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WOMEN IN AGRARIAN SCIENCES

ORIGINAL ARTICLE

Women's participation in the leadership of research projects at Embrapa (2007–2025)

Sonia Holler[1]*, Cristina Arzabe[2], Cláudia de Mori[3]

Abstract – This study examines female participation in the leadership of research projects at Embrapa from 2007 to 2025. A total of 6,867 projects registered in the Embrapa Project Management System (SEG) were examined using a descriptive quantitative and inferential approach. Women led 2,488 projects (36.2 %), a proportion statistically equivalent to their representation among the institution's research staff (35.7 %; $p > 0.05$), which indicates distributive equity, although not gender parity. A statistically significant negative temporal trend was observed in the absolute number of projects for both genders (women: $\beta = -3.66$; $p = 0.001$; men: $\beta = -7.28$; $p < 0.001$), associated with an overall decline in project volume. However, the analysis of proportions showed no statistically significant linear trend in female participation ($R^2 = 0.0609$; $p = 0.308$), which fluctuated between 33.0 % and 39.6 % over the study period. Association tests (Chi-square and Mantel–Haenszel) confirmed structural stability in the gender distribution. Despite persistent male predominance, a slight reduction in relative gender inequality was observed. The findings indicate gradual progress in women's leadership proportional to the available workforce base, which suggests that more substantial advances depend on structural policies targeting the scientific career pipeline in the agricultural sciences.

Keywords: Women in science. Gender disparity. Female leadership. Female participation. Agricultural research management. Gender and agricultural sciences.

Participação feminina na liderança de projetos de pesquisa da Embrapa (2007–2025)

Resumo – Este artigo analisa a participação feminina na liderança de projetos de Pesquisa da Embrapa no período entre 2007 e 2025. Foram examinados 6.867 projetos registrados no Sistema Embrapa de Gestão de Projetos, por meio de abordagem quantitativa descritiva e inferencial. As mulheres lideraram 2.488 projetos (36,2 %), proporção estatisticamente equivalente à sua participação no quadro de pesquisadores da instituição (35,7 %; $p > 0,05$), indicando equidade distributiva, embora não paridade de gênero. Observou-se tendência temporal negativa e significativa no número absoluto de projetos para ambos os gêneros (mulheres: $\beta = -3,66$; $p = 0,001$; homens: $\beta = -7,28$; $p < 0,001$), associada à redução global de projetos. Contudo, a análise das proporções não evidenciou tendência linear significativa na participação feminina ($R^2 = 0,0609$; $p = 0,308$), que oscilou entre 33,0 % e 39,6 % ao longo do período. Testes de associação (Qui-quadrado e Mantel–Haenszel) confirmaram estabilidade estrutural da distribuição por gênero. Apesar da persistente predominância masculina, observou-se leve redução da desigualdade relativa entre homens e mulheres. Conclui-se que a liderança feminina na Embrapa evolui de forma gradual e proporcional à base funcional disponível, sugerindo que avanços mais expressivos dependem de políticas estruturais voltadas ao pipeline de formação e carreira nas ciências agrárias.

Palavras-chave: Mulheres na ciência. Disparidade de gênero. Liderança feminina. Participação feminina. Gestão da pesquisa agropecuária. Gênero e ciências agrárias.

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Introduction

The presence of women in leadership positions has become an increasingly relevant topic in discussions on gender equality, organisational management and institutional development. This issue assumes particular strategic importance in the context of public research organisations, as diversity in decision-making spaces tends to promote greater plurality of perspectives, innovation and efficiency in knowledge production.

The ability to make choices and act to achieve them is the central component of empowerment. It involves internal qualities such as critical thinking skills and autonomy. These skills are used to navigate relational and societal dynamics that involve negotiation, deception and manipulation, among others. Acting (or not acting) provides direct evidence of empowerment (Richardson, 2018). Choosing and participating in competitive research calls requires, among other requirements, meeting criteria, stages, clauses and obligations; structuring the research problem with a scientific basis; organising teams; planning the use of financial resources; and updating bibliographic references.

The literature on gender and leadership indicates that the presence of women in positions of power favours more collaborative and multidisciplinary models with effects on priorities, flexibility in the management of uncertainties and in the expansion of methodological contributions. Kong *et al* (2024) associates female leadership with gains in innovative performance and governance style that prioritise diversity and inclusion, which are relevant variables for the management of organisations. Data show that women are involved in more multidisciplinary research and their research is more likely to be cited in public policy documents and in the media (Linden; Roberge; Malkov, 2024).

The Brazilian labour market is marked by strong segregation between women and men (Brasil, 2025). There are activities in which workers of one sex or the other are concentrated, and this phenomenon is called 'occupational segregation' or 'sectoral segregation by sex', according to the way in which women and men are distributed among several specific occupations or among different sectors of activity (Salas; Leite, 2007). For example, Jobim and Silva (2023) cites the area of agricultural sciences as 'traditionally masculine'. Data from the Ministry of Labor and Employment for the year 2023 indicate that sectors such as agriculture, livestock, forestry, fishing and aquaculture, industry, and civil construction have a strong male presence in Brazil. The stock of formal employment contracts in agriculture was 17.3 % of women, one of the lowest rates of participation by women, second only to civil construction, with 11.1 % of women (Brasil, 2025). Considering the year of graduation of people with curricula in the Lattes Platform in the area of agricultural sciences, only 10.5 % of among those who graduated between 1964 and 1984 were women. This percentage increased to 40.2 % among those who graduated between 1985 and 2005. Women surpass men only among those who graduated between the years 2006 and 2025, making a total of 55.8 % (CNPq, 2026).

