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ARTÍCULOS

Igualdad de género en el emprendimiento digital: una perspectiva social y educativa

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ES Resumen. Este artículo aborda la influencia del género en el rendimiento financiero de las startups digitales desde una perspectiva social, destacando disparidades y oportunidades en este sector. A través del análisis de datos de la base de datos *Sistema de Análisis y Balances Ibéricos* (SABI), se evalúan indicadores clave como el tamaño de la empresa, la rentabilidad, el apalancamiento y la eficiencia, utilizando técnicas de Propensity Score Matching (PSM) para una comparación justa entre empresas lideradas por hombres y mujeres. El estudio revela desafíos significativos para las empresarias, especialmente en términos del tamaño inicial de la empresa y el acceso a financiamiento. A pesar de estos obstáculos, se observa que las *startups* lideradas por mujeres muestran un sólido rendimiento financiero, enfatizando la importancia de un enfoque controlado para el tamaño de la empresa y otros factores. El artículo destaca que el acceso equitativo a la financiación es crucial para el desarrollo y la competitividad de las mujeres en el ámbito empresarial. Más allá de los aspectos financieros, este artículo se centra en la necesidad de políticas y apoyos financieros que aborden la brecha de género en el emprendimiento digital, resaltando el papel vital de la economía social en la promoción de la igualdad de género. Argumenta a favor de un mejor acceso al crédito y fomenta un ecosistema de apoyo que no solo mejore el éxito de los negocios liderados por mujeres, sino que también contribuya a un entorno emprendedor más inclusivo y equitativo. Este enfoque refuerza la importancia de la economía, desde su perspectiva social, en la creación de un terreno de juego nivelado para todos los emprendedores, independientemente de su género.
Palabras clave. Startups digitales, rendimiento financiero, emprendimiento femenino, Propensity Score Matching, economía social y digital, educación emprendedora.
Claves Econlit. M130, M140, M200, M210.

ENG Gender equality in digital entrepreneurship: a social and educational perspective

ENG Abstract. This article addresses the influence of gender on the financial performance of digital startups from a social perspective, highlighting disparities and opportunities in this sector. Through the analysis of data from the *Sistema de Análisis y Balances Ibéricos* (SABI) database, key indicators such as company size, profitability, leverage, and efficiency are evaluated, employing Propensity Score Matching (PSM) techniques for a fair comparison between male and female-led enterprises. The study reveals significant challenges for female entrepreneurs, especially in terms of initial company size and access to financing. Despite these obstacles, it is observed that startups led by women exhibit robust financial performance, emphasizing the importance of an approach controlled for company size and other factors. The article underscores that equitable access to financing is crucial for the development and competitiveness of women in the business arena. Beyond financial aspects, this article focuses on the need for policies and financial supports that address the gender gap in digital entrepreneurship, highlighting the vital role of the social economy in promoting gender equality. It argues for improved access to credit and fostering a supportive ecosystem that not only enhances the success of women-led businesses but also contributes to a more inclusive and equitable entrepreneurial environment. This approach reinforces the importance of the economy, from its social and educational perspective, in creating a level playing field for all entrepreneurs, regardless of gender.
Keywords. Digital startups, financial performance, female entrepreneurship, Propensity Score Matching, social and digital economy, education entrepreneurship.

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1. Introduction

The growing visibility of female entrepreneurship contrasts with the persistent gender gap in the digital economy. Despite progress in regulatory frameworks and public policies promoting gender equality, women still face structural barriers in accessing entrepreneurial opportunities, especially in technology-based sectors (Agrawal et al., 2023; González-Pérez et al., 2025; Molina-López et al., 2021). The role of women in entrepreneurship has gained increasing attention not only due to their contributions to economic and social development, but also because of their alignment with the United Nations Sustainable Development Goals (OEE, 2021).

In the Spanish context, digital entrepreneurship has become a strategic axis for economic transformation. As of 2022, over 3.3 million active companies operate in Spain, with 95.78% being microenterprises (DIRCE, 2023). These companies generate 38% of employment and contribute 28% of GDP (ONTIS, 2023). Spain ranks seventh in the European Union's Digital Economy and Society Index (DESI), and eleventh in the digital integration of businesses. Indicators such as the percentage of SMEs with basic digital intensity or environmental ICT use exceed the European average (Comisión Europea, 2023). Public strategies such as "España Digital 2025" and the "SME Digitalisation Plan 2020–2025" allocate 23% of Recovery Plan funds to digital transformation, particularly benefiting microenterprises and self-employed workers (Gobierno de España, 2023). Part of this investment can potentially support sectors where the social economy is more prominent, such as agriculture, contributing to territorial cohesion, environmental sustainability, and job creation (Del Cerro et al., 2023; Palomo and Isabel, 2022).

However, the gender gap persists. It is observed that 90% of innovative startups seeking venture capital are founded by men, while women-led startups receive 23% less funding and present lower success expectations (OECD, 2018). Policy initiatives such as ENISA loans, the Women's Talent Attraction Programme (EOI), and NEOTEC programmes aim to mitigate these inequalities.

In this context, this study focuses on female entrepreneurship in digital enterprises, particularly new technology-based firms (NEBTs), defined as small, recently created, independent companies that operate in high-tech sectors (Storey and Tether, 1998; Almus and Nerlinger, 1999). These companies are characterised by short life cycles, high growth potential, and the use of emerging technologies (Motohashi, 2005). It is observed that digital entrepreneurship has a strong projection capacity, even in small labour structures, and offers self-employment and microenterprises a strategic pathway to economic participation and job creation (Martínez, Guilló and Santero, 2019). This gives rise to what may be considered a digital social economy, where entrepreneurship is not only a business endeavour but also a vector of inclusion and innovation, particularly in platform-based models that seek to democratize technological governance and algorithmic control (Alquézar Crusellas, 2025; Sánchez Espada J., et. al, 2018).

Therefore, the focus on female digital entrepreneurship is justified for two reasons. Firstly, it is a sector with significant economic and social potential. Secondly, as a traditionally male-dominated field, understanding the gender-based dynamics is essential. The objective of this article is to analyse the economic and financial performance of female-led digital startups in Spain, using a matched sample methodology (Propensity Score Matching) to evaluate whether their results differ significantly from male-led firms. In addition to financial indicators, the analysis incorporates a social and educational lens, considering the implications of these inequalities for policy-making and gender-inclusive entrepreneurship promotion.

Results reveal structural barriers that hinder the growth and competitiveness of female-led ventures, particularly in their initial stages. However, the analysis shows that when firms are evaluated under comparable conditions, women-led startups achieve profitability and operational efficiency levels equivalent to those of their male-led counterparts.

