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ORIGINAL SCIENTIFIC PAPER

Technological innovation versus Gender Equality: Perspectives in the Dairy Sector

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A B S T R A C T

Women remain significantly underrepresented in the leadership of agricultural organizations. Simultaneously, increasing environmental pressures and global efforts to achieve the Sustainable Development Goals (SDGs) create new opportunities to restructure agribusiness operations and promote women's leadership. This study analyzes data from over five hundred dairy enterprises in the Visegrad Group countries (Czech Republic, Hungary, Poland, and Slovakia, sourced through ORBIS) to identify management features that foster female leadership within this European context. Principal Component Analysis revealed that a higher number of female directors and shareholders is associated with enhanced women's leadership. These features are most common in medium-sized enterprises. In contrast to these findings, current EU initiatives promoting gender equality in European agriculture target start-ups and small businesses. However, statistical analysis indicates that leadership in small enterprises is less strongly influenced by gender dynamics. Meanwhile, emerging innovations in dairy production could further strengthen larger companies, potentially diminishing the

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role of women-led smaller enterprises. To counterbalance this shift, future policies should actively promote gender diversity in corporate boards to ensure equitable leadership opportunities across all business sizes while simultaneously strengthening support for small businesses, regardless of gender.

KEYWORDS: *entrepreneurship, gender, innovation, technology, agriculture*

Introduction

Leadership serves as a critical driver of organizational success and societal progress, shaping decision-making, innovation, and economic development (Arici & Uysal, 2022). The intersection of leadership, gender equality, and technological innovation has become increasingly relevant as businesses and policymakers strive to create inclusive and sustainable economies (Al-Qahtani et al., 2022). Women's leadership has been shown to enhance organizational resilience, innovation capacity, and alignment with the Sustainable Development Goals (SDGs) (Kapse et al., 2024; Karali et al., 2024). However, persistent gender disparities, particularly in male-dominated industries such as agriculture, continue to limit women's access to leadership roles and decision-making power (Farhall & Rickards, 2021).

Transformational leadership theory suggests that women leaders, by emphasizing collaboration, ethical decision-making, and innovation, can drive significant organizational change (Popovic-Pantic et al., 2023). In the agricultural sector, where traditional leadership models often reinforce male dominance, transformational leadership could offer a framework for more inclusive governance structures (Greimel et al., 2023). Similarly, feminist economics highlights the structural barriers - such as land ownership and unequal access to resources - that hinder women's participation in agribusiness leadership (Omolekan & Alli, 2020; Vercillo, 2022). Institutional theory further explains how deeply ingrained societal norms and regulatory frameworks perpetuate gender disparities, particularly in male-dominated industries like dairy farming (Midamba & Ouko, 2024). Studies in Cambodia and the Philippines have found that women hold leadership positions in cooperatives, but these roles often come with limitations. Cambodian women leaders struggle to balance farm work with leadership responsibilities, while Filipina leaders are stereotyped into specific roles.

A broader study across Africa shows a similar pattern. While women participate in agricultural organizations, they are underrepresented in

leadership, especially at higher levels. This underrepresentation can be attributed to factors such as lack of land ownership or the organizations themselves not addressing women's specific needs. The study highlights an extreme example in Zimbabwe where women make up three-quarters of the members but only hold five percent of leadership positions (Huot et al., 2023). Disparities exist in Europe as well (Fanelli, 2022), where the transmission of farmland from father to son remains a significant barrier for women (Balezentis et al., 2021). Regenerative agriculture could offer small-scale, environmentally friendly opportunities (for newcomer women), would be beneficial for farmers as well (O'Donoghue et al., 2022). However, among others, the demand for large-scale sustainable production to eliminate poverty (SDG 1), and hunger (SDG 2) and support responsible consumption (SDG 12), the mitigation of greenhouse gas emissions to support climate action (SDG 13), the controlled environment to foster the sustainable water management (SDG 6) suggests a global-scale change in the agriculture, rather than a local one (Zurek et al., 2022). Since the dairy sector is considered one of the most polluting within the agriculture (Cellone et al., 2020), the upcoming (inter)governmentally supported shift is likely to favor innovative technological solutions, which would affect the number and composition of the current market players. Technological transformation within the dairy sector is particularly critical, as it can either exacerbate existing gender disparities or provide opportunities for women-led enterprises (Khan et al., 2021; Islam et al., 2023).

