	5.20	40.90	22.73	88.64	59.09	15.91
Paraguay	71	4.20	23.94	12.68	61.97	39.44	18.31
Peru	443	26.18	33.86	9.93	75.17	60.05	17.83
Uruguay	60	3.54	33.33	16.67	83.33	61.67	11.67
Total	**1,712**	**100.00**	**31.97**	**13.59**	**67.67**	**52.01**	**16.25**

Firm performance was measured using two indicators available in the WBES database, namely total annual sales and annual profits. Both measures were transformed using logarithmic values to reduce data skewness and improve model estimation. Consistent with prior studies conducted in emerging economies, sales and profits were considered appropriate proxies for evaluating organizational performance.

The independent variables consisted of three groups. The first group represented technological strategies, including Internal R&D and Technology Licensing. Internal R&D was measured as a binary variable indicating whether a firm invested in formal research and development activities during the previous fiscal year. Technology Licensing was measured as a binary variable indicating whether the firm used licensed technology acquired from foreign-owned organizations.

The second group represented technological innovation activities, consisting of Product Innovation and Process Innovation. Product Innovation was measured based on

whether the firm introduced new or significantly improved products or services during the previous three years. Process Innovation was measured based on whether the firm implemented new or significantly improved operational processes during the same period. Both variables were coded as dichotomous indicators.

The third group captured gender diversity in managerial positions. Women Top Manager was measured as a binary variable indicating whether the highest-ranking manager of the firm was female. Women Middle Manager was measured using the number of permanent female non-production employees occupying managerial, administrative, or supervisory positions within the organization.

To improve the robustness of the analysis, several control variables were included. Firm Age was measured as the logarithm of the number of years since the firm's establishment, while Firm Size was measured as the logarithm of the total number of permanent employees. Country dummy variables were also incorporated to account for institutional and economic differences across the seven South American countries included in the sample.

Table 2. Variable Definitions and Measurements

Variable	Definition	Abbreviation	Scale
Dependent Variables			
Sales	Total annual sales in the last fiscal year (2017), measured in constant US dollar values	S	Logarithmic
Profits	Total annual sales minus total costs in the last fiscal year (2017), measured in constant US dollar values	PF	Logarithmic
Independent Variables			
Internal R&D Activities	A value of 1 indicates that the firm invested in formal research and development activities during the last fiscal year; 0 otherwise	R&D	Dichotomous
Licensed Technology	A value of 1 indicates that the firm used licensed technology from external sources during the last fiscal year; 0 otherwise	LT	Dichotomous

Variable	Definition	Abbreviation	Scale
Product Innovation	A value of 1 indicates that the firm introduced new or significantly improved products or services during the previous three years; 0 otherwise	PRODIN	Dichotomous
Process Innovation	A value of 1 indicates that the firm introduced new or significantly improved production or operational processes during the previous three years; 0 otherwise	PROCIN	Dichotomous
Women in Top Management	A value of 1 indicates that the firm's top manager is female; 0 otherwise	WTM	Dichotomous
Women in Middle Management	Number of permanent full-time female non-production employees (e.g., managers, administrative staff, and sales personnel)	WMM	Logarithmic
Control Variables			
Firm Age	Number of years since the firm's establishment (excluding firms younger than three years)	AGE	Logarithmic
Firm Size	Number of permanent full-time employees	SIZE	Logarithmic
Country	South American country in which the firm operates	C	Dichotomous

To examine the proposed relationships, Ordinary Least Squares (OLS) regression analysis was employed. OLS regression was selected because it enables the estimation of the relationships between technological strategies, innovation activities, gender diversity,

and firm performance while controlling for firm-specific and country-level characteristics. All statistical analyses were conducted using R software.

The empirical model is specified as follows:

$$Y_i = \beta_0 + \beta_1 R\&D_i + \beta_2 LT_i + \beta_3 PRODIN_i + \beta_4 PROCIN_i + \beta_5 WTM_i + \beta_6 WMM_i + \beta_7 AGE_i + \beta_8 SIZE_i + C_i + \varepsilon_i \quad (1)$$

where Yi represents firm performance, measured by annual sales and profits. R&Di refers to a firm's investment in internal research and development activities, while LTi denotes the use of licensed technologies acquired from external sources. PRODINi represents product innovation, and PROCINi represents process innovation. WTMi indicates the presence of a woman in a top management position, whereas WMMi reflects the presence of women in middle management roles. AGEi and SIZEi are control variables representing firm age and firm size, respectively. Ci denotes country fixed effects included to capture institutional differences across countries, and εi represents the random error term. This model enables the examination of the individual effects of technological strategies, technological innovation, and managerial gender diversity on the performance of manufacturing firms in South America while controlling for firm-specific and country-level characteristics.