2. Theoretical framework

2.1. Entrepreneurship and performance

The analysis of gender in entrepreneurship performance has generated two opposing perspectives in the literature. On one hand, a body of research has suggested that female entrepreneurs tend to achieve lower economic outcomes compared to their male counterparts, with differences in sales, profitability, and employment creation (Du Rietz and Henrekson, 2000; Fairlie and Robb, 2007; Klapper and Parker, 2010; Brixiová and Kangoye, 2016; Shinnar et al., 2018). It is observed that factors such as limited access to credit, reduced initial capital, and lower levels of previous experience and education contribute to these discrepancies (Kalleberg and Leicht, 1991; Rosa et al., 1996; Robb and Wolken, 2002). In this sense, Fairlie and Robb (2007), based on a sample of U.S. companies, point out that women-led businesses are smaller, more vulnerable to closure, and less profitable. These outcomes are explained by structural conditions that disadvantage women in the entrepreneurial process, reinforcing the notion of underperformance.

Moreover, Mazrekaj (2024) states that women are less likely than men to engage in high-growth businesses and entrepreneurial activities, primarily because of lower self-perceived entrepreneurial abilities and differing motivations shaped by cultural and societal norms. Women's self-perceptions about their skills and risk-taking capacities tend to be lower (Kariv et al., 2023; Molina-López et al. 2024), influenced by longstanding gender stereotypes that question female competence in business, which discourages them from pursuing aggressive

growth ventures. In this sense, Jennings et al. (2022) find, by analyzing the Global Entrepreneurship Monitor (GEM) 2020, that women are just as likely as men to have accurate self-assessments of their entrepreneurial abilities, while men are more prone to overconfidence. This overconfidence can lead to riskier and potentially detrimental business decisions. Furthermore, Milanov et al. (2025) analyze why highly qualified women with high entrepreneurial self-efficacy (ESE), prestigious education, and access to Silicon Valley entrepreneurial networks often do not choose tech venture founding as their primary career path, because if their personal goals or culturally assumed gender roles do not align with what they believe entrepreneurship entails, their interest in starting a business may diminish, or they may seek alternative ways to engage.

On the other hand, other studies question this hypothesis. It is observed that when controlling for variables such as company size, sector, or capital intensity, female-owned businesses do not necessarily show lower performance (Justo et al., 2015; Aidis and Weeks, 2016; Farhat and Mijid, 2016). Robb and Watson (2012), for instance, argue that the evaluation of business success should adjust for structural factors, as traditional financial indicators may not capture the full complexity of women's entrepreneurial strategies. Moreover, Farhat and Mijid (2016) demonstrate that business survival, profitability, and growth are not significantly different between male and female entrepreneurs when observed under matched conditions. Demartini (2018) also highlights that differences in performance can be attributed to divergent motivations, risk attitudes, and goals rather than to lower entrepreneurial capacity among women. Recent contributions have also emphasized how gender diversity in governance structures can positively influence business performance, even in traditionally male-dominated industries such as insurance (Morales de Vega et al., 2025).

From a critical perspective, feminist approaches have introduced conceptual frameworks that deconstruct the notion of underperformance. Ahl (2006) and Ahl and Marlow (2012) argue that mainstream entrepreneurship research often adopts a gender-neutral perspective that overlooks the structural constraints affecting women. These studies call for a redefinition of entrepreneurial success that goes beyond economic outcomes, incorporating social value creation, resilience, and innovation. In this line, Aidis and Weeks (2016) propose the concept of *high-impact female entrepreneurship*, focusing on market-expanding and export-oriented women-led ventures. Measurement tools such as the Gender-Global Entrepreneurship and Development Index (GEDI, 2018) reflect this broader approach to evaluating entrepreneurial ecosystems from a gender-sensitive perspective.

Finally, it is observed that women may voluntarily exit ventures not due to failure but because of personal or professional choice (Justo et al., 2015). This nuance challenges assumptions around performance and opens the debate on how gender, context, and institutional frameworks interact to shape entrepreneurial trajectories.

2.2. Female digital entrepreneurship

Female digital entrepreneurship is an emerging and rapidly evolving field within the broader digital entrepreneurship literature (Dana et al., 2024). Although this research topic has garnered increasing attention, it remains at a nascent stage, characterized by fragmented contributions and a lack of solid theoretical foundations (Alhajri & Aloud, 2023; Paul et al., 2023). Research highlights the empowering role of digital technologies in reducing gender gaps in entrepreneurship by enhancing women's access to investment decision-making, education, and health resources (Miniesy et al., 2022; Shukla et al., 2021). However, empirical studies suggest that women entrepreneurs often face underperformance in high-tech digital environments, underscoring the need for experience-based research to better understand the challenges they encounter (Kang, 2022; Jawad et al., 2021).

In this regard, adopting a comprehensive approach that analyzes the digital entrepreneurial ecosystem, encompassing key elements such as social norms, government policies, human capital, financial capital, infrastructure, and the digital economy, is essential to understanding the complex and multifaceted causal mechanisms influencing female entrepreneurial activity (Huang et al., 2025). Prior research demonstrates that no single element within this ecosystem is sufficient or necessary alone to achieve high levels of female entrepreneurial participation; rather, it is the interaction and configuration of these factors that drive outcomes (Hechavarría and Ingram, 2019). Social norms emerge as particularly critical because they exert a broad and profound influence not only directly on women's entrepreneurial intentions and cognitions, byshaping perceptions about gender roles and entrepreneurial self-efficacy, but also indirectly by strengthening the effects of other ecosystem components such as government policies and human capital development (Grootaert & Van Bastelaer, 2002; Huang et al., 2022). For instance, strong societal support and positive social recognition can compensate for weaknesses in other areas, such as limited financial resources or suboptimal market conditions, by fostering entrepreneurial confidence and motivation among women (Huang et al., 2025).

Furthermore, the integration of digital economy elements, such as digital infrastructure, platforms, and e-commerce channels, into the entrepreneurial ecosystem creates new opportunities for women by lowering traditional barriers related to financing, market access, and networking, thus expanding their market reach and innovative capacities (Nambisan, 2017; Elia et al., 2020; Alhajri & Aloud, 2024). However, the degree of digital accessibility and usability of technological environments remains a critical factor in ensuring inclusive participation (Fernández Torres et al., 2025) A digital entrepreneurial ecosystem perspective, particularly one that accounts for the interplay between normative, institutional, human, and technological factors, offers a nuanced and holistic understanding of the conditions that facilitate or constrain female entrepreneurial dynamism in the digital economy (Hechavarría & Ingram, 2019; Yang et al., 2024).