In light of these dynamics, this study is guided by the following research questions:

- How does company size influence the likelihood of female leadership in the dairy sector?
- What is the relationship between company ownership structure and the gender of company directors?
- How might emerging technological and market trends reshape gender dynamics in leadership within the dairy industry?

By addressing these questions, the study aims to explore how structural, organizational, and technological factors intersect to shape gender representation in leadership roles within the dairy industry and put the latest EU project in context through the study of the Central European dairy sector.

The theoretical background is followed by the presentation of the research design and methodology, which describes the analyzed variables of

dairy businesses in the Visegrad Group (V4) countries (Czech Republic, Hungary, Poland, and Slovakia) and outlines the methodologies used for the statistical tests. In the results and discussion section the identified gender differences are highlighted, reflecting the dissimilarities between the businesses of these closely related countries. Company-related variables that are likely to influence women's leadership opportunities in the dairy sector are also examined. The article concludes with a brief description of emerging technological developments and their potential effects on the dairy industry.

Theoretical Background

Understanding gender disparities in leadership within the agricultural sector requires a multidimensional theoretical approach. This study draws upon insights from various theories to frame the investigation of women's roles in the dairy industry amid environmental and market transitions. Feminist economics provides a foundational lens by emphasizing that gender inequalities in economic participation are not merely outcomes of individual choices but are embedded in broader structural and historical contexts (M. Kim, 2023). In agriculture, persistent disparities in land ownership, resource access, and financial capital have systematically limited women's opportunities for leadership and entrepreneurship (Masuku et al., 2023).These structural constraints, although often less visible in formal company data, manifest themselves in the composition of corporate boards, ownership structures, and entrepreneurial activity—dimensions this study seeks to explore through company-level analysis. Simultaneously, institutional theory highlights the role of cultural norms, formal regulations, and organizational practices in reinforcing or challenging gendered structures (Kulkarni et al., 2020). In the context of the V4 countries, where historical legacies and socio-political transitions have shaped gender roles similarly, institutional factors could be particularly salient. Emerging pressures from European Union policies, including ESG disclosure requirements and sustainability initiatives, represent potential institutional shifts that could create more favorable environments for women's leadership. Leadership styles themselves are also important. Transformational leadership theory suggests that leaders who emphasize collaboration, vision, and ethical stewardship are particularly well-suited to drive organizations through periods of transition (Zhu & Huang, 2023).

Research indicates that women leaders often exhibit transformational qualities, which could be especially valuable in the dairy industry's current phase of environmental and market adaptation (Saleem et al., 2024). This theoretical perspective underscores the importance of examining not only the presence of women in leadership roles but also the organizational contexts—such as company size and governance structure—that may enable or constrain transformational leadership practices. Bringing these theoretical strands together, the present study positions the gendered patterns observed in the V4 dairy sector as products of intersecting structural and institutional dynamics. Rather than treating female underrepresentation as a standalone phenomenon, the analysis situates it within broader systems of economic opportunity, cultural expectations, and leadership adaptation.

Research Design and Methodology

This section outlines the research design and methodology employed to investigate gender dynamics in leadership within the dairy industry across the V4 countries. It provides a detailed description of the data sources, the data collection process, and the analytical methods applied.