According to the Elsevier (Linden; Roberge; Malkov, 2024) report, women accounted for 41 % of all active researchers in the world in 2022 (participation as authorship in scientific publications). This share varies substantially by country: Portugal (52 %), Brazil (49 %), USA (42 %), Germany (35 %), India (33 %) and Japan (22 %). There are also disparities between the different areas of knowledge: nursing (68 %), psychology (61 %), computer science (29 %), engineering (28 %) and mathematics (27 %). In areas related to agricultural sciences, women's participation is

48 % in veterinary medicine and 44 % in agriculture and biological sciences.

Considering particular data referring to students linked to agricultural sciences at the Federal University of Viçosa, Fiúza, Pinto and Costa (2016) and, later, Motta (2018) point to a lower percentage of women in this area of knowledge in the early 2000s. Pinto and Costa mention that the average number of women enrolled in the area of agricultural sciences at the Viçosa Campus (UFV) was only 39.0 % each semester between 2010 and 2014, and Motta (2018) points out that only 37.0 % of the students linked to the Centre for Agrarian Sciences at UFV were women in 2017. Considering data from the period between 2006 and 2014 from the Administrative Management System of the Research Programme of the Coffee Research Consortium (SISGAP), under the coordination of Embrapa Coffee, Arzabe and Abu-Hana (2015) showed that about 70.0 % of the coffee research projects at different research institutions forming part of the Coffee Research Consortium at the time were coordinated by men in the period.

Considering particular data regarding professors in the area of agricultural sciences, Motta (2018) recorded that among professors linked to the Centre for Agrarian Sciences of the UFV, the number was 41 women (19.0 %) and 176 men (81.0 %) in 2017. Oliveira, Bomfim and Freire (2024) evaluated the female presence at the Centre for Applied Agrarian Sciences of the Federal University of Sergipe in 2022 and observed that among professors with a doctorate, only 32.9 % were women and among those with a postdoctoral degree, only 30.8 %.

As an agricultural research organisation, Embrapa reflects this broader structural pattern. The staff is made up of assistants, technicians, analysts and researchers, totalling 7,527 people at present (November 2025), of which only 2,490 are women (33.08 %). Sectoral segregation by sex occurs especially between the positions of 'technicians' and 'assistants' (women, 20.92 %; men, 79.08 %) and among researchers (women, 35.75 %; men, 64.25 %) (data provided by Embrapa's Staff Planning Supervision, referring to the year 2025). The research projects developed in the company are predominantly led by staff in researcher positions, within which women constitute a minority. Various factors and mechanisms contribute to this female underrepresentation, including structural barriers (institutional norms, access to funding and opportunities, and professional networks), cultural factors (competence stereotypes, segregation by area, racial and class issues) and personal constraints (care responsibilities and double burden of paid and unpaid work) (Melo; Lastres; Marques, 2004; Pharaoh; Bordin, 2024; Chiarini; Rapini; Santos, 2024; Linden; Roberge; Malkov, 2024).

In this context, the present study analysed the landscape of female leadership in research projects developed at Embrapa between 2007 and 2025, identifying patterns in the temporal distribution of gender in project coordination and examining the association between leadership gender profiles, functional profiles and the number of projects per individual. The study is justified by the need to generate empirical evidence to support the academic debate; enhance the visibility of women's roles in research, development and innovation (RDI) activities; and inform the formulation of policies aimed at expanding gender equality in scientific production and decision-making bodies. Such efforts are essential not only to reduce disparities and broader socioeconomic inequalities but also to promote scientific excellence, innovation and efficient human capital management.

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Materials and Methods

This study considered the gender variable in binary form (woman/man), according to the categorisation available in Embrapa's institutional databases. We acknowledge that this approach does not capture the diversity of gender identities and that this limitation may restrict a comprehensive understanding of gender and leadership dynamics in the RDI environment.

Data collection was conducted in September 2025, and the dataset comprised 6,867 RDI projects, either completed or ongoing, between 2007 and 2025. These projects were distributed across different regions of Brazil and covered a wide range of scientific and technological topics within agricultural and related sciences. The time frame reflects the implementation, in 2007, of the Embrapa Project Management System (SEG), which centralised and standardised project records, thereby ensuring data consistency and enabling a longitudinal analysis not previously explored. The data were obtained through the Business Intelligence tool in the SEG project information repository. Projects led by institutions external to Embrapa were excluded from the analysis.

Data treatment and analysis followed a quantitative approach of both a descriptive and inferential nature, based on the tabulation and categorisation of information related to the project leaders. Data were organised in electronic spreadsheets according to variables including leader identification, gender (female/male), execution period (year of project initiation), functional profile (researcher; analyst) and number of projects led per individuals (units). These data were subjected to validation and consistency procedures to ensure their reliability. The analysis sought to identify patterns of distribution and temporal evolution in the participation of women and men in project leadership, focusing on: the temporal evolution of the number of projects and the behaviour of leadership proportions by gender; the association between year and leadership gender; the relationship between the proportion of female project leadership and the gender composition of the research staff; and the behaviour of the proportions of (i) occupational profile and (ii) number of projects led per individual by gender.

Data were analysed using absolute and relative frequency measures. Absolute frequency refers to the number of occurrences of a given variable value, whereas relative frequency corresponds to the ratio between the absolute frequency and the total number of observations (Marconi; Lakatos, 2007). Percentages of project leadership were calculated by gender both annually and cumulatively, as well as by occupational profile and by categories based on the number of projects led per individual (1–3, 4–6, 7–9 and ≥ 10 projects).

Simple linear regression analyses were conducted to evaluate (i) the temporal trend in the absolute number of projects led by women and men between 2007 and 2025 and (ii) the temporal trend in the percentage distribution of both genders over the same period. For these analyses, simple linear regression models were fitted, with calendar year as the independent variable (X) and either the number of projects or percentage of participation as the dependent variable (Y). Model significance was assessed using the ANOVA F test, while the significance of individual coefficients was evaluated using the Student's t-test, adopting a significance level of 5 %. Model fit was assessed using the coefficient of determination (R^2). These models enabled the assessment temporal trends, including their direction and magnitude. Regression analyses of percentage values were used to investigate structural changes in the gender composition of leadership over

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time, independently of variations in total projects volume.