The reality shows that women's participation in digital entrepreneurship remains markedly low despite recent advances. It is observed that, although the gender gap in early-stage entrepreneurship has been

narrowing since 2012 (OEE, 2021), women still face significant limitations in consolidating sustainable and innovative business projects, particularly in digital sectors. According to the GEM report (2022), 6.5% of women in Spain are engaged in consolidated entrepreneurship, compared to 7.5% of men.

Sociodemographic and structural characteristics define this gap. Female-led initiatives tend to concentrate in consumer and business services, with only a marginal presence in manufacturing and extractive industries. Most women entrepreneurs lead microenterprises, with 45% of initiatives lacking employees and only 2% having more than 20 employees. The technological level of women-led businesses is also low: 95% are non-innovative and operate with basic technological inputs (GEM, 2022; OEE, 2021).

In terms of financing, women entrepreneurs mobilize 11% less capital than men on average, with a higher dependence on personal savings and family contributions. Only 14.9% of their financing comes from financial institutions, and 1.2% from crowdfunding, limiting their growth capacity and access to scale economies.

At the European level, women account for just 5.7% of entrepreneurs—well below the global average of 11%—and are significantly underrepresented in patent authorship (Naldi et al., 2005). However, it is observed that women in Europe participate more actively in ICT entrepreneurship than in other regions, with increasing involvement in sectors such as fintech, healthtech, legaltech, and digital education (GERA, 2021; Tejeiro Koller et al., 2021).

In Spain, the “solopreneur” model has emerged, particularly in digital ventures, where individual women entrepreneurs create and manage their startups without founding teams (South Summit & IE University, 2022). Regional studies reinforce the gender imbalance: in the Community of Madrid, only 16% of tech entrepreneurs are women (Morales-Alonso et al., 2016), indicating persistent exclusion from high-impact innovation ecosystems.

Despite this, it is observed that the areas with the highest number of women digital entrepreneurs include digital education and social-purpose ventures, reflecting an alternative pattern of innovation oriented toward social needs (Tejeiro Koller et al., 2021). This suggests that promoting digital entrepreneurship among women requires more than financing: it demands structural changes in education, support networks, and public policy. This perspective is consistent with recent systematic evidence on student entrepreneurship in higher education, which highlights the decisive role of universities in shaping entrepreneurial intention, sustainability orientation, and social value creation (Hernández Muñoz et al., 2025).

In this regard, early interventions that foster leadership capacity and entrepreneurial attitudes in girls and young women are crucial. It has been demonstrated that educational programmes based on authentic leadership models can enhance self-perception, agency, and ambition among adolescent girls, strengthening their potential to overcome gendered barriers in future professional contexts (Molina-López et al., 2024; Rubio-Andrés et al., 2023). These approaches align with a broader strategy that integrates gender equality, education, and digital innovation as mutually reinforcing dimensions.

3. Description of sample and methodology

This study adopts a quantitative approach based on the analysis of financial and economic variables of digital startups in Spain, with a specific focus on gender-based differences in entrepreneurial outcomes. The analysis is supported by data extracted from the *Sistema de Análisis y Balances Ibéricos* (SABI) database and employs Propensity Score Matching (PSM) techniques to ensure comparability between female- and male-led firms.

The first phase of the research consisted of a large-scale data extraction process using the following criteria: companies established from 1 January 2010 onwards, with at least five years of available fiscal data (not necessarily consecutive), legally active, and domiciled in Spain. In order to identify potentially digital companies, the selection was limited to firms operating within the CNAE codes used by Zubillaga and Peletier (2018), consistent with the classification criteria for technology-based companies employed by Demartini (2018).

The initial search yielded approximately 309,000 companies. A random 1% sample (3,013 companies) was selected and subjected to manual verification to confirm their digital nature, based on website content, social media presence, and core business activities. Once validated, companies were classified by the predominant gender composition of their boards of directors. This process resulted in a final sample of 1,802 male-led and 130 female-led digital companies.

The second phase of the study involved a descriptive analysis of the financial performance of female-led startups across five key dimensions: volume (assets, revenue, employees), profitability (ROA, ROE), financial structure (debt and equity), leverage, and operational efficiency. This analysis was conducted over a five-year time horizon, starting from the year of company creation.

To ensure fair comparison and to control for selection bias, a matching process was applied using the PSM technique. This method estimates the probability of a company being female-led based on observable characteristics (company size, year of foundation, sector of activity, and location), allowing for the construction of a control group of male-led firms with similar profiles. The matching was conducted using two methods: nearest neighbour matching and kernel matching.

The subsequent comparative analysis between male- and female-led firms focused on key financial indicators: return on assets (ROA), return on equity (ROE), debt ratio, equity levels, financial leverage, revenue per employee, solvency, effective interest rates, and interest-to-income ratios. Differences in mean values were tested using t-tests for statistical significance.

This methodological design makes it possible to isolate the effect of gender on entrepreneurial outcomes, controlling for structural variables, and to assess whether performance disparities are attributable to gender-based discrimination or other firm-level characteristics.

4. Analysis and Results

4.1. Descriptive analysis of female-led digital startups

We have a sample of 130 female digital companies, of which 26% are based in Barcelona and 30% are located in Madrid. More than half of these companies were founded after 2015, with the oldest companies established in 2008. First, the average evolutionary behaviour of the entire group of companies in terms of the number of employees, assets, and revenue is characterised.

Table 1 illustrates the dynamics across different groups of variables (volume, profitability, financial structure, financial management, and financial efficiency) of the studied female digital companies. A general upward trend in the volume of the companies is evident in terms of assets and revenue, starting from the year of creation (year 0) with respective averages of 70,000 euros and 41,000 euros, reaching mean values of 320,000 euros and 285,000 euros in year 5. The number of employees, with an average of just over one employee in the founding year, evolves to mean values exceeding 3 employees, stabilising somewhat in the later years. Focusing on financial efficiency, as shown in Table 2, there is an increase in equity and, more steadily, in income per employee, with a significant rise in the former in the last period. The average profitability of the companies in the sample, as measured by the mean values of ROA and ROE, grows in the initial years and then declines to initial values in year 3, with a sharp rise in ROE in the latter periods.

The indebtedness of the female companies decreases in the first year to below 46% and then generally shows an increasing trend to values exceeding 54%. Notably, there is a mean decrease in year 4. Regarding financial leverage (Graph 6), the mean value in the first year is close to zero, increasing in the following two years to peak at a mean value greater than 0.6, and then decreasing to initial values in the final period.