Contextual Background

The study by Gawel et al., (2024) found a correlation between green transition and female entrepreneurship in agriculture across twenty-three EU member states. The research also highlighted variations among countries. To further explore these differences, this study focuses on the dairy industry of the V4 countries. The member states partly share their history and even cultural background, but lately regarding the Gender Equality Index (EIGE, 2023) they have present different approaches. The current dataset can also be used to verify the differences between the V4 countries highlighted by the study of Gawel et al., (2024). Since, the dairy sector is a significant contributor to agricultural GDP and is heavily influenced by government policies, making it a suitable representative for studying trends in general agriculture (Dhungana et al., 2024). Additionally, the industry faces challenges due to its environmental impact, leading to a transition that could present opportunities for female entrepreneurs (van Selm et al., 2021). This is further supported by the growing focus on gender equality within Environmental, Social, and Governance (ESG) disclosure (Khemakhem et al., 2023).

Data

ORBIS (Orbis Europe, 2024) has proven to be the most suitable database for the comparative analysis of dairy companies in the V4 region. Its advanced industry filtering capabilities and extensive coverage of EU countries make it a valuable resource. ORBIS provides detailed corporate structures and comprehensive information on company leaders, including their names and positions, while also covering solo entrepreneurs. In contrast, other databases, such as Bloomberg Terminal, primarily focus on publicly traded companies and financial markets. Although ORBIS is a high-quality data source, some instances of missing data were identified. While various imputation methods could be used to address these gaps, they risk distorting results and failing to ensure accurate representation. Consequently, excluding companies with insufficient data was deemed the most appropriate approach to maintain data reliability, even though this may influence the study's conclusions. As mostly small businesses were affected, they are less represented in the research, and the conclusions regarding them may therefore be less accurate. It is important to note that the current sample cannot be considered representative. The data was collected between 13 February 2024. and 6 March 2024, and it contains the latest available financial (2022) and management-related information connected to the studied variables (presented in Table 1). In total, five hundred and eighty-two companies were analyzed: seventy Czech, one hundred and twenty-nine Hungarian, two hundred and ninety-three Polish, and ninety Slovakian.

Table 1: The studied variables

Company	**Leadership**
Country	Number of board members
Founded	Number of females within board members
Profit after tax	Number of males within board members
Number of employees	Number of shareholders
Number of subsidiaries	Chairman of the board
	Working days

Source: Authors' elaboration, 2025

Statistical Methods

Prior to statistical analysis, the normality of the data was evaluated using the Shapiro-Wilk and Kolmogorov-Smirnov tests. This step ensured the selection of appropriate statistical methods for subsequent analyses. The Kolmogorov-Smirnov test is a statistical tool used to compare the distributions of two groups, regardless of whether they follow a specific pattern (Berger & Zhou, 2014). The Shapiro-Wilk test is a nonparametric method to analyze the variables' distribution, which doesn't require any specific assumptions about the data's distribution (Hanusz et al., 2016). Since both of the tests indicated that the data was not normally distributed, the requirements for using one-way ANOVA test were not met (T. K. Kim, 2017). The Mann-Whitney U test was used to compare the distributions of two independent groups, regardless of whether they follow a specific pattern, based on the ranks assigned to the data points within the combined groups (MacFarland & Yates, 2016). Principal Component Analysis (PCA) was used to transform the related variables in the dataset. This multivariate statistical procedure reduces the number of dimensions in the data by "compressing" it into fewer variables than the original, while the fewer factors contain nearly the same amount of data (Kherif & Latypova, 2020). Before running it, some conditions had to be checked. One of them is the correlation matrix, which shows the correlation between variables in the database. The other is the anti-image matrix which decomposes the variables into explained and unexplained squares of variance. The elements outside the diagonal represent the fraction of variance that is not dependent on the other variables, therefore, they should have low values in these positions (Shlens, 2014). The run of Bartlett's test is also important. It tests whether the deviation of values outside the main diagonal from zero is random (Aslam, 2020). The Kaiser-Meyer-Olkin (KMO) criterion should be used too, to measure the suitability of variables for factor analysis (Rojas-Valverde et al., 2020).