A contingency table (year × leadership gender) was also constructed, and the following tests were applied:

(i) Pearson's Chi-square test ($\alpha = 0.05$) was used to assess the association between categorical variables and to test the null hypothesis of independence between year and leadership gender. This non-parametric statistical test evaluates whether observed frequency distributions differ from expected distributions under independence, thereby indicating whether association between variables are statistically significant (Leal; Silva; Sopelete, 2005).

(ii) The Mantel–Haenszel test was used to evaluate the presence of a linear trend in the association between year and leadership gender, assessing whether the proportion of projects led by women (or men) systematically increases or decreases over time.

The relationship between female leadership in projects and the gender composition of the research staff was evaluated using a one sample proportion test with a reference value. The observed proportion of projects led by women was compared with the proportion of women in the research staff (35.75 %), which was considered the primary group responsible for project submission and used as a benchmark for proportional distribution (distributive equity). A Z-test for a single proportion was applied, and a 95 % confidence interval for the observed proportion was estimated to assess whether female participation in project leadership differed statistically from the gender composition of the organisation's research staff. The null hypothesis (H_0) states that the proportion of projects led by women does not differ from the proportion of women among the research staff (distributive equity), while the alternative hypothesis (H_1) states that the observed proportion of projects led by women differs from the proportion of women in the research staff.

The Chi-square test ($p < 0.05$) was also applied to assess differences between observed and expected frequencies for (i) gender and occupational profile (researcher vs analyst) and (ii) gender and number of projects led per individual (Categories 1–3, 4–6, 7–9 and ≥10 projects). These analyses evaluated based on whether there was homogeneity or divergence between observed and expected proportions across categories. In this analysis, the hypothesis is that the proportion of leadership by (i) occupation profile (H0: there is no association between gender and occupation profile; H1: there is an association between gender and occupation profile) and (ii) by category for the number of projects per individual (H0: there is no association between gender and number of projects per individual and H1: there is an association between gender and number of projects per individual) is the same regardless of gender.

Statistical analyses were performed using Microsoft Excel® and the SAS statistical package (SAS Institute Inc., [2012]). This is an observational study, so it sought to identify associations and test hypotheses, but not to establish causal relationships.

Results and Discussion

Between 2007 and 2025, a total of 6,867 projects were recorded in the SEG. A reduction in the annual number of projects can be observed (Fig. 1), declining from an average of 477 projects per year during the 2007–2009 triennium to 270 projects per year in 2023–2025 – representing a compound annual decrease rate of 3.2 %. Within this dataset, 2,488 projects were led by women (36.2 %), while 4,379 projects were led by men (63.8 %). In absolute terms, both leadership categories exhibited similar fluctuations in terms of annual project count (Fig. 1). Projects led by women peaked in 2009

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(188 projects) and 2014 (196 projects), followed by a more pronounced decline from the late 2010s onwards, falling below 100 projects in 2018, 2020, 2024 and 2025, with an annual decrease rate of 3.0 %. Similarly, projects led by men reached their peaks in 2009 (365 projects) and 2014 (337 projects), likewise indicating a downward trend in recent years, with a decrease rate of 3.8 %.

The results of the linear regression analysis of the absolute number of projects indicate a negative and statistically significant temporal trend in the number of projects led by both women and men over the analysed period (Fig. 1). The reduction in the number of projects approved in recent years may be associated with multiple factors, including constraints on the availability of resources and the adoption of institutional strategies aimed at formulating more comprehensive, robust and systemic projects of longer duration, which tends to reduce the number of one-off, short-term projects.

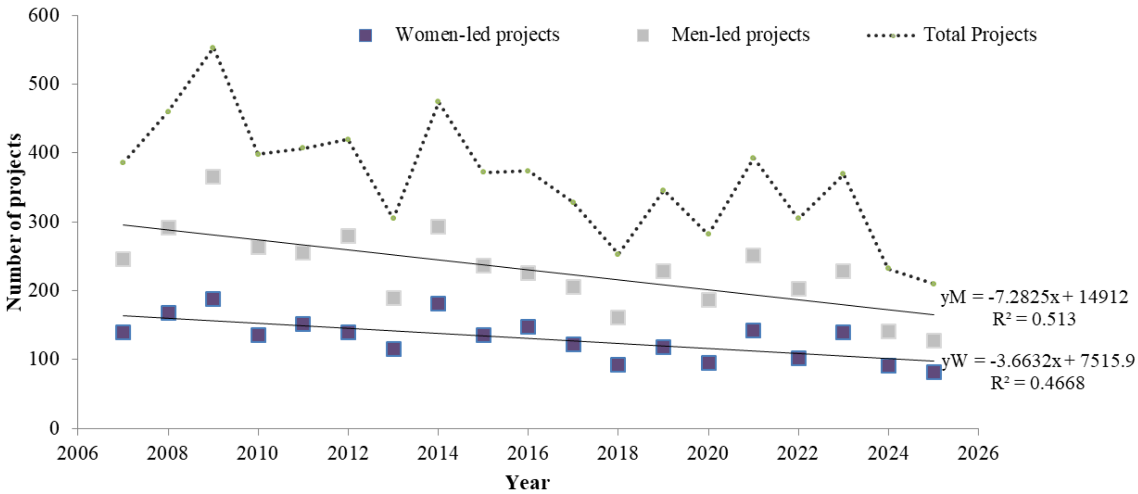

Figure 1. Linear regression of the absolute number of Embrapa R&D projects led by women and men over the period 2007–2025.