On average, over the study period, the companies have between 2 and 3 employees, assets exceeding 212,000 euros, and revenue of 183,000 euros. In terms of profitability, the values of ROE and ROA are observed to be 9% and -4.8%, respectively. Additionally, the companies show an average indebtedness just over 50%, with logarithmic-scale equity of 3.7 and leverage of 0.3. Concerning financial efficiency, the average solvency value for the period is 0.6, with income per employee amounting to 66,000, an average effective interest rate of 2.6%, and an interest payment-to-income value of 0.014.

Table 1. Temporal evolution of the main analysed variables

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Average
Volume							
Employees	1.1	1.9	2.5	3.2	3.4	3.3	2.6
Assets (‘000 EUR)	70.9	155.1	198.4	252.5	275.4	320.4	212.1
Revenue (‘000 EUR)	41.7	128.2	177.0	217.6	247.8	285.1	182.9
Profitability							
ROE	-3.2	15.8	11.6	-0.2	11.3	18.8	9.0
ROA	-8.1	-3.6	-2.6	-6.8	-1.3	-6.5	-4.8
Financial Structure							
Debt ratio (%)	48.8	45.7	50.2	53.6	49.1	54.5	50.3
Equity (logarithm)	2.5	3.4	3.9	3.8	4.0	4.6	3.7
Financial leverage	0.0	0.5	0.6	0.2	0.2	0.1	0.3
Financial Management and Operational Efficiency							
Solvency (logarithm)	0.8	0.8	0.5	0.6	0.4	0.8	0.6
Revenue per employee	36.2	64.6	71.7	67.6	72.4	84.2	66.1
Effective interest (%)	0.3	8.1	0.7	0.9	2.9	2.8	2.6
Interest to revenue	0.012	0.029	0.031	0.008	0.003	0.003	0.014

Source: Own elaboration with SABI data.

4.2. Comparative analysis of the economic and financial features between female and male digital startups

Below is a comparison of the economic and financial characteristics of the female companies in relation to their male counterparts.

4.2.1. Comparison of mean equality between startups founded by women and men

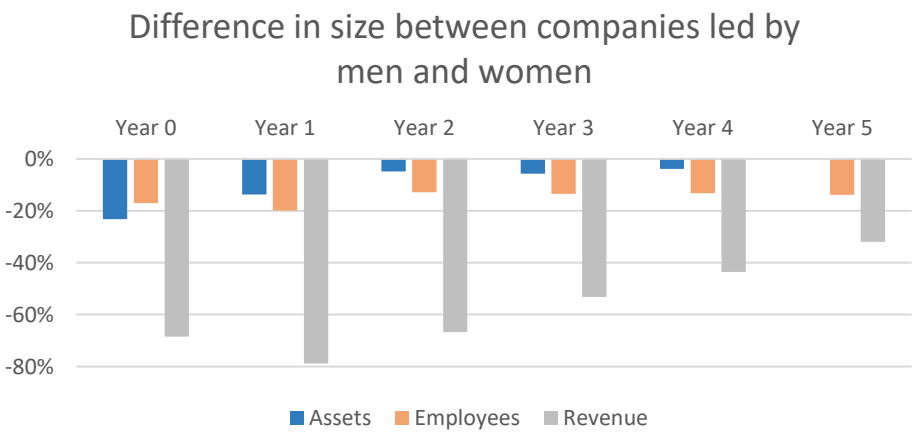
Table 2 displays the mean values in the set of female digital companies along with a set of male companies for various economic variables measuring business size, such as the total company assets, the number of employees, and the total annual revenue. The variables were logged to standardise the data.

Table 2. Test of mean equality of companies led by men and women.

		Men	Women	Difference	t-test	p-value	
Assets (log)	Year 0	3.947	3.715	-0.232	2.47	0.014	**
	Year 1	4.650	4.513	-0.137	1.43	0.155	
	Year 2	4.905	4.858	-0.048	0.55	0.584	
	Year 3	5.168	5.111	-0.057	0.63	0.53	
	Year 4	5.244	5.205	-0.039	0.44	0.661	
	Year 5	5.328	5.344	0.016	-0.18	0.855	
Employees (log)	Year 0	0.404	0.235	-0.170	5.29	0.000	***
	Year 1	0.847	0.648	-0.199	4.87	0.000	***
	Year 2	0.955	0.826	-0.128	2.73	0.007	***
	Year 3	1.186	1.051	-0.135	2.87	0.005	***
	Year 4	1.220	1.088	-0.132	2.61	0.010	**
	Year 5	1.218	1.080	-0.138	2.75	0.007	***
Revenue (log)	Year 0	3.987	3.303	-0.684	6.55	0.000	***
	Year 1	5.063	4.275	-0.788	6.43	0.000	***
	Year 2	5.317	4.650	-0.667	5.87	0.000	***
	Year 3	5.495	4.963	-0.532	5.38	0.000	***
	Year 4	5.589	5.154	-0.436	5.00	0.000	***
	Year 5	5.655	5.336	-0.319	3.85	0.000	***

Source: Own elaboration with SABI data.

Graph 1. Difference in size between companies led by men and women.



Source: Own elaboration with SABI data.

In Graph 1, it can be observed that companies led by women are smaller than those led by men. These differences are more pronounced in the early years of the companies' lives and generally tend to decrease over time. The variable showing the largest difference is the total annual revenue, which exceeds 60% in the first three years of the company's life. The number of employees fluctuates between a 10% and 20% difference between companies, and the total assets in the founding year are 20% higher in male-led companies, although this difference diminishes and disappears in the fifth year of operation.

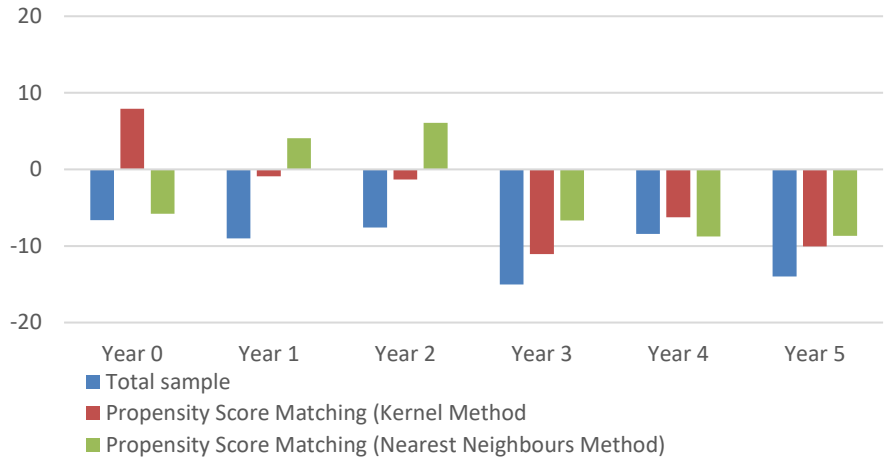
4.2.2. Comparison of profitability

Before matching companies using PSM, we can observe that companies founded by women achieve lower profitability compared to those founded by men, especially in the first three years since the company's establishment (Table 2). However, once we compare companies of the same size between men and women and eliminate sample selection biases using PSM, these differences diminish or disappear. This fact indicates that the smaller size of women's companies is what might be preventing them from achieving the "economies" (of scale, scope, network, etc.) that would allow them to be more profitable. We proceed to analyse this

situation.

