

Women entrepreneurs and innovation: Retrospect and prospect

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ABSTRACT

This paper answers the call for a deeper understanding of innovation issues in relation to female entrepreneurship. In doing so, it offers a comprehensive and updated picture of the state of the art of management research on innovation in women-owned firms. Specifically, by conducting a systematic literature review, which is widely used in management studies, and by using rigorous and replicable criteria, this manuscript seeks to understand this crucial intersection through an in depth investigation of 48 papers, thus addressing a relevant gap that exists in literature to date. Results demonstrate that, despite the increasing attention given to female entrepreneurship and innovation at both political and social levels, due to their key role worldwide, a significant gap in the integration of these two areas still exists. Thus, it is time for scholars to reimagine the concept of innovation and to explore the untapped potential within female entrepreneurship, redefining and bringing to light all the facets that innovation may have. The study provides avenues on which scholars should focus in order to help policy makers to work towards fostering a more inclusive and dynamic entrepreneurial ecosystem that empowers women to drive innovation and economic growth.

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Introduction

According to Schumpeter's, 1934 seminal study, in an industrial context, innovation is associated with the creation of new outputs, or improved goods, new organizational structures, new markets, or new producers. Since then, several further definitions of innovation have been proposed and developed and many analyses of its impact on the economy have been performed (e.g., Baregheh, Rowley & Sambrook, 2009). Today, a general agreement emerges in defining innovation as the successful creation and implementation of creative/new ideas (e.g., Alsos, Hytti & Ljunggren, 2016; Stein, 1974; Woodman, Sawyer & Griffin, 1993). Traditionally, innovation is perceived to be strictly connected with technological progress to the point that the "linear model of innovation" theoretical framework has dominated (and, somehow, still does) for many years. Introduced in the 1980s in the field of innovation studies, the model is "based on the assumption that innovation is applied science. It is 'linear' because there is a well-defined set of stages that innovations are assumed to go through. Research (science) comes first, then development, and finally production and marketing..." (Fagerberg et al., 2005, p. 8). Innovation is, thus, traditionally conceptualized as the result of basic and applied research, development, production, and distribution.

As recently underlined by authors such as Chávez-Rivera, Ruíz-Jiménez and Fuentes-Fuentes (2024), despite the way in which innovation is conceptualized, there is consensus, today, on the fact that innovation is a vital factor for the success of businesses and a key driver of competitive advantage and its role is even more crucial in the case of small and medium-sized enterprises (SMEs) (e.g., Rashid & Ratten, 2020). However, it is noteworthy that the significance of this topic is not reflected in a comprehensive exploration of all facets of innovation in management studies. A particularly crucial aspect is the observation that, within organizational innovation research, there is both a strong gender bias in academic studies and a certain degree of gender blindness in this field. (e.g., Audretsch, Belitski & Brush, 2022; Ranga & Etzkowitz, 2010). On the one hand, indeed, calculating investments in "Research and Development" was a typical method to measure innovation due to the above-cited dominance of the linear model of innovation theoretical framework. If this proxy can be easily applied in the manufacturing sector, basically perceived as male-dominated, the situation partially changes when considering the service sector where soft types of innovations generally happen and where most women-owned firms are established. On the other hand, when taking innovation studies into account (e.g., Alsos et al., 2016; Poggesi, Mari & Schilleci, 2024; Ranga & Etzkowitz, 2010; Seigner, Milanov & McKenny, 2022), over time it emerges that the focus is on organizations and institutions, both at country and regional levels, devoting little attention to the innovator, as an

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individual, and, consequently, to the related gender. However, a socially constructed assumption seems to emerge that women are less innovative than men (e.g., Henry, Foss & Ahl, 2016; Ranga & Etzkowitz, 2010).

Moving the attention from innovation to entrepreneurial studies, where an emphasis on the role of the (male/female) entrepreneur can undoubtedly be observed, it is a matter of fact that research on innovation in women-owned firms still lags behind (e.g., Alsos, Hytti & Ljunggren, 2013; Brush et al., 2022; Jennings & Brush, 2013; Mari & Poggesi, 2024), which can be explained by the underrepresentation of women in innovation-driven sectors; the majority of women-owned firms are predominantly established in low value-added and low technology-based sectors such as retail, healthcare, and education (Brush, Edelman, Manolova & Welter, 2019; GEM, 2023; Jennings & Brush, 2013; OECD/European Union, 2023). The data on involvement in the ICT sector is particularly clear; only 2.3% of women work in this sector compared to 5.3% of men (GEM, 2023). This concentration in the so called traditionally female-dominant sectors limits the potential for high growth and innovation, which are more prevalent in technology-intensive industries.