For projects led by women, the model yielded an $R^2 = 0.467$, which indicates that approximately 47 % of the annual variation in the number of projects is explained by time. The coefficient associated with year was negative and statistically significant ($\beta = -3.66$; $p = 0.001$, CI [–5.67; –1.66]); it suggests an average reduction of 3.7 projects per year. Similarly, the fitted model for projects led by men presented an $R^2 = 0.513$, indicating that 51.3 % of the variation is explained by the temporal trend. The slope coefficient was also negative and statistically significant ($\beta = -7.28$; $p < 0.001$), CI [–10.91; –3.65], suggesting an average annual reduction of 7.3 projects. A comparison between the models indicates a consistent and statistically significant decline in the number of projects over time, regardless of leadership gender. However, the analysis shows that the decrease was more pronounced among projects led by men. This suggests a more intense contraction for this group in the analysed period. Although projects led by women present lower absolute

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numbers over the period, the smaller negative slope suggests greater relative stability over time and changes in leadership dynamics.

A slight increase in the proportion of projects under female leadership was observed over the analysed period, which indicates a gradual improvement in the percentage participation of women in leadership roles within Embrapa projects (Fig. 2). Female participation fluctuated between 33.0 % (2012) and 39.6 % (2016). In the 2007–2009 triennium, the average was 35.3 %, followed by growth in subsequent years, such as 2013 (38.3 %), 2016 (39.6 %) and 2024 (39.2 %), reaching 38.7 % in the 2023–2025 triennium.

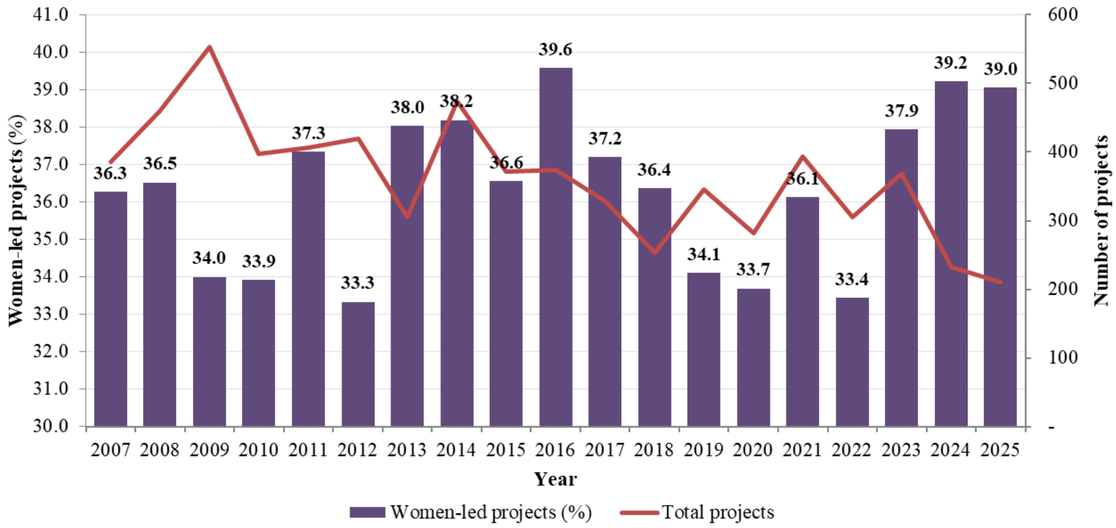

Figure 2. Total number of projects and percentage of projects led by women at Embrapa between 2007 and 2025.

However, the temporal analysis of leadership proportions by gender did not indicate statistically significant trends during the 2007–2025 period. For female leadership, the adjusted linear regression ($y = 0.0911x + 35.45$; $R^2 = 0.0609$, $p = 0.308$) pointed to a discrete positive variation of less than 0.1 percentage point per year, without statistical significance (Fig. 3). The 95 % confidence interval for the slope included zero (95 % CI: −0.09 to 0.27), which indicates the lack of robust evidence for systematic growth in female participation over time. Only approximately 6.01 % of the observed variation in the proportion of female leadership is explained by the temporal factor. This suggests that annual fluctuations, random noise or conjunctural changes exert a greater influence than a continuous linear trend.

Complementarily, the analysis of the proportion of male leadership yielded symmetrical and consistent results. The linear regression ($y = -0.0911x + 64.55$; $R^2 = 0.0609$, $p = 0.308$) indicated an average annual reduction of less than 0.1 percentage point, which was likewise not statistically significant (Fig. 3). The 95 % confidence interval of the slope (95 % CI: −0.27 to 0.09) also included zero, thus reinforcing the absence of a statistically detectable temporal trend. As observed for female leadership, the low R^2 value indicates that most of the variability in the proportion of male leadership is not explained by time, but rather by unmodeled factors

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or interannual fluctuations. These results suggest that female participation in project leadership remained relatively constant over the course of nearly two decades, characterised by discontinuous movements and interannual oscillations, without statistical evidence of linear growth or continuous or accelerated change over time, which were insufficient to alter the structural level. This pattern is consistent with the literature highlighting the persistence of institutional inertia mechanisms within scientific systems, where organisational profiles and norms, evaluation criteria and disciplinary cultures tend to reproduce historical gender inequalities (Fox, 2001; Nielsen *et al*., 2017). The absence of a statistically significant temporal trend suggests that isolated advances do not automatically translate into systemic changes and may instead be linked to different factors, such as organisational profiles and integrated policies.