As shown in Table 3 concerning the ROA, female startups exhibit an ROA close to that of male companies in the early years when controlling for company size, although, overall, there is a deterioration in the value of the ROA of female startups over time. Additionally, examining the data reflected in Table 4, if we consider a company profitable when its ROA exceeds 5%, female startups do not reach this level of profitability in any period, while male startups do achieve it in the later years when controlling the sample for size.

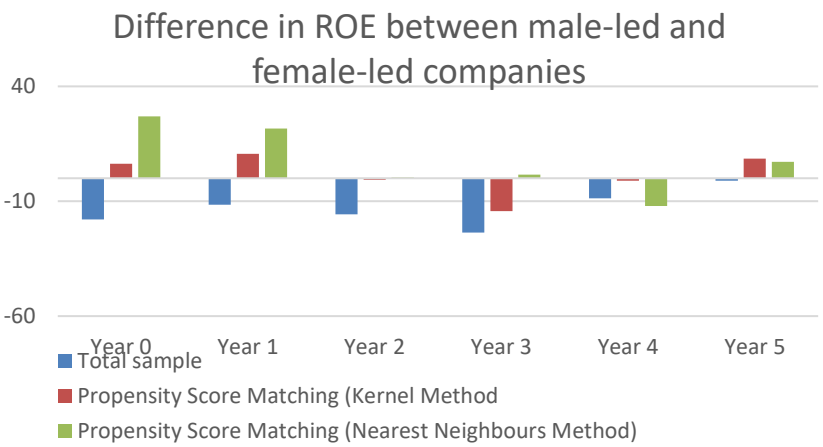
Graph 2. Difference in ROA between male and female companies



Source: Own elaboration with SABI data.

Regarding financial profitability (ROE), when controlling for size, we observe a better result for ROE in the early years of the company's life. However, this ratio experiences a negative trend in female startups compared to male ones, although in this case, the differences diminish over time in the matchings conducted (Graph 3).

Graph 3. Difference of ROE between male-led and female-led companies



Source: Own elaboration with SABI data.

The analysis of both ratios collectively by periods will provide us with information on the "leverage effect." As shown in the tables, in the case of the sample of male and female startups controlled by size, the ROA is generally lower than the ROE in each year analysed, implying a positive leverage effect. This means that part of the assets has been financed with debt, leading to an increase in financial profitability.

Overall, the assets of female-led companies initially demonstrate a similar ability to generate profits (ROA) compared to male-led startups, although this situation tends to worsen over time. They also achieve better returns on invested funds (ROE) at the beginning of their operations, although this tendency diminishes as the company matures.

Table 3. PSM result in the profitability indicators.

		Complete Sample						Propensity Score Matching (Kernel Method)						Propensity Score Matching (Nearest Neighbour Method)					
		Men	Women	Difference	*t*-test	*p*-value		Men	Women	Difference	*t*-test	*p*-value		Men	Women	Difference	*t*-test	*p*-value	
ROA	Year 0	-1.52	-8.15	-6.63	1.13	0.265		-6.79	1.12	7.91	0.953	0.341		6.94	1.12	-5.81	-0.40	0.692	
	Year 1	5.35	-3.66	-9.01	1.75	0.086	*	0.08	-0.84	-0.92	-0.169	0.866		-4.91	-0.84	4.07	0.47	0.636	
	Year 2	5.01	-2.57	-7.58	1.75	0.086	*	1.17	-0.14	-1.31	-0.247	0.805		-6.22	-0.14	6.09	0.94	0.350	
	Year 3	8.25	-6.76	-15.01	3.41	0.001	***	3.71	-7.35	-11.06	-2.463	0.014	**	-0.67	-7.35	-6.67	-1.23	0.217	
	Year 4	7.16	-1.29	-8.44	1.61	0.114		4.98	-1.29	-6.27	-1.216	0.224		7.48	-1.29	-8.77	-1.633	0.102	
	Year 5	7.55	-6.45	-14.00	2.36	0.026	**	4.81	-5.24	-10.05	-1.787	0.074	*	3.45	-5.24	-8.69	-1.125	0.261	
ROE	Year 0	14.74	-3.18	-17.92	2.28	0.030	**	7.98	14.28	6.30	0.466	0.641		-12.69	14.28	26.97	1.62	0.105	
	Year 1	27.29	15.82	-11.47	1.36	0.183		12.58	23.25	10.67	1.261	0.207		1.66	23.25	21.60	1.47	0.141	
	Year 2	27.30	11.59	-15.71	2.27	0.027	**	17.44	16.73	-0.72	-0.059	0.953		16.46	16.73	0.27	0.02	0.982	
	Year 3	23.42	-0.23	-23.65	2.73	0.010	**	13.58	-0.75	-14.32	-1.691	0.091	*	11.28	12.83	1.55	0.10	0.920	
	Year 4	20.14	11.34	-8.80	1.26	0.219		12.36	11.34	-1.03	-0.133	0.894		11.38	-0.75	-12.13	-1.12	0.264	
	Year 5	19.24	18.21	-1.02	0.05	0.961		8.58	17.10	8.52	0.656	0.512		9.99	17.10	7.11	0.40	0.691	