Results and Discussion

To reveal the hypothetical dissimilarities between the clusters one-way ANOVA or the Student's t-test was planned to be used. However, as the Kolmogorov-Smirnov and the Shapiro-Wilk tests showed a lack of normal distribution in the dataset, alternative methods were necessary. The Mann-Whitney U test and the Kruskal-Wallis test could be considered as ideal

nonparametric alternatives to the one-way ANOVA since they are not sensitive to violations of normality. The suitability of the dataset was first assessed to determine whether it met the assumptions of the test. The variables met the assumptions required for the Mann-Whitney U Test. The independence of observations was ensured, as group members' values were not dependent on each other. While Q-Q plots indicated some outliers, these were considered valid data points rather than errors resulting from data collection. To address potential distortions caused by differences in sample sizes, the analysis was conducted within countries rather than across countries.

First, the share of women-led companies was identified within the dairy sector of the V4 countries. The results showed that the highest number of women directors was found in Hungary, and the lowest in the Czech Republic. The analysis of business-related variables revealed that, in most cases, there was no significant difference between the age of the company and whether it was run by a man or a woman, except in the Czech Republic, where older companies tended to be run by men.

Table 2: The age of the company and the gender of the Chairman

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
Slovakia	The distribution of old company (years) is the same across categories of Chairman of the Board.	Independent-Samples Mann-Whitney U Test	0.958	Retain the null hypothesis.
Hungary			0.55	Retain the null hypothesis.
Czech Republic			0.010	Reject the null hypothesis.
Poland			0.098	Retain the null hypothesis.

Source: Authors' elaboration, 2025

In relation to the number of employees, companies with more employees were more likely to be managed by men in Hungary and Poland. At the same time, no significant difference related to this variable was found in businesses located in Slovakia and the Czech Republic.

Table 3: The number of employees and the gender of the Chairman

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
Slovakia	The distribution of Number of employees is the same across categories of Chairman of the Board.	Independent-Samples Mann-Whitney U Test	0.872	Retain the null hypothesis.
Hungary			0.025	Reject the null hypothesis.
Czech Republic			0.183	Retain the null hypothesis.
Poland			0.045	Reject the null hypothesis.

Source: Authors' elaboration, 2025

Profit after tax did not show any statistically significant differences among dairy enterprises in any of the V4 member countries.

Table 4: Profit after tax and the gender of the Chairman

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
Slovakia	The distribution of profit after tax is the same across categories of Chairman of the Board.	Independent-Samples Mann-Whitney U Test	0.545	Retain the null hypothesis.
Hungary			0.717	Retain the null hypothesis.
Czech Republic			0.286	Retain the null hypothesis.
Poland			0.436	Retain the null hypothesis.

Source: Authors' elaboration, 2025

A higher number of directors is less favorable for women in Slovakian dairy companies, which supports male leadership. However, in the other three countries, it does not appear to be connected with the gender of the manager.

Table 5: Number of board members and the gender of the Chairman

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
Slovakia	The distribution of Number of board members is the same across categories of Chairman of the Board.	Independent-Samples Mann-Whitney U Test	0.011	Reject the null hypothesis.
Hungary			0.51	Retain the null hypothesis.
Czech Republic			0.226	Retain the null hypothesis.
Poland			0.506	Retain the null hypothesis.

Source: Authors' elaboration, 2025

In each case, except in Slovakia, when the number of female board members was high, the business was more likely to be directed by women. Conversely, when the number of male board members was high, the company was more likely to be managed by men.

Table 6: Number of shareholders and the gender of the Chairman

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
Slovakia	The distribution of number of shareholders is the same across categories of Chairman of the Board.	Independent-Samples Mann-Whitney U Test	0.947	Retain the null hypothesis.
Hungary			0.078	Retain the null hypothesis.
Czech Republic			0.726	Retain the null hypothesis.
Poland			0.046	Reject the null hypothesis.