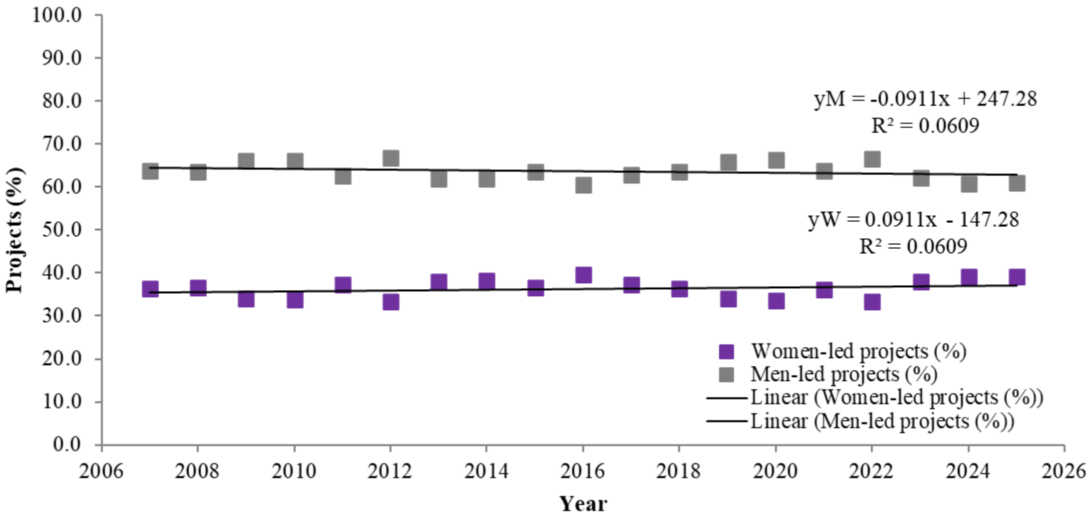

Figure 3. Linear regression of the proportions of female and male leadership in Embrapa R&D projects over the period 2007–2025.

For all years, the proportion of projects led by men exceeded that led by women. Annual female participation ranged from 33 % to 39 %, with a confidence interval of 36.22 % to 36.24 %. In contrast, the proportion of male leadership fluctuated between 61 % and 67 %, with a confidence interval of 63.75 % to 63.79 %. The results of Pearson's Chi-square test for the association between year and leadership gender did not indicate a statistically significant association between the variables ($\chi^2 = 116.31$; gl = 18; $p = 0.8657$), which suggests that the distribution of projects between women and men did not vary significantly over the years analysed. The Mantel–Haenszel test also identified no significant linear trend in the association between year and gender ($\chi^2 = 0.65$; $p = 0.4202$), which indicates an absence of a systematic increase or decrease in the relative participation of women and suggests the stability of the gender distribution over the analysed period. These results indicate that, although the total number of projects declined over time, this reduction occurred proportionally among women and men, thus preserving a stable gender leadership structure, with male predominance in all years analysed. The results of the Chi-square and Mantel–Haenszel tests indicate that changes were gradual, distributed over time and did not constitute abrupt statistical ruptures. The combination of methods demonstrated that gender dynamics have evolved through progressive, gradual reconfiguration rather than through structural shocks.

Although the absolute number of projects led by women did not increase, a significant rise can be observed in female participation in project coordination, both in percentage terms (Figs. 2 and 3) and in the ratio of projects led by women to those led by men over the period (Fig. 4). In 2009, for instance, the ratio was 1.94 male-led projects per female-led project; in 2014, this figure was 1.71, in 2023 it was 1.63 and in 2024 it reached 1.55.

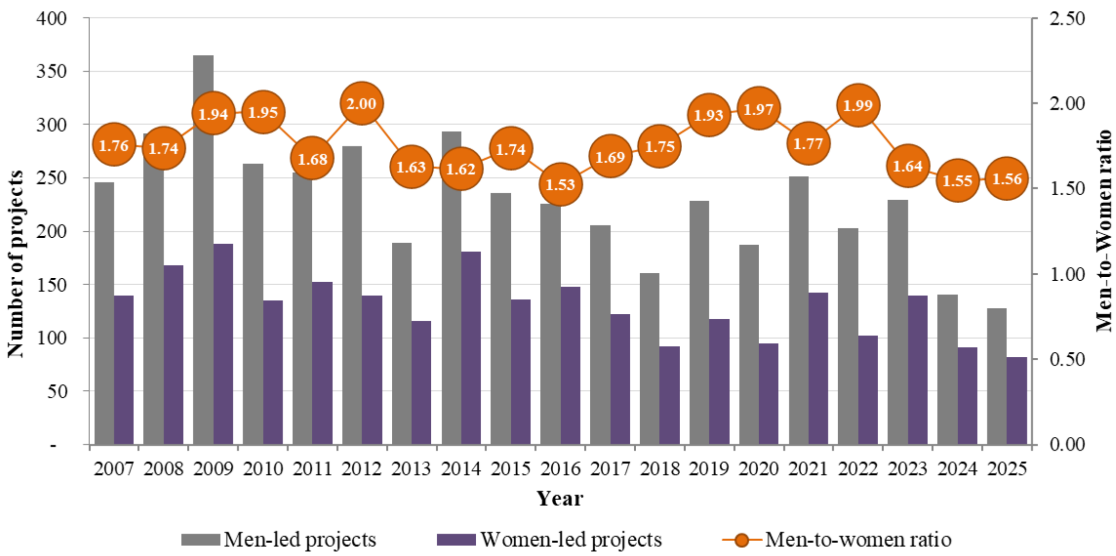

Figure 4. Total number of projects by leadership category (women and men) and the list of projects led by men and women at Embrapa between 2007 and 2025.

This result may reflect the effectiveness of internal mechanisms and strategies reinforcing the institutional commitment to gender equality and the encouragement of an expanded female presence in leadership positions. In 2007, Embrapa joined the Pro-Gender and Race Equity Programme of the National Secretariat of Policies for Women of the Presidency of the Republic (SPM/PR). Since then, the Company has participated in this programme, completing the second (2007–2008), third (2009–2010), fourth (2011–2012), fifth (2013–2015) and sixth edition for the 2016–2018 biennium. It was awarded the Gender and Race Pro-Equity seal, an instrument that demonstrates commitment to developing policies and practices in favour of gender and race equity (Arzabe; Costa, 2018). In 2024, Embrapa joined the seventh edition of the programme, coordinated by the Ministry of Women, for the 2024–2026 biennium, which is currently ongoing. In 2025, the company approved its Diversity, Equity and Inclusion Policy, in which it committed to promote gender equality through a range of actions, including the encouragement of gender proportionality within teams and management roles.