3. Results and Discussion

3.1 Descriptive Statistics

The descriptive statistics presented in Table 3 indicate that only a relatively small proportion of manufacturing firms invested in technological development activities. Approximately 32% of the sampled firms reported expenditures on internal research and development (R&D), while only 14% adopted licensed technologies obtained from external sources. In contrast, innovation activities were more widespread across the sample, with 68% of firms introducing product innovations and 52% implementing process innovations during the observation period. Regarding gender representation in leadership positions, women occupied top management roles in only 16% of the surveyed firms.

Table 3. Descriptive Statistics of Dichotomous Variables

Variables	Yes	No
Internal R&D Activities	0.32	0.68
Use of Licensed Technologies	0.14	0.86
Product Innovations	0.68	0.32
Process Innovations	0.52	0.48
Women in Top Management (WTM)	0.16	0.84

Table 4 summarizes the descriptive statistics of the continuous variables included in the study. The results show that firms employed an average of 16.88 women in middle-management positions. Additionally, the average firm had approximately 122 employees and had been operating for nearly 28 years since its establishment. These findings suggest considerable variation in organizational size, managerial composition, and business maturity among South American manufacturing firms.

Table 4. Summary Statistics of Continuous Variables

Variable	Min.	Max.	Mean	SD	N
Sales	1,436.782	623,229,462	10,823,810	39,026,810	1,712
Profits	88.279	255,224,430	4,165,310	20,309,386	1,240

Variable	Min.	Max.	Mean	SD	N
Women in Middle Management (WMM)	0	2,150	16.88	65.61	1,712
Firm Age	2	180	27.90	20.59	1,712
Firm Size	3	6,500	122.02	323.93	1,712

To further examine the relationships among the study variables, Table 5 presents the Spearman correlation matrix. Spearman's correlation coefficients were selected because several variables were measured as binary indicators and did not satisfy the assumption of normal distribution. The results reveal generally weak to moderate correlations among the explanatory variables, indicating that multicollinearity is unlikely to be a major concern. The statistical significance of the coefficients also provides preliminary evidence regarding the associations between technological strategies, innovation activities, gender diversity in management, and firm performance.

Table 5. Spearman Correlation Matrix

Variables	Sales	Profits	R&D	LT	PRODIN	PROCIN	WTM	WMM	AGE	SIZE
Sales	1.000									
Profits	0.89***	1.000								
R&D	0.26***	0.24***	1.000							
LT	0.20***	0.22***	0.18***	1.000						
PRODIN	0.12***	0.18***	0.22***	0.10***	1.000					
PROCIN	0.13***	0.16***	0.24***	0.12***	0.29***	1.000				
WTM	-0.16***	-0.11***	-0.01	-0.04	0.07***	0.01	1.000			
WMM	0.72***	0.67***	0.21***	0.16***	0.14***	0.13***	-0.01	1.000		
AGE	0.33***	0.29***	0.07*	0.05**	0.00	0.00	-0.06***	0.26***	1.000	
SIZE	0.88***	0.79***	0.23***	0.18***	0.12***	0.13***	-0.14***	0.79***	0.34***	1.000

Notes: ***p < 0.01; **p < 0.05; *p < 0.10

4.2 Hypothesis Testing

Table 6. OLS Regression Results for the Full Sample

Variables	Sales (1)	Sales (2)	Sales (3)	Profit (4)	Profit (5)	Profit (6)
Intercept	11.0848***	9.4899***	9.7031***	9.1789***	7.7986***	7.8174***
R&D	0.4351***	0.2713***	0.2794***	0.3809***	0.2462***	0.2515***
LT	0.4456***	0.2068***	0.2629***	0.6030***	0.4415***	0.3958***
PRODIN	0.0641	0.0373	0.0518	0.4139***	0.3600***	0.3220***
PROCIN	0.0475	0.0093	0.0139	0.1050	0.0766	0.0540

Variables	Sales (1)	Sales (2)	Sales (3)	Profit (4)	Profit (5)	Profit (6)
WTM	-0.7665***	-0.2819***	-0.2300***	-0.6395***	-0.1711	-0.1808*
WMM	0.9830***	0.0454	0.0687**	1.0136***	0.1931***	0.1969***
AGE	0.3847***	0.1383***	0.1173***	0.3742***	0.1518***	0.1293**
SIZE	–	1.1209***	1.1093***	–	0.9836***	0.9259***
Country Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.5667	0.7659	0.7780	0.5033	0.6246	0.6348
Adjusted R^2	0.5650	0.7648	0.7762	0.5004	0.6221	0.6306
Observations	1,712	1,712	1,712	1,240	1,240	1,240

Notes: ***p < 0.01; **p < 0.05; *p < 0.10.