Several reasons can explain this situation. This study particularly highlights the importance of women's educational and training backgrounds. For instance, the most recent data for Europe show that women comprise nearly one-third of STEM graduates in 2021 (Eurostat, 2024). Scholars have suggested multiple reasons for explaining this gender disparity in STEM education including the persistence of gender stereotypes in society, family socialization still based on traditional gender roles, job-related gender segregation and, last but not least, the lack of female role models and mentors (e.g., Poggesi, Mari, De Vita & Foss, 2020; Smeding, 2012). As a consequence, the obstacles for women to enter high-technology sectors, the sectors that are mostly investigated when innovation issues are studied, are still massive. Therefore, it is not surprising that there is only a niche of studies, to date, that has focused on the intertwinement among innovation, gender, and entrepreneurship in the management field. However, as this intersection holds significant potential for bolstering the socioeconomic development of both more developed countries and emerging economies, it warrants greater attention and understanding.

Given this premise, the aim of this paper is to provide an updated contribution to the research on the relationship between gender and innovation, providing a comprehensive overview of the current state of the art of management research on innovation in women-owned firms through a systematic literature review (SLR). This review identifies the determinants that drive innovation, examines the effects of innovation on firm outcomes, explores the pressing challenges women encounter, and suggests potential solutions.

Specifically, the authors systematically investigate and compare 48 papers by examining how each paper addresses innovation, whether as an input or an outcome of the management process. This pioneering analysis led to the identification of two distinct clusters and the results clearly indicate that both entrepreneurship and innovation are gendered, as is the research conducted in these areas.

Consequently, the adoption of a gender-neutral approach in research as well as the need to delve deeper into the investigated sector, type of innovation, and the contextual grounding of firms emerge as crucial areas for future analyses.

The structure of the paper results as follows: firstly, consolidated findings regarding women entrepreneurs and innovation are presented; then, a description of the methodology adopted and the SLR protocol are provided. The resulting trends emerging from research are presented and the main thematic areas are subsequently analyzed. Accordingly, the implications for research and policy are discussed.

Women entrepreneurs and innovation: consolidated findings

Discourse around women entrepreneurship has gained substantial momentum in recent years, with scholars and practitioners devoting considerable attention to understanding its peculiarities and distinctive features.

This attention is further reinforced by yearly data and statistics from the Global Entrepreneurship Monitor (GEM) report. The most recent version released, GEM 2022/23, highlights that, globally, 1 out of 6 women express a strong inclination towards starting an entrepreneurial venture in the near future, against 1 out of 5 men. Moreover, as GEM (2023) underlines, the countries in which women's intentions to become entrepreneurs are the highest are low-income countries (28.2%) in contrast to a much lower percentage (11%) observed in high-income countries.

While these statistics represent only a fraction of the complex global landscape of women's entrepreneurship, they underscore that significant challenges persist, hindering the realization of women's full potential in driving innovation and fostering economic growth.

Among these challenges, we can cite:

Activity sector: from the GEM 2022/2023 report data, there is still evidence of the high concentration of women entrepreneurs in low value-added and low technology-based sectors such as retail, healthcare, and education. The data on involvement in the ICT sector is particularly clear; only 2.3% of women work in this sector compared to 5.3% of men (W/M ratio of 0.43) (GEM, 2023).

Access to finance: over the years, scholars have investigated both the demand side and the supply side of financing for women entrepreneurs and results show women entrepreneurs often face greater difficulties in accessing financial resources compared to men. This disparity can be attributed to a variety of factors including gender biases in lending practices (see for example Bellucci, Borisov & Zazzaro, 2010; Carter, Shaw, Lam & Wilson, 2007; Kanze, Huang, Conley & Higgins, 2018; Wilson, Carter, Tagg, Shaw & Lam, 2007) and lack of collateral. These considerations are reflected also in Brush, Greene, Balachandra and Davis (2018) study, in which the authors point out that women entrepreneurs still face a lower attraction of early-stage equity investments in comparison to their male counterpart, while research clearly points out the importance of venture capital funding for the growth of innovative startups (e.g., Kanze et al., 2018; Lerner & Nanda, 2020).