Regarding the total number of projects analysed over the period, the proportion of projects led by women (36.2 %) is consistent with the relative participation of

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female researchers within Embrapa's workforce, which was 35.7 % in 2025. The one-sample Z test for proportion indicates no statistically significant difference between these values (Z = 0.832; p = 0.405), which suggests that the distribution of female projects leadership is statistically equivalent to the gender composition of the workforce within the confidence interval (Table 1). The reference value (35.75 %) is contained within the confidence interval of the temporal series [35.1 %; 37.4 %], further corroborating the conclusion of equivalence between the proportion of women in leadership and within the workforce composition. This result indicates that, for the period in aggregate, female participation in project leadership proportionally reflects the workforce composition, with no statistical evidence of either under- or over-representation of female project leaders. The analysis identifies the presence of distributive equity, but not gender parity, which is a distinction widely discussed in the literature on equality of opportunity in science. This female under-representation within the institution may be associated with the composition of graduating cohorts from the 1980s (1980–89) and 1990s (1990–99), where the percentage of women registered in the Lattes Panel – Education and Professional Activity is 20.95 % and 33.24 % in Agricultural Sciences (CNPq, 2026). Blickenstaff (2005) considered the field of agricultural sciences in the early 2000s to be a predominantly male field – that is, numerically dominated by men both in practice and in general public perception.

Table 1. Proportionality test of female leadership in R&D projects and women in the workforce, 2007–2025.

Indicator	**Value**
Observed proportion of female leadership in R&D projects	36.24
Female proportion in the workforce	35.75
Z-Statistic	0.85
p value	0.397
95 % CI of the observed proportion	[35.1 %; 37.4 %]

Pipeline studies conducted in the early 2000s demonstrated that women were progressively under-represented in positions of greater prestige and decision-making power, even when entering scientific careers in similar proportions to men at the initial stages (Blickenstaff, 2005). The results observed in this study are consistent with this approach, which suggests that the main bottleneck for female leadership does not lie in the internal distribution of projects, but in earlier stages of the professional trajectory. The institution appears to allocate leadership opportunities proportionally to the available base; however, this base is shaped by structural inequalities resulting from cumulative processes of limitation throughout professional training and academic qualification in the agricultural sciences, as well as from the institutional recruitment and workforce composition profile. Thus, policies focused exclusively on leadership may be insufficient unless accompanied by structural interventions in recruitment, scientific recognition and the expansion of collaboration networks, alongside the incorporation of systematic monitoring of gender indicators and the revision of

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scientific evaluation criteria. Evidence indicates that only structural and sustained policies are capable of producing significant changes in patterns of scientific leadership (Blickenstaff, 2005; Fox, 2001; Nielsen *et al*., 2017).

The 2,488 women-led projects analysed during the period were led by 832 women, comprising 721 researchers (86.7 %) and 111 analysts (13.3 %) (Fig. 3). The majority of these women (63.0 %) led between one and three projects, fewer women (23.0 %) led between four and six projects, and a limited number of women (11.0 %) led between seven and nine projects. Only 23 women (3 %) led 10 or more projects, with the maximum reaching 14 projects per researcher (Fig. 5).

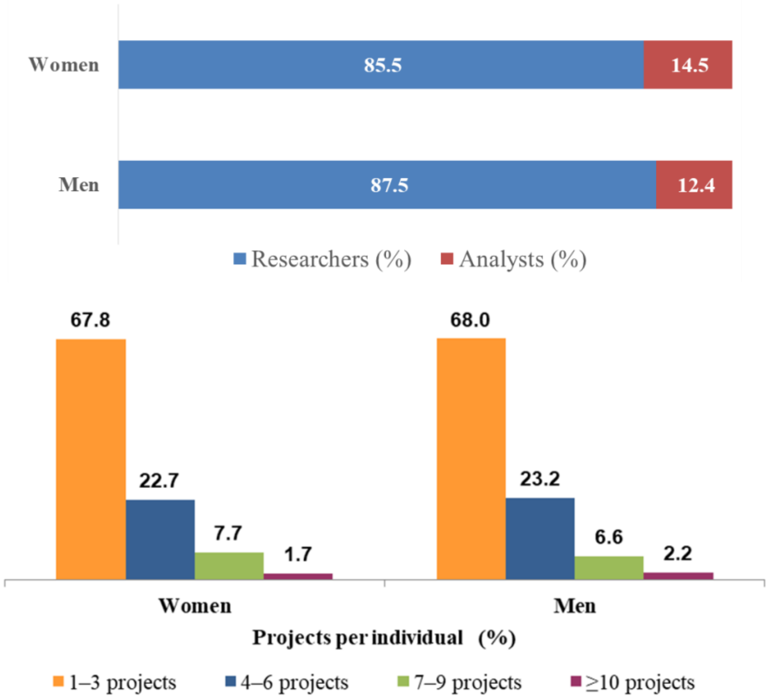

Figure 5. Percentage distribution by functional profile and number of projects per individual for projects led by women and men at Embrapa, 2007–2025.

For the 4,379 projects under male leadership, a group of 1,491 male leaders was identified. Among those with defined roles, 1,056 were researchers (86.2 %) and 169 were analysts (13.8 %). It was observed that the majority (976 individuals; 65.5 %) led between one and three projects, fewer men (348; 23.3 %) led between four and six projects, and a small number (124; 8.3 %) led between seven and nine projects. Only 44 men (2.9 %) led 10 or more projects, with the maximum number reaching 26 projects per researcher (Fig. 5).