Source: Authors' elaboration, 2025

A higher number of shareholders seems to be advantageous for women. In Poland, more women-directed companies were found in cases where there were more shareholders. However, in Slovakia, Hungary, and the Czech Republic, this variable did not differ significantly between companies run by men and those run by women.

Table 7: Number of subsidiary and the gender of the Chairman

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
Slovakia	The distribution of number of subsidiary is the same across categories of Chairman of the Board.	Independent-Samples Mann-Whitney U Test	0.366	Retain the null hypothesis.
Hungary			0.387	Retain the null hypothesis.
Czech Republic			0.975	Retain the null hypothesis.
Poland			0.049	Reject the null hypothesis.

Source: Authors' elaboration, 2025

In general, the number of subsidiaries did not differ significantly within the dairy businesses led by women or men. Although the more subsidiaries a company had, the more likely it was to be directed by men in Poland.

Table 8: Number of working days and the gender of the Chairman

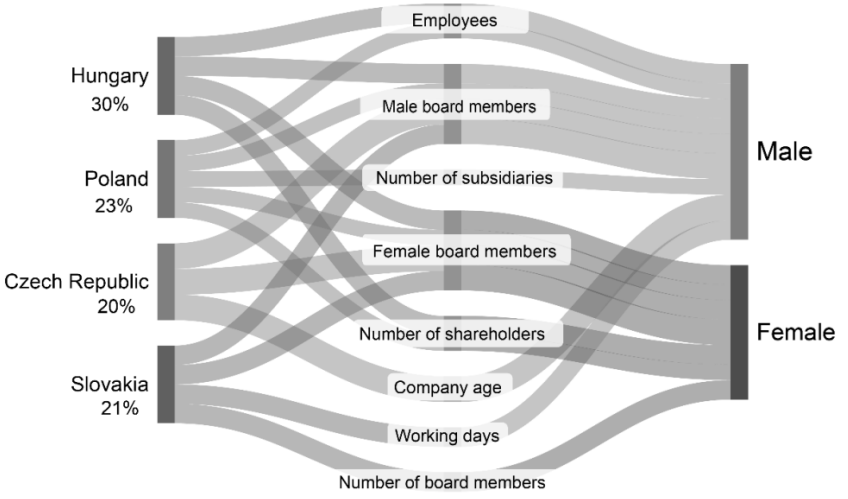
	Hypothesis Test Summary			
	Null Hypothesis	Test	Sig.	Decision
Slovakia	The distribution of days as leader is the same across categories of Chairman of the Board.	Independent-Samples Mann-Whitney U Test	0.012	Reject the null hypothesis.
Hungary			0.904	Retain the null hypothesis.
Czech Republic			0.529	Retain the null hypothesis.
Poland			0.978	Retain the null hypothesis.

Source: Authors' elaboration, 2025

According to the companies analyzed, male directors in Slovakia enjoy the trust of owners for a longer period than female directors. In the other countries, no statistically significant difference was found related to this variable. A summary of these findings is presented in Figure 1.

The highest share of women leaders within the V4 countries could be found in Hungary, which aligns with the study of Gawel et al., (2024), where Hungary was associated with a higher share of female entrepreneurship. Poland belonged to the same cluster, but its supportive environment was far from that of Hungary. In contrast, the Czech Republic had the lowest share, which matches the findings of (Gawel et al., 2024), where a lower number of women leaders was suggested. The work of (Gawel et al., 2024) did not analyze Slovakia, however, the given case suggests, just like in the Czech Republic the number of female entrepreneurs is low.