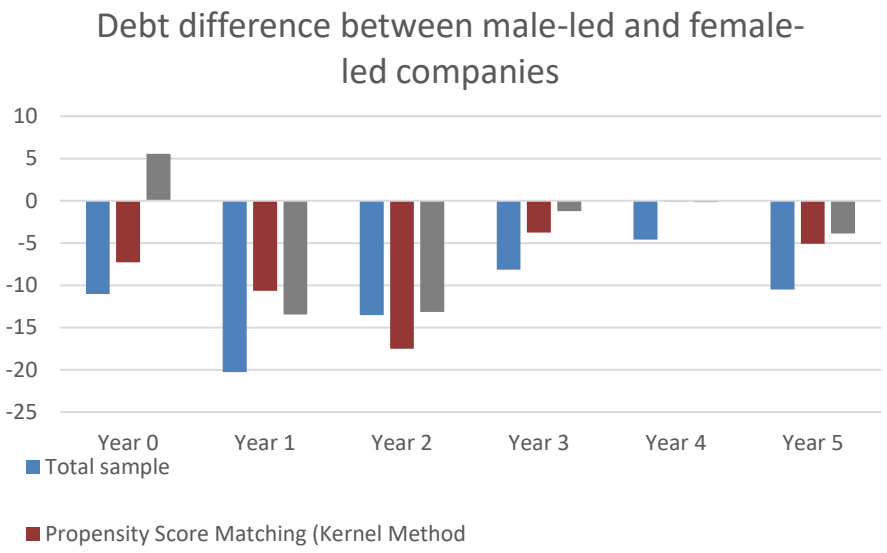
Source: Own elaboration with SABI data.

4.2.3. Leverage comparison

Regarding leverage, it has been observed that women-led companies are initially less indebted, less leveraged, and more solvent. When matching similar male-led companies using PSM, although the differences are reduced, they do not disappear completely, especially in relation to solvency (they remain more solvent) and indebtedness, particularly in the first three years.

As seen in Graph 4, female-led startups generally exhibit a lower level of indebtedness and a more stable trend compared to male-led ones, which become more indebted in the two periods following the establishment of the company. Meanwhile, female-led startups, in general, reduce this ratio and fluctuate to a lesser extent as the periods progress.

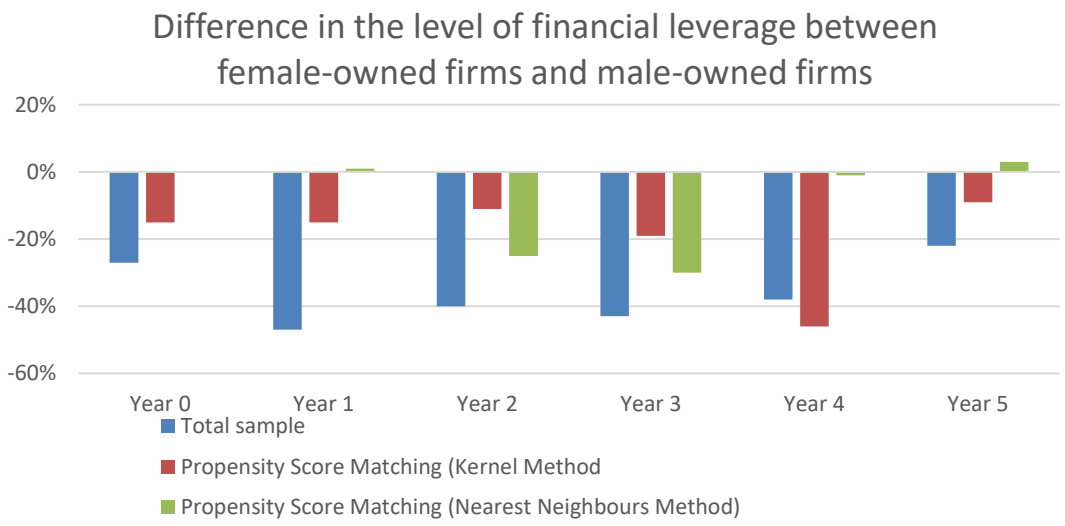
Graph 4. Debt difference between male-led and female-led companies



Source: Own elaboration with SABI data.

Regarding the leverage ratio, and in line with the variables of debt level and equity level, we observe that female-led startups are much less leveraged than their male counterparts. These differences are notable in years 2, 3, and 4 of the sample, as a result of an increase in leverage for male-led startups that is greater than that for female-led ones (Graph 5).

Graph 5. Difference in the level of financial leverage between male-led and female-led companies



Source: Own elaboration with SABI data.

Regarding the level of equity, Table 4 shows that female-led startups exhibit higher equity levels compared to male-led ones, and this difference increases over time, with significant values of around 100% in the third and fifth years of analysis, according to the nearest neighbour method. This finding may indicate the capacity of female-led startups to attract investors, particularly considering the unique financing characteristics these startups possess. Table 5 also presents the solvency ratio, which demonstrates the favourable solvency position of female-led startups, as they show better results than their male-led counterparts in most of the values when both analysing the complete sample and controlling for size.