Considering a significance level of $p < 0.05$ (95 % confidence interval), no difference was observed ($p = 0.76$) between the observed and expected proportions of researchers and analysts in projects led by women and men. This indicates a homogeneous pattern in the functional distribution across the analysed groups. The same applies to the distribution of the number of projects led by a single individual ($p = 0.18$); that is, the observed proportions by leadership profile are similar to those expected (based on the proportions observed in the overall set of projects) with $p < 0.005$.

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These results indicate that both the functional profile and the distribution of project-number class per individual are independent of gender.

This study has, however, certain methodological limitations that should be acknowledged to enable a more rigorous interpretation of its results. First, the variable of gender was operationalised in a binary form. This choice stems from the limitations of the databases used and implies the exclusion of non-binary and gender-diverse identities. Recognising this limitation is fundamental, as is the suggestion that future studies adopt more inclusive approaches capable of reflecting the diversity of gender identities and broadening the understanding of inequalities within the analysed field. Additionally, it should be noted that this study was observational in nature, focusing on identifying relationships rather than inferring causality.

Although the results discuss the integration between the evolution of female participation and the existence of institutional equity policies and programmes, a more robust analysis establishing a direct causal or associative relationship between these policies and the observed advances was not conducted. Consequently, it was not possible to determine the extent to which institutional programmes effectively influenced the increase in female participation; this must be recognised as a relevant limitation of the analysis and recommended as a direction for future study.

The analysis could also benefit from greater interpretative depth, particularly regarding the understanding of the factors that explaining the observed reality. A more detailed exploration of institutional and organisational factors – especially those related to research programming and the availability of resources, in conjunction with information on the recruitment of female researchers into Embrapa through public examinations – could help elucidate the mechanisms underlying these results. In this context, it would also be pertinent to investigate whether such advances are associated with the thematic areas of the projects, given that certain fields of knowledge tend to exhibit distinct patterns of female participation.

Finally, it is important to emphasise that the study is observational in nature and based exclusively on quantitative data. The absence of qualitative data, such as interviews or more in-depth documentary analysis, limits the understanding of the motivations, perceptions and experiences of the subjects involved; however, it points towards promising and relevant avenues for future research. The results indicate a gradual and qualified ‘feminisation’ of project leadership at Embrapa over the analysed period, which may reflect a cumulative process of the entry and consolidation of women in more senior positions within their scientific careers, resulting from recruitment in early decades. Further and more comprehensive studies would allow for a more detailed understanding of gender dynamics in academic and institutional contexts.

Conclusion

The results indicate that, during the analysed period, there was an overall reduction in the number of projects that affected both genders, although this effect was more pronounced among projects led by men. Concurrently, a progressive increase in the relative participation of women in project leadership was also observed, as evidenced by the regression analyses of proportions. This suggests a gradual transformation in the gender composition of leadership, characterised more by an incremental rebalancing process than by abrupt structural changes.

As shown by the analyses, there is no statistical

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evidence of a consolidated temporal increase in female leadership in R&D projects, and the proportion observed over the period corresponds statistically to the percentage of women within the research-dedicated workforce, which indicates distributive equity but not parity. This suggests that any inequalities observed in aggregate cannot be attributed to gender distribution in the allocation of leadership roles, but rather to interconnected structural factors, such as disparities in workforce composition, professional training trajectories, career progression, or access to networks and resources. Additionally, effective equality policies require systemic and longitudinal approaches to achieve their intended outcomes. As in other institutions within the field of agricultural sciences, sectoral segregation by gender is observable at Embrapa, where female researchers still represent a minority. The progressive reduction in the gap between projects led by women and those led by men over the years points towards greater balance and inclusion within the institutional environment. The results reinforce the fact that, despite persisting challenges, female participation at Embrapa has been strengthened, reflecting a steady path towards female protagonism in agricultural research.

Based on the observed results, which indicate gradual advances in female participation in research project leadership at Embrapa while also highlighting the persistence of structural inequalities, the implementation and strengthening of institutional and public policies aimed at promoting gender equity in the scientific environment is recommended. This should include, first, the development of institutional mechanisms to incentivise female leadership (funding calls that incorporate gender equity criteria or affirmative actions aimed at increasing female participation in project leadership). Second, it could also involve structured training and mentoring programmes aimed for female researchers, particularly during the early and intermediate stages of their scientific careers. Third, gender neutrality in project evaluation and selection processes should be ensured through the continuous review of adopted criteria and by raising awareness among evaluation committees regarding the existence of implicit biases, thereby making assessment practices more transparent. Fourth, work-life balance policies should be developed, including the flexible working arrangements and institutional recognition of the impacts of parental leave on scientific productivity indicators. Finally, gender indicators should be systematically produced, with transparent dissemination of this information.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any potential conflicts of interest.

Ethical Statements

The authors confirm that the ethical guidelines adopted by the journal were followed by this work, and all authors agree with the submission, content and transfer of the publication rights of the article to the journal. They also declare that the work has not been previously published nor is it being considered for publication in another journal.

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References

ARZABE, C.; COSTA, V. C. (ed.). **Igualdade de gênero**: contribuições da Embrapa. Brasília, DF: Embrapa, 2018. 76 p. (Objetivos de Desenvolvimento Sustentável, 5). Available from: https://www.alice.cnptia.embrapa.br/alice/bitstream/doc/1090711/2/ODS5igualdadedegnerocontribuiesdaembrapacristi.epub. Accessed: Nov. 26, 2025.

ARZABE, C.; ABU-HANA, R. A gender approach in the universe of research on coffee. *In*: SIMPÓSIO DE PESQUISA DOS CAFÉS DO BRASIL, 9., 2015, Curitiba. **Anais [...]**. Brasília, DF: Embrapa Café, 2015. Available from: https://www.embrapa.br/busca-de-publicacoes/-/publicacao/1024148/uma-abordagem-de-genero-no-universo-da-pesquisa-sobre-cafe. Accessed: Nov. 10, 2025.