Figure 1: Share of woman leaders and the business-related variables that could be significantly connected to gender differences



Source: Authors' elaboration, 2025

Note: The higher the value of the variable, the higher the probability of the indicated gender leadership

Through the run of Principal Component Analysis, various business sizes could be outlined, which probably influence the gender of the director. The run of the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and the Bartlett test, in addition to the creation of correlation and anti-image matrixes, showed that the sample could be used for PCA. To identify the ideal component number, the Kaiser's rule was used. The eigenvalues showed (Table 9), that three factors should be defined to appropriately

characterize well the analyzed businesses since their eigenvalues are greater than one. With these, over sixty-five percent of the variance could be explained.

Table 9: Principal component analysis of business-related variables

	Initial Eigenvalues		
Component	**Total**	**% of Variance**	**Cumulative %**
1	3.092	38.653	38.653
2	1.165	14.562	53.215
3	1.011	12.641	65.856
4	0.942	11.775	
5	0.679	8.486	
6	0.609	7.611	
7	0.502	6.272	
8	1.892E-15	2.365E-14	

Source: Authors' elaboration, 2025

The factor loads of the agricultural enterprises' variables highlighted the markedly different approach to the gender of the director according to the possible characteristics of the company (Table 10).

Table 10: The new components and the factor load of the company-related variables

	Small Business	**Medium Business**	**Large Business**
Company's age	0.192	-0.196	0.688
Number of employees	-0.013	-0.154	0.667
Number of directors	-0.076	0.087	0.917
Number of female directors	0.082	0.755	0.307
Number of male directors	-0.127	-0.291	0.863
Number of shareholders	0.185	0.626	0.145
Number of subsidiaries	0.462	0.024	0.604
Working days	0.835	-0.220	-0.329

Source: Authors' elaboration, 2025

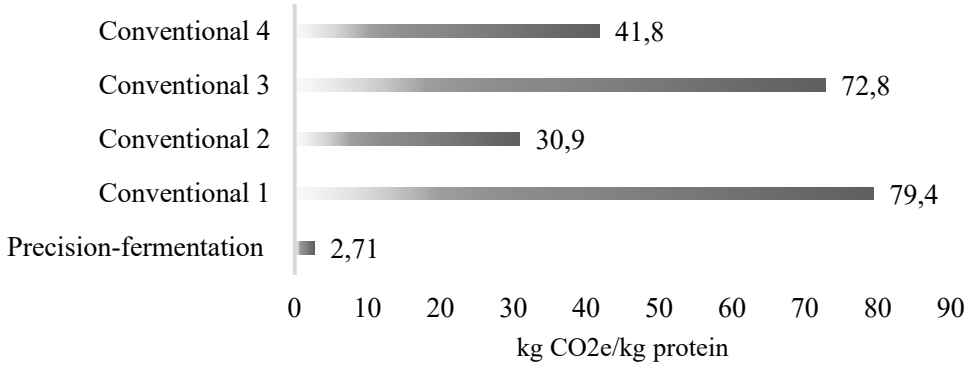
Businesses with a longer history (age), a high number of employees, directors, and subsidiaries are typically large nationwide or even internationally operating companies that are run by male-dominated boards, a trend widely documented in corporate governance research (Li & Chen, 2018). These enterprises are more likely to be directed by men due to entrenched gender norms and access to leadership networks (Díez-Martín et al., 2024). In contrast, medium-sized enterprises seem to have more shareholders (Beck & Demirguc-Kunt, 2006) which could increase the opportunities for female leadership. This may facilitate women's chance of securing positions not as board members but also as directors (Rastad & Dobson, 2022). However, the relationship between ownership structure and leadership gender composition remains underexplored and may be influenced by additional firm-specific factors (Alshareef, 2024). Small enterprises which are often founded and directed by one person do not face the same leadership competition. Consequently, the founder's access to capital, industry experience, and personal networks likely play a more decisive role in leadership than gender alone (Dessein & Prat, 2022). Yet, gender dynamics in small businesses are not entirely neutral, as access to financing and institutional support can still pose challenges for women entrepreneurs (Radhakrishnan & Ping Ho, 2025).