Table 4. Result of PSM on the leverage indicators

		Complete Sample						Propensity Score Matching (Kernel Method)						Propensity Score Matching (Nearest Neighbour Method)					
		Men	Women	Difference	*t*-test	*p*-value		Men	Women	Difference	*t*-test	*p*-value		Men	Women	Difference	*t*-test	*p*-value	
Debt ratio	Year 0	59.87	48.84	-11.04	2.03	0.048	**	62.47	55.20	-7.27	-0.98	0.327		49.65	55.20	5.55	0.50	0.618	
	Year 1	65.96	45.68	-20.28	4.64	0.000	***	60.94	50.28	-10.66	-1.93	0.054	*	63.73	50.28	-13.45	-1.71	0.087	*
	Year 2	63.76	50.21	-13.55	3.36	0.001	**	67.49	49.99	-17.49	-3.37	0.001	***	63.16	49.99	-13.16	-1.55	0.120	
	Year 3	61.73	53.56	-8.17	1.69	0.092	*	56.71	52.95	-3.76	-0.60	0.551		52.95	51.74	-1.21	0.13	0.897	
	Year 4	59.09	54.51	-4.58	0.83	0.405		54.59	54.51	-0.08	-0.01	0.991		54.69	54.51	-0.18	-0.02	0.982	
	Year 5	59.66	49.14	-10.52	1.53	0.125		54.23	49.14	-5.09	-0.51	0.607		53.02	49.14	-3.87	-0.37	0.712	
Equity	Year 0	2.58	2.46	-0.12	0.43	0.670		2.80	2.84	0.03	0.08	0.935		2.71	2.84	0.13	0.237	0.813	
	Year 1	3.12	3.36	0.24	-0.83	0.411		3.28	3.48	0.20	0.65	0.515		3.33	3.48	0.14	0.272	0.786	
	Year 2	3.45	3.92	0.48	-2.27	0.027	**	3.44	3.98	0.54	2.63	0.009	***	3.05	3.98	0.93	1.869	0.062	*
	Year 3	3.65	3.83	0.18	-0.62	0.539		3.66	3.96	0.29	1.18	0.237		4.24	3.96	-0.29	-0.7	0.485	
	Year 4	3.84	3.99	0.16	-0.48	0.637		3.80	3.99	0.20	0.60	0.549		3.99	4.04	0.05	-0.16	0.873	
	Year 5	3.96	4.61	0.65	1.45	0.163		3.99	4.61	0.61	1.19	0.234		3.57	4.61	1.04	2.075	0.038	**
Financial leverage	Year 0	0.35	0.08	-0.27	3.60	0.000	***	0.16	0.01	-0.15	-1.91	0.056	*	0.01	0.01	0.00	0.11	0.916	
	Year 1	0.66	0.19	-0.47	2.72	0.006	***	0.25	0.10	-0.15	-1.57	0.117		0.09	0.10	0.01	0.12	0.907	
	Year 2	0.48	0.08	-0.40	1.65	0.099	*	0.31	0.21	-0.11	-0.73	0.464		0.50	0.25	-0.25	-0.65	0.517	
	Year 3	0.49	0.05	-0.43	2.90	0.004	***	0.27	0.09	-0.19	-1.45	0.147		0.39	0.09	-0.30	-0.72	0.473	
	Year 4	0.41	0.04	-0.38	3.05	0.002	***	0.52	0.05	-0.46	-1.11	0.266		0.06	0.05	-0.01	-0.13	0.893	
	Year 5	0.26	0.04	-0.22	3.78	0.000	***	0.13	0.04	-0.09	-1.49	0.137		0.01	0.04	0.03	1.19	0.232	
Solvency (log)	Year 0	0.21	0.76	0.55	-2.14	0.037	**	0.14	0.58	0.43	2.00	0.046	**	0.32	0.58	0.26	0.42	0.676	
	Year 1	0.15	0.82	0.67	-3.45	0.001	***	0.29	0.73	0.45	3.02	0.003	***	0.42	0.73	0.32	0.74	0.462	
	Year 2	0.17	0.52	0.35	-2.14	0.036	**	0.17	0.55	0.38	1.99	0.046	**	-0.05	0.55	0.60	1.93	0.053	*
	Year 3	0.24	0.58	0.34	-1.76	0.084	*	0.33	0.49	0.17	0.82	0.413		0.55	0.49	-0.06	-0.15	0.881	
	Year 4	0.33	0.39	0.06	-0.25	0.801		0.54	0.39	-0.16	-0.38	0.706		0.78	0.39	-0.39	-1.28	0.199	
	Year 5	0.31	0.79	0.47	-1.91	0.067	*	0.46	0.74	0.27	0.70	0.486		-0.24	0.74	0.98	3.36	0.001	***

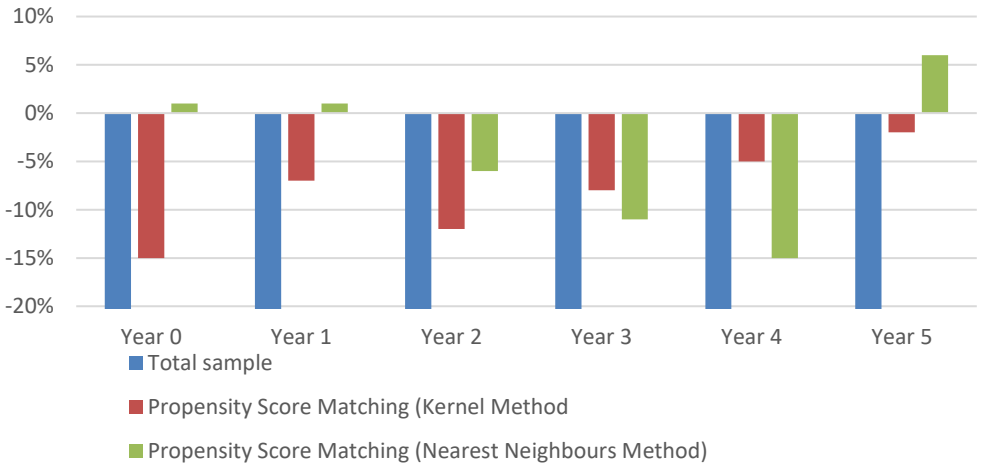
Source: Own elaboration with SABI data.

4.2.4. Comparison of financial efficiency

The same argument as above could be used for operational efficiency. Without matching, women-led

companies are less efficient, but once matched using PSM with male-led companies of similar characteristics, there are no appreciable differences in the productivity generated per employee (Graph 6).

Graph 6. Difference in the level of revenue per employee between companies led by men and women



Source: Own elaboration with SABI data.

Regarding the effective interest paid by companies to obtain financing, in the case of female startups, this interest is higher in both the unmatched sample and the matched sample (Table 5). However, concerning the interest-to-revenue ratio, the differences are small in both samples.