Table 6 presents the OLS regression results for the full sample of manufacturing firms operating in South America. The findings indicate that both internal R&D activities and technology licensing are positively and significantly associated with firm performance, measured by sales and profits. Internal R&D exhibits a positive and statistically significant relationship across all model specifications, suggesting that firms investing in knowledge creation and technological development tend to achieve superior performance outcomes. Similarly, the use of licensed technologies demonstrates a positive effect on both sales and profits, indicating that external technology acquisition serves as an effective mechanism for enhancing firm competitiveness. These findings provide support for Hypotheses H1a and H1b.

Regarding technological innovation, product innovation shows a positive and significant association with profits, whereas its relationship with sales remains statistically insignificant. In contrast, process innovation does not exhibit a significant relationship with either sales or profits. These results suggest that the introduction of new or improved products contributes to profitability enhancement, while process improvements alone may not immediately generate measurable financial benefits. Consequently, Hypothesis H2a is supported, whereas Hypothesis H2b is not supported.

With respect to gender diversity, women in top management positions demonstrate a negative and significant relationship with firm performance in several model specifications. Therefore, Hypothesis H3a is not supported. Conversely, women in middle management positions are positively associated with both sales and profits, highlighting the important contribution of female middle managers to operational effectiveness and organizational performance. Thus, Hypothesis H3b is supported. Among the control variables, firm age and firm size consistently display positive and significant effects on performance, indicating that older and larger firms tend to achieve better economic outcomes.

Table 7. OLS Regression Results for Large Firms

Variables	Sales (7)	Sales (8)	Sales (9)	Profit (10)	Profit (11)	Profit (12)
Intercept	13.7401***	10.1781***	10.4133***	10.7838***	7.7997***	7.9639***
R&D	0.4230***	0.3156***	0.3294***	0.3283***	0.2636*	0.2521*
LT	0.1020**	0.2233**	0.1843*	0.3940**	0.3532**	0.2969*
PRODIN	0.1239	0.1032	0.1056	0.2438*	0.1835	0.1578
PROCIN	0.0953	0.0596	0.0599	0.1119	0.0747	0.0516

Variables	Sales (7)	Sales (8)	Sales (9)	Profit (10)	Profit (11)	Profit (12)
WTM	-0.3560***	-0.2585*	-0.2302*	-0.1912	-0.0762	-0.1287
WMM	0.3714***	0.0223	0.0399	0.5210***	0.2138***	0.2115***
AGE	0.3153***	0.2288***	0.2043***	0.4845***	0.3926***	0.3564***
SIZE	–	0.9265***	0.8976***	–	0.7982***	0.7572***
Country Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.2609	0.4892	0.5051	0.3194	0.4219	0.4576
Adjusted R^2	0.2496	0.4802	0.4897	0.3061	0.4089	0.4359
Observations	464	464	464	365	365	365

Notes: ***p < 0.01; **p < 0.05; *p < 0.10.

Table 7 reports the regression results for large manufacturing firms. The results reveal that internal R&D remains one of the strongest predictors of firm performance, particularly in terms of sales. This finding suggests that large firms possess greater capabilities to transform R&D investments into market and financial outcomes, likely due to superior absorptive capacity, economies of scale, and greater resource availability. Technology licensing also exhibits a positive relationship with performance, although its effect is generally weaker than that of internal R&D.

Product innovation is positively associated with profitability among large firms, supporting the argument that larger organizations are better positioned to commercialize innovative products and capture financial returns from innovation activities. However, process innovation remains statistically insignificant across most specifications, indicating that process improvements alone are insufficient to generate substantial performance gains. Furthermore, women in top management positions do not contribute positively to performance, whereas women in middle management continue to demonstrate a positive association with firm outcomes. Overall, the findings suggest that large firms primarily benefit from internally generated technological capabilities and successful product innovation initiatives.