The study of Han et al., (2019) shows similar findings, where the female CEOs' share was the lowest among those companies that have one hundred eighty-two or more employees. The same work highlighted the lowest share of women by businesses older than twelve years. Plenty of studies revealed that the bigger the company, the higher the probability of being led by a man (Bureau for Employers' Activities, 2019). Numerous international studies revealed the gender composition of the board has an effect on the CEO's gender (Dah et al., 2020). In Germany, for instance, women hold only about five percent of board seats in the top 200 companies, reinforcing the trend of male dominance in larger firms (Holst & Kirsch, 2014). Since these large companies often have subsidiaries and extensive market experience, they are also more likely to be led by men (Audretsch & Guenther, 2023). However, further research is needed to understand the role of ownership and governance structures in shaping gender representation in different business sizes. The number of shareholders' potential influence on the gender composition of company boards has not been extensively studied (Rastad & Dobson, 2022). Still, given that founders play a crucial role in decision-making and business growth in micro and small enterprises, their influence could shape gender

representation differently in these firms compared to larger ones (Meressa, 2020).

The underrepresentation of women in leadership has been recognized by the EU, which has launched the "Promoting Gender Equality in European Agriculture" project (European Commission, 2024). This initiative seeks to address intersecting forms of discrimination that disadvantage women in agriculture. However, its primary focus is on fostering gender-inclusive policies for start-ups and smaller businesses rather than addressing structural inequalities in larger firms. At the same time, the latest technological developments in the dairy industry are likely to reshape the current relations. Even though GMOs (genetically modified organisms) are prohibited within the EU, future regulatory changes could alter this stance, potentially introducing efficiency gains and cost reductions on a larger scale (Kavhiza et al., 2022). Other innovations, such as precision fermentation (Chai et al., 2022) and cellular agriculture (Yart et al., 2023) offer alternative dairy production methods that reduce environmental impact (Figure 2). The application of new raw materials, like fungi, legumes, nuts, or seeds, could further transform the industry (Kamath et al., 2022).

Figure 2: Greenhouse gas emissions of protein made by precision-fermentation and conventional method (from milk)



Source: Authors' elaboration, based on Perfect Day (2021), 2025

Note: The various conventional values were measured by other studies

Precision fermentation-derived proteins enable the production of animal-free dairy products with significantly lower greenhouse gas emissions, contributing to sustainability goals (Hilgendorf et al., 2024).

Consumers are increasingly supportive of sustainable alternatives, which could accelerate market shifts (Banovic & Grunert, 2023). Currently, start-ups and smaller firms are pioneering many of these micro-level solutions. These firms can scale through direct market entry, partnerships with established companies, or acquisitions, the latter of which may reshape the industry's competitive landscape. While these innovations may create opportunities for women-led businesses, they could also reinforce existing inequalities if market consolidation favors larger firms. As novel food technologies gain traction, larger enterprises with greater capital and infrastructure may benefit disproportionately, potentially limiting the role of smaller businesses, including those led by women. Thus, while gender diversity in leadership may improve among smaller enterprises, the overall female representation in dairy leadership could decline if market concentration intensifies. Future policy interventions should consider both technological transformation and gender inclusivity to ensure equitable opportunities across different business sizes (Del Baldo, 2022; Wahab, et al., 2022).