Table 5. Result of PSM on the financial efficiency indicators

		Complete Sample						Propensity Score Matching (Kernel Method)						Propensity Score Matching (Nearest Neighbour Method)					
		Men	Women	Difference	*t*-test	*p*-value		Men	Women	Difference	*t*-test	*p*-value		Men	Women	Difference	*t*-test	*p*-value	
Revenue per employee	Year 0	3.67	3.09	-0.58	5.26	0.000	***	3.66	3.50	-0.15	-1.67	0.095	*	3.52	3.53	0.01	-0.12	0.906	
	Year 1	4.28	3.72	-0.56	5.27	0.000	***	3.93	3.86	-0.07	-0.70	0.484		3.86	3.86	0.01	0.06	0.952	
	Year 2	4.39	3.91	-0.48	4.86	0.000	***	4.13	4.01	-0.12	-0.94	0.349		4.07	4.01	-0.06	-0.53	0.596	
	Year 3	4.33	3.95	-0.38	4.96	0.000	***	4.08	4.00	-0.08	-1.17	0.240		4.11	4.00	-0.11	-1.36	0.175	
	Year 4	4.40	4.09	-0.31	4.91	0.000	***	4.15	4.10	-0.05	-0.84	0.401		4.25	4.10	-0.15	-1.47	0.143	
	Year 5	4.47	4.24	-0.24	3.32	0.001	***	4.33	4.31	-0.02	-0.34	0.734		4.25	4.31	0.06	1.01	0.311	
Effective interest rate	Year 0	0.18	0.28	0.10	-0.47	0.650		0.12	0.37	0.25	1.03	0.303		0.02	0.37	0.36	1.32	0.186	
	Year 1	0.57	8.06	7.49	-1.98	0.070	*	0.29	9.39	9.10	1.74	0.083	*	0.13	9.39	9.26	2.148	0.032	**
	Year 2	0.74	0.65	-0.09	0.20	0.841		0.65	0.97	0.32	-0.24	0.811		0.90	0.65	-0.25	-0.13	0.897	
	Year 3	0.65	0.92	0.27	-0.34	0.737		0.75	0.92	0.17	0.21	0.838		0.11	0.92	0.81	1.106	0.269	
	Year 4	1.25	2.89	1.64	-1.02	0.330		1.38	2.89	1.51	1.09	0.275		0.31	2.89	2.58	1.488	0.137	
	Year 5	0.85	2.84	2.00	-1.05	0.316		0.27	3.13	2.86	1.45	0.148		0.04	3.13	3.08	1.508	0.132	
Interest to revenue	Year 0	0.0015	0.0124	0.01	-1.447	0.15		0.001	0.012	0.010	1.03	0.305		0.0001	0.0116	0.011	1.121	0.262	
	Year 1	0.0104	0.0293	0.02	-1.431	0.154		0.018	0.032	0.014	1.01	0.313		0.0030	0.0320	0.029	2.204	0.028	**
	Year 2	0.0135	0.0315	0.02	-1.318	0.189		0.011	0.027	0.02	1.24	0.216		0.0215	0.0271	0.006	0.361	0.718	
	Year 3	0.0047	0.0077	0.00	-0.797	0.427		0.007	0.008	0.00	0.35	0.726		0.0051	0.0080	0.003	0.725	0.468	
	Year 4	0.0036	0.0029	0.00	0.049	0.626		0.007	0.003	0.00	-1.11	0.267		0.0030	0.0077	0.005	-3.07	0.002	***
	Year 5	0.0026	0.065	0.06	-0.999	0.32		0.002	0.003	0.00	0.59	0.553		0.0022	0.0026	0.000	0.246	0.806	

Source: Own elaboration with SABI data.

5. Conclusions and discussion

This article has analysed gender-based differences in the economic and financial performance of digital startups in Spain. The results highlight structural inequalities that limit the growth and competitiveness of female-led ventures, particularly in their early stages. Despite these constraints, it is observed that when firms are compared under equivalent conditions—using Propensity Score Matching (PSM)—female-led startups

achieve similar levels of profitability and operational efficiency as those led by men.

One of the main findings is that the initial smaller size of female-led firms plays a decisive role in their performance gaps. These enterprises tend to operate with fewer resources, have lower access to financing, and face greater difficulties in reaching the thresholds necessary to benefit from economies of scale and scope. This dynamic helps explain their lower levels of leverage and debt, as well as the higher interest rates they face, even when structural variables are controlled. The persistence of such disadvantages suggests the presence of implicit gender-based biases in the financing ecosystem.

These results also shed light on broader discussions regarding financial behaviour, risk perception, and indebtedness in female entrepreneurship. Women-led firms often adopt more conservative financial structures, characterised by lower debt levels and greater solvency. However, these decisions cannot simply be interpreted as higher aversion to risk. Instead, they appear to reflect a rational adaptation to an environment in which access to credit is more limited, financing conditions are less favourable, and the cost of potential failure is higher. In this context, the prioritisation of internal funding, the preference for gradual growth, and the cautious use of debt emerge as strategies that aim to ensure stability and reduce vulnerability during the early stages of business development.

The analysis also shows that when the structural disadvantages faced by female-led firms are accounted for, the supposed performance gap largely disappears. Once comparable groups of firms are analysed, women-led startups show levels of profitability (ROA and ROE) close to those of male-led startups. This indicates that observed differences are not the result of managerial ability or entrepreneurial capacity, but of unequal initial conditions. The deterioration of profitability indicators over time among female-led firms further suggests that the persistence of structural constraints may prevent these ventures from capturing growth opportunities associated with scale, investment, or rapid expansion.

The dynamics of risk and indebtedness observed in this study also relate to their implications for scalability in digital sectors. Digital businesses often require significant upfront investment and rapid market positioning, two conditions that may disadvantage firms that rely on more conservative financial strategies or have less access to external capital. Nevertheless, the stability and solvency displayed by women-led startups may also indicate greater resilience, even if this entails slower short-term growth.

Furthermore, the results support the importance of fostering gender diversity not only among entrepreneurial teams but also within corporate governance structures, where its positive influence on business performance has been demonstrated in other contexts such as the European insurance sector (Morales de Vega et al., 2025). Encouraging gender-balanced leadership structures can contribute to more robust decision-making processes and facilitate the consolidation of women-led digital ventures.

These findings underscore the need for public policies that explicitly address gender gaps in entrepreneurship, particularly in digital sectors. Ensuring equitable access to financing, improving credit evaluation processes, and expanding support services for early-stage ventures are essential steps to enhance the long-term sustainability and competitiveness of women-led startups. Existing programmes play a relevant role, but their scope and coordination should be strengthened to address structural disparities more effectively.

Future research could complement this quantitative analysis with qualitative approaches that capture the perceptions, motivations, and strategies of entrepreneurs. Understanding how women and men experience and navigate digital entrepreneurship would provide additional insights into the mechanisms underpinning gendered differences in financial behaviour and business performance.

Other lines of action should consider the importance of mentorship, networks, and role models in strengthening the visibility and legitimacy of women in digital entrepreneurship. Access to investment networks, accelerators, and incubators remains uneven, reinforcing informal barriers that limit women's growth potential. Promoting collaborative spaces, peer learning, and intergenerational support structures may thus become key drivers of empowerment and sustainability.

Finally, the role of intersectionality must be acknowledged. Gender interacts with factors such as age, socio-economic background, or territorial context, shaping differentiated entrepreneurial realities. Policies aimed at fostering equality should therefore incorporate these dimensions, ensuring that support programmes respond to the diverse needs and constraints experienced by different groups of women entrepreneurs in the digital economy.

Conflict of Interest

The authors declare that they have no direct or indirect conflict of interest with the editors, members of the editorial team, or members of the scientific committee.

Author Contributions

Manuel M. Molina López: conceptualization, formal analysis, research, methodology, project management, writing. Ricardo J. Palomo Zurdo and Susana González-Pérez: supervision, validation, writing. Encina Morales de Vega: supervision, validation, writing. All authors: data curation, writing, visualization.

Data Availability Statement

The data supporting the findings of this study are publicly available at SABI database.

Statement on the Use of Generative AI

During the preparation of this work, the authors used Chat GPT 5.2 for the purpose of translating the

manuscript. After using this tool, the authors reviewed and edited the content as necessary, assuming full responsibility for the content of the publication.

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