Networking: entrepreneurial networks (including professional networks, business, and trade associations) are described as intermediate institutions between the macro-society and economy-wide level and the micro-level (Brush, De Bruin & Welter, 2009). Over the years, research has verified that women frequently have limited access to networks that are crucial for their entrepreneurial success, thus limiting their ability to gain mentorship, resources, and business opportunities. The male-dominated nature of many industry networks and the consequent gender biases and exclusionary practices further exacerbate this challenge (Brush et al., 2019a; Stam, Arzlanian & Elfring, 2021).

Societal and cultural norms: societal expectations and cultural norms often make balancing work and life particularly challenging for women, especially for women entrepreneurs. According to the OECD (2024), men in OECD countries spent an average of 2 h, 27 min per day of unpaid work last year, while women spent 4 h, 39 min. This significant disparity in family and caregiving responsibilities can severely impact the growth ambitions and entrepreneurial activities of women.

Educational background: according to Eurostat, a higher percentage of women have tertiary education compared with men (48% of women and 37% of men, respectively) in 2022 (Eurostat, 2023). However, in 2021, in the EU, women accounted for only 32.8% of

tertiary education graduates in STEM fields (Eurostat, 2024). The lower representation of women in STEM fields impacts their ability to enter high-growth, technology-driven sectors.

The above-mentioned characteristics can be read as substantial obstacles that hinder the full realization of women's potential in driving innovation. The aim of this paper is, therefore, to perform a comprehensive overview of the state of the art of management research on innovation in women-owned firms to identify further pressing challenges and potential solutions.

The systematic literature review rationale

SLR methodology

The study addresses the research question by conducting a SLR, which follows the traditional management approach based on rigorous criteria (e.g., Newbert, 2008; Pittaway & Cope, 2007; Thorpe, Holt, Macpherson & Pittaway, 2005; Tranfield, Denyer & Smart, 2003). The research has been conducted on papers published up to 1st April 2024. The research databases chosen for the analysis are Scopus, Web of Science (WoS), and EBSCOhost and the following keywords have been searched in the papers' abstract:

In the 1st row – (“innovat*”) ⁽¹⁾

In the 2nd row – AND (“female” or “wom*” or “gender”)

In the 3rd row – AND (“firm*” or “enter*” or “own*” or “business*” or “corporation*” or “compan*” or “entrep*” or “venture*” or “SME*” or “organization*” or “organization*”)

The selected keyword in the first row ensured inclusion of all those papers dealing with innovation issues, while the chosen keywords in rows 2 and 3 identified those articles that are specifically focused on the role of women as entrepreneurs in management studies (e.g., Poggesi et al., 2020).

Table 1 shows the search options selected for each database.

The process followed four steps to select relevant papers.

Firstly, duplicate articles within each database and among the three databases have been removed.

Secondly, abstracts resulting from the research have been reviewed to ensure the papers' substantive context. In this vein, five main inclusion/exclusion criteria have been used, namely: *i*) discarding papers related to women managers/scientists in the innovation process; *ii*) discarding papers related to the women students' attitude towards entrepreneurship; *iii*) discarding papers focused on women's entrepreneurial intentions; *iv*) including only published articles in peer-reviewed journals; and *v*) including only papers written in English. Here, attention must be paid to the fact that a number of papers have been discarded, as they used the word “innovat*”, actually just to put the accent on the novelty of the conducted research, without any reference within the manuscripts, to any kind of innovation process.

Thirdly, a full-text analysis was undertaken of the 172 selected papers to ensure articles' substantive relevance. In doing this, the authors have applied again the previously identified five criteria and the full text of all the potentially relevant articles were read according to two main criteria, i.e., *i*) theoretical strength, and *ii*) focus on the issue of innovation in relation to female entrepreneurship, thus removing those works showing poor research design and not centered on the above mentioned interlink. Here, it is worth mentioning that a high number of papers have been deleted as they do not analyze the interrelation among firms' outcomes/characteristics, gender, and innovation.

⁽¹⁾ The asterisk at the end of a search word allowed for different suffixes (e.g., “innovation”, “innovative”, etc.).

Table 1
Search options for the chosen databases.

Database	Search criteria	No. of articles
Scopus	Search in: Article Title, Abstract, Keywords Document type: Article, Review Subject area: Business, management and accounting Data range: all years to 1.04.2024 Language: English	1671
Web of Science (WoS)	Search in: Topic Document type: Article, Review Subject area: Management, business Data range: all years to 1.04.2024 Language: English	990
EBSCOhost	Search in: Abstract Document type: Academic Journals Data range: all years to 01.04.2024 Language: English Limitation: Scholarly (Peer Reviewed) Journals	786

Thus, after careful consideration of 172 articles, this step resulted in 126 research articles eliminated from the dataset.

Fourthly, in order to ensure that all relevant articles were included in the final dataset, a tracking of the existing documents was conducted. This step of “hand searching” allowed the authors to add 2 more research articles, taking the total number of articles to 48.

SLR data and sample

The phases of the conducted SLR described in the previous section as well as the step-by-step results in terms of inclusion/exclusion of papers, which are highlighted in Fig. 1, are then synthesized in the PRISMA flow diagram, showing the complete research process.

After conducting the SLR, a final dataset comprised 48 papers and, in order to properly manage them, following Henry et al. (2016), a thematic reading guideline was developed ⁽²⁾. Then, an *ad hoc* coding system was developed, considering two main dimensions: *i*) each paper's research question(s); and *ii*) how each paper addresses innovation. After grouping the codes according to their coherency, two main themes emerged ⁽³⁾, distinguishing in particular between cases in which innovation is the input or the outcome of the management process.

The evidence base

The analysis of the selected papers shows some interesting results.

Considering the number papers published yearly in peer-reviewed international management journals, results from the dataset show that all the articles on this topic are relatively recent, with the first paper dating back to 2005. It is only from 2012 onwards that stabilization in scholarly attention and publication activity on this topic has occurred, as illustrated in Fig. 2.

The distribution of the 48 publications over the years reveals a peak in 2019, with 8 papers published, which is contrasted with several years where only 2 papers were published. This data clearly indicates that the topic has yet to receive the full and well-deserved attention in management studies. Given the importance of the investigated topic, it is reasonable to hypothesize that the number of publications will increase and eventually stabilize in the coming years. The analysis of the outlets for the selected publications reveals a highly fragmented situation. Over the years, more than 30 different

⁽²⁾ The reading guideline is available from the authors.

⁽³⁾ The 3 theoretical papers in the dataset are not included in any of the two themes.

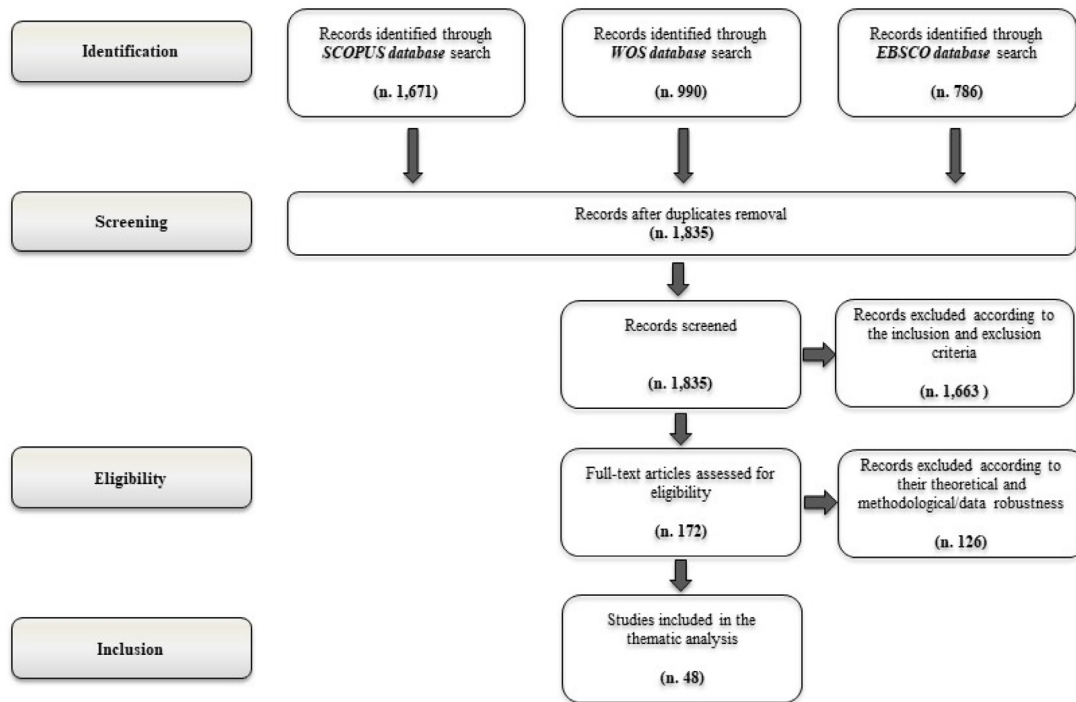


Fig. 1. SLR phases – PRISMA diagram. Source: authors' elaboration.

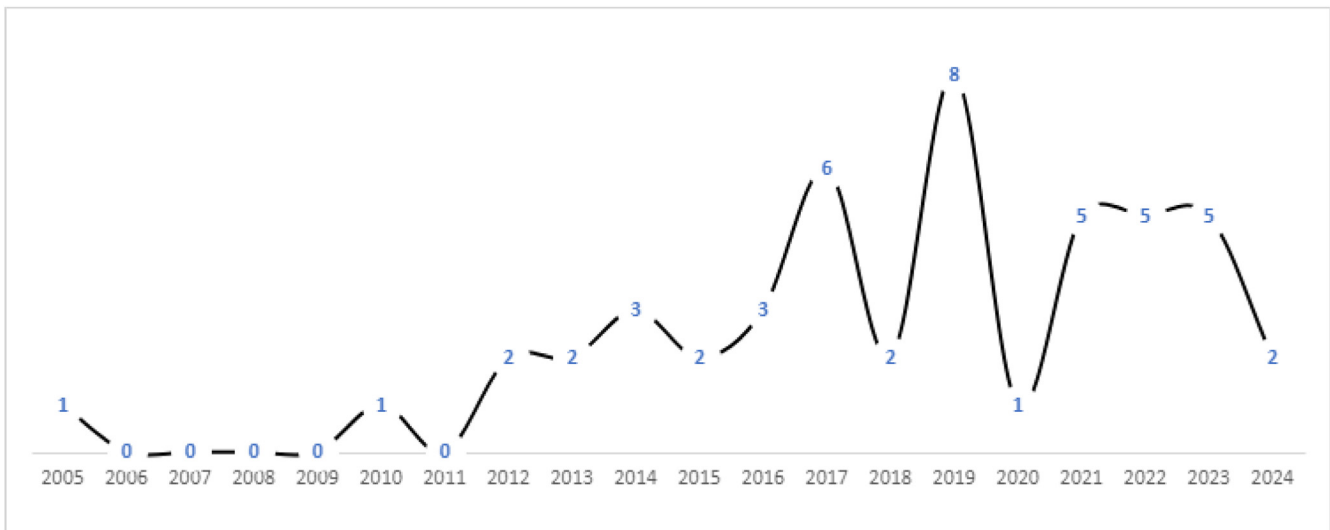


Fig. 2. Papers' distribution per year. Source: authors' elaboration.

journals have published at least one article relevant to this study's aim. Amid this fragmentation, the *International Journal of Gender and Entrepreneurship* stands out, having published 5 of the 48 papers in the dataset. Table 2 highlights the journals that have shown the most commitment to the conversation on this topic.

With regard to the nature of the papers, three studies included in the dataset are purely theoretical (Alsos et al., 2013; Kemppainen,

2019; Nair, 2020), while the other 45 are based on empirical investigations, adopting various types of analysis; among them, very frequently adopted are the regression analysis and the structural equation modeling (Table 3).

Table 2
Publications' outlets.

Journal	N. of papers per Journal
International Journal of Gender and Entrepreneurship	5
International Journal of Entrepreneurship and Small Business	3
Small Business Economics	2

Table 3
Types of methodologies adopted.

Methodology	N. of papers per Methodology
Theoretical	3
Regression	25
SEM	8
Qualitative Analysis	7
Factor Analysis	1
Correlations	2
ANOVA	2