Conclusion

Gender equality and environmental sustainability are crucial SDGs that significantly impact the agricultural sector. The dairy industry, a key contributor to agricultural GDP, faces mounting challenges from shifting consumer preferences, the rise of milk substitutes, and increasing scrutiny of traditional dairy production methods. Addressing these challenges presents an opportunity to enhance gender diversity in a historically male-dominated field. Despite the shared historical and cultural background of the V4 countries, their approaches to women's leadership in the dairy sector vary considerably. The findings confirm that Hungary and Poland exhibit a relatively higher share of female directors, while the Czech Republic and Slovakia have fewer women in leadership roles. However, the determinants of gender representation differ across countries. In Hungary, a greater share of women-led businesses exists despite notable structural biases. In contrast, Czech dairy enterprises, which display fewer explicit barriers, still have the lowest proportion of female directors, suggesting the influence of deeper cultural or systemic factors being at play. Company size emerged as a significant determinant of gender representation. Larger, well-established companies with extensive subsidiaries and male-dominated boards are more

likely to be led by men, reinforcing trends observed in corporate governance research. Medium-sized enterprises, characterized by a higher number of shareholders and a more balanced board composition, provide greater opportunities for women in leadership. Small and micro-enterprises, often led by their founders, are less influenced by gender but remain shaped by access to capital and resources. These findings align with broader global research, highlighting persistent gender disparities at the upper levels of corporate hierarchies.

To address these structural imbalances more effectively, the use of softer policy tools could be more successful than rigid quotas. For instance, introducing voluntary gender diversity targets within agricultural business programs could encourage dairy companies to gradually promote female leadership without compromising perceptions of merit-based advancement. Voluntary targets would respect corporate autonomy while setting clear expectations for progress, thus fostering cultural change from within rather than through external enforcement.

Additionally, fostering women's leadership may be better supported through industry-driven initiatives rather than government mandates. Encouraging dairy cooperatives and sectoral organizations to create mentorship and networking opportunities for women entrepreneurs could offer more organic pathways to leadership. By strengthening professional connections and peer support systems, these initiatives can reduce the isolation that many women leaders face, particularly in traditional industries like agriculture. Over time, such community-based efforts could significantly lower informal barriers to women's advancement.

While ESG disclosure requirements offer another avenue for promoting gender diversity, achieving meaningful progress will likely depend on a combination of cultural change, political support, and innovative business practices that prioritize inclusiveness and sustainability.

Naturally, the present study is not without limitations. The sample, though substantial, is not representative. Methodological constraints, such as reliance on cross-sectional data and non-parametric tests, also limit the causal interpretations that can be drawn. Future research could expand the dataset longitudinally to capture trends over time and explore qualitative approaches to better understand the cultural and organizational dynamics behind gender disparities. Broader comparative studies, incorporating additional EU countries or examining different agricultural sectors, could

further enrich the understanding of gender dynamics in the green transition of European agriculture.

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Appendix - Characteristics of the sample

Variable	Subcategory/Range	Count (N)	Percentage (%)
Country	Czech Republic	70	12,0%
	Hungary	129	22,2%
	Poland	293	50,3%
	Slovakia	90	15,5%
Company: Founded (year)	1900-1950	30	5,2%
	1951-2000	195	33,5%
	2001-Present	357	61,3%
Company: Profit After Tax (EUR)	<0	200	34,4%
	0-1M	8	1,4%
	1M-10M	79	13,6%
	10M+	295	50,7%
Company: Number of Employees	1-50	327	56,2%
	51-250	212	36,4%
	251+	43	7,4%
Company: Number of Subsidiaries	0	523	89,9%
	1-5	53	9,1%
	6+	6	1,0%
Leadership: Board Members	1-3	447	76,8%
	4-6	47	8,1%
	7+	88	15,1%
Leadership: Female Board Members	0	313	53,8%
	1	171	29,4%
	2+	98	16,8%
Leadership: Male Board Members	0	93	16,0%
	1	247	42,4%
	2+	242	41,6%
Leadership: Number of Shareholders	1	212	36,4%
	1-5	308	52,9%
	6+	62	10,7%

Variable	**Subcategory/Range**	**Count (N)**	**Percentage (%)**
Leadership: Chairman of Board	Female	107	18,4%
	Male	475	81,6%
Leadership: Working Days	<365	311	53,4%
	365-1095	39	6,7%
	1095+	232	39,9%

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