Table 8. OLS Regression Results for SMEs

Variables	Sales (13)	Sales (14)	Sales (15)	Profit (16)	Profit (17)	Profit (18)
Intercept	11.4770***	9.5196***	9.8516***	9.8250***	8.1480***	8.1417***
R&D	0.3604***	0.2501***	0.2498***	0.3288***	0.2277**	0.2305*
LT	0.3389***	0.1739*	0.2482***	0.5369***	0.4030**	0.3851*
PRODIN	0.0442	-0.0081	0.0051	0.3245***	0.2716***	0.2590**
PROCIN	-0.0115	-0.0040	0.0184	0.0495	0.0766	0.0466
WTM	-0.6959***	-0.2857**	-0.2108**	-0.5848***	-0.1855	-0.1794
WMM	0.8126***	0.0774*	0.0874*	0.8196***	0.1727**	0.1628**
AGE	0.2699***	0.0941***	0.0638*	0.2101***	0.0482	0.0353
SIZE	–	1.1530***	1.1269***	–	0.9931***	1.0079***

Variables	Sales (13)	Sales (14)	Sales (15)	Profit (16)	Profit (17)	Profit (18)
Country Fixed Effects	No	No	Yes	No	No	Yes
R^2	0.3210	0.5611	0.6031	0.2310	0.3528	0.3687
Adjusted R^2	0.3172	0.5583	0.5986	0.2248	0.3468	0.3584
Observations	1,248	1,248	1,248	875	875	875

Table 8 presents the regression results for SMEs. Unlike large firms, SMEs appear to benefit more strongly from technology licensing than from internal R&D activities. Although internal R&D remains positively associated with performance, the coefficient of licensed technology is generally larger and more significant, indicating that external technology acquisition represents a valuable strategy for overcoming resource constraints and accelerating performance improvements among smaller firms. These findings support the argument that SMEs rely more heavily on external sources of knowledge due to limited internal innovation capabilities.

The results further show that product innovation contributes positively to profitability, while process innovation does not exhibit a significant relationship with either sales or profits. Similar to the full sample and large-firm analyses, process innovation alone appears insufficient to improve financial performance. Regarding gender diversity, women in top management positions remain negatively associated with firm performance, whereas women in middle management positions display a positive and significant relationship with both sales and profits. Notably, the positive effect of women in middle management is stronger among SMEs than among large firms, suggesting that female middle managers play a particularly important role in coordinating operations, facilitating innovation implementation, and supporting organizational performance in smaller firms.

Overall, the comparative analysis across Tables 6–8 indicates that the mechanisms driving firm performance differ according to firm size. Large firms derive greater benefits from internal R&D investments, whereas SMEs obtain stronger performance gains through technology licensing. Product innovation consistently enhances profitability across firm categories, while process innovation shows no significant direct effect on performance. In addition, women in middle management positions emerge as an important driver of firm success, particularly among SMEs, whereas the contribution of women in top management remains limited within the sampled South American manufacturing firms.

4. Conclusions

This study examined the relationships between technological strategies, technological innovation, gender diversity in management, and firm performance among manufacturing firms in South America. Using data from 1,712 firms across seven countries, the findings demonstrate that both internal R&D activities and technology licensing are positively associated with firm performance. However, their relative importance differs according to firm size. Internal R&D shows a stronger association with performance among large firms, whereas technology licensing appears to be more beneficial for SMEs. These findings suggest that firms can enhance their competitiveness by combining internally generated knowledge with externally acquired technological capabilities.

The results further indicate that product innovation contributes positively to firm profitability, while process innovation does not exhibit a significant relationship with performance. This suggests that the commercialization of new products generates more direct economic benefits than improvements in production processes alone. In addition, the study highlights the importance of gender diversity at the managerial level. While the presence of women in top management positions does not show a positive association with firm performance, women in middle-management roles are positively related to both sales and profitability. This finding underscores the strategic contribution of middle managers in implementing technological initiatives and innovation activities within organizations.

Overall, the study contributes to the understanding of how technological strategies, innovation activities, and managerial diversity shape organizational performance in emerging economies. The findings emphasize the importance of balancing internal and external knowledge sources, strengthening product innovation capabilities, and promoting inclusive managerial structures to improve firm competitiveness. These results also provide valuable insights for policymakers and business leaders seeking to foster innovation-driven growth in South American manufacturing industries.

Despite its contributions, this study has several limitations. The analysis is based on cross-sectional survey data, which restricts the ability to establish causal relationships over time. Furthermore, the study focuses exclusively on manufacturing firms in South America, which may limit the generalizability of the findings to other industries or regions. Future research could employ longitudinal data, incorporate additional organizational variables such as corporate governance and human resource practices, and extend the analysis to service industries and other emerging economies to provide a more comprehensive understanding of the determinants of firm performance.

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