BLICKENSTAFF, J. C. Women and science careers: leaky pipeline or gender filter? **Gender and Education**, v. 17, n. 4, p. 369-386, 2005. https://doi.org/10.1080/09540250500145072.

BRASIL. Ministério do Trabalho e Emprego. **Boletim**: Mulheres no mercado de trabalho. Brasília, DF: Ministério do Trabalho e Emprego, 2025. 13 p. Available from: https://www.gov.br/trabalho-e-emprego/pt-br/assuntos/estatisticas-trabalho/publicacoes/boletim_mulheres_8m_20250307.pdf. Accessed: Nov. 26, 2025.

CHIARINI, T.; RAPINI, M. S.; SANTOS, E. G. **Revelando tendências**: análise dos resultados do censo dos grupos de pesquisa de 2023. Brasília, DF: Ipea, 2024. (Diset: Nota Técnica, 136). 22 p. http://doi.org/10.38116/ntdiset136-port.

FARAO, S. A.; BORDIN, A. S. Mulheres em cargos de liderança em tecnologia: uma revisão sistemática. *In*: WOMEN IN INFORMATION TECHNOLOGY, 18., 2024, Brasília, DF. **Anais** [...]. Porto Alegre: Sociedade Brasileira de Computação, 2024. p. 439-444. https://doi.org/10.5753/wit.2024.2673.

FIÚZA, A. L. C.; PINTO, N. M. A.; COSTA, E. R. Gender inequality in public university: the practice of professors of agricultural science. **Educação e Pesquisa**, São Paulo, v. 42, n. 3, p. 803-818, 2016. https://doi.org/10.1590/S1517-9702201609148223.

FOX, M. F. Women, science, and academia: Graduate education and careers. **Gender & Society**, v. 15, n. 5, p. 654-665, 2001. https://doi.org/10.1177/089124301015005002.

JOBIM, L. M.; SILVA, M. A. Narrativas de mulheres sobre as relações de gênero nas Ciências Agrárias. *In*: COLÓQUIO INTERNACIONAL EDUCAÇÃO E CONTEMPORANEIDADE, 17., 2023, São Cristóvão. **Anais** [...]. São Cristóvão: Grupo de Pesquisa EDUCON, 2023. Available from: https://ri.ufs.br/jspui/handle/riufs/20112. Accessed: Nov. 10, 2025.

KONG, L. *et al*. Leadher: role of women leadership in shaping corporate innovation. **Humanities and Social Sciences Communications**, v. 11, n. 1313, p. 1-10, 2024. https://doi.org/10.1057/s41599-024-03852-2.

LEAL, G. D.; SILVA, D. A. O.; SOPELETE, M. C. Conceitos básicos de bioestatística. *In*: MINEO, J. R. *et al*. **Pesquisa na área biomédica**: do planejamento à publicação. Uberlândia: EDUFU, 2005. p. 137-180. https://doi.org/10.7476/9788570785237.

LINDEN, N. V. D.; ROBERGE, G.; MALKOV, D. **Progress toward gender equality in Research & Innovation – 2024 Review**: an in-depth analysis of research participation, career progression and research contributions across the globe. [*S. l.*]: Elsevier B. V., 2024. 38 p. https://doi.org/10.17632/bb5jb7t2zv.1.

MARCONI, M. A.; LAKATOS, E. M. **Fundamentos de metodologia científica**. 6. ed. 4. reimpr. São Paulo: Atlas, 2007. 311 p.

MELO, H. P.; LASTRES, H. M. M.; MARQUES, T. C. N. Gênero no sistema de ciência, tecnologia e inovação no Brasil. **Revista Gênero**, Niterói, v. 4, n. 2, p. 73-94, 2004. https://doi.org/10.22409/rg.v4i2.247.

MOTTA, J. A. **Mecanismos de reprodução das assimetrias de gênero no campo acadêmico: a formação universitária e a atuação profissional no Centro de Ciências Agrárias da Universidade Federal de Viçosa – MG**. 2018. 111 f. Dissertação (Mestrado em Extensão Rural) – Departamento de Economia Rural, Universidade Federal de Viçosa, Viçosa, MG, 2018. Available from: http://www.locus.ufv.br/handle/123456789/22337. Accessed: Nov. 10, 2025.

NIELSEN, M. W. *et al*. Gender diversity leads to better science. **Proceedings of the National Academy of Sciences**, v. 114, n. 8, p. 1740-1742, 2017. https://doi.org/10.1073/pnas.1700616114.

OLIVEIRA, L. K. S.; BOMFIM, C. N. C.; FREIRE, K. M. F. Women in agricultural sciences. **Revista Humanidades e Inovação**, Palmas, TO, v. 11, n. 3, p. 114-128, 2024. Available from: https://revista.unitins.br/index.php/humanidadeseinovacao/article/view/9320. Accessed: Nov. 10, 2025.

CNPQ. **Painel Lattes**: Formação e Atuação. Brasília, DF: CNPq, 2026. Available from: http://www.bi.cnpq.br/painel/formacao-atuacao-lattes. Accessed: Jan. 20, 2026.

RICHARDSON, R. A. Measuring women's empowerment: a critical review of current practices and recommendations for researchers. **Social Indicators Research**, v. 137, n. 2, p. 539-557, 2018. https://doi.org/10.1007/s11205-017-1622-4.

SALAS, C.; LEITE, M. Segregación sectorial por género: una comparación Brasil-México. **Brazilian Journal of Latin American Studies**, São Paulo, v. 6, n. 11, p. 241-259, 2007. https://doi.org/10.11606/issn.1676-

PESQ. AGROP. GAÚCHA, V.32, N.1, P. 97-112, 2026.
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6288.prolam.2007.82307.

SAS INSTITUTE INC. SAS. 9.3 Version. Cary, NC, USA: SAS Institute Inc., [2012]. Available from: https://support.sas.com/software/93. Accessed: Mar. 02, 2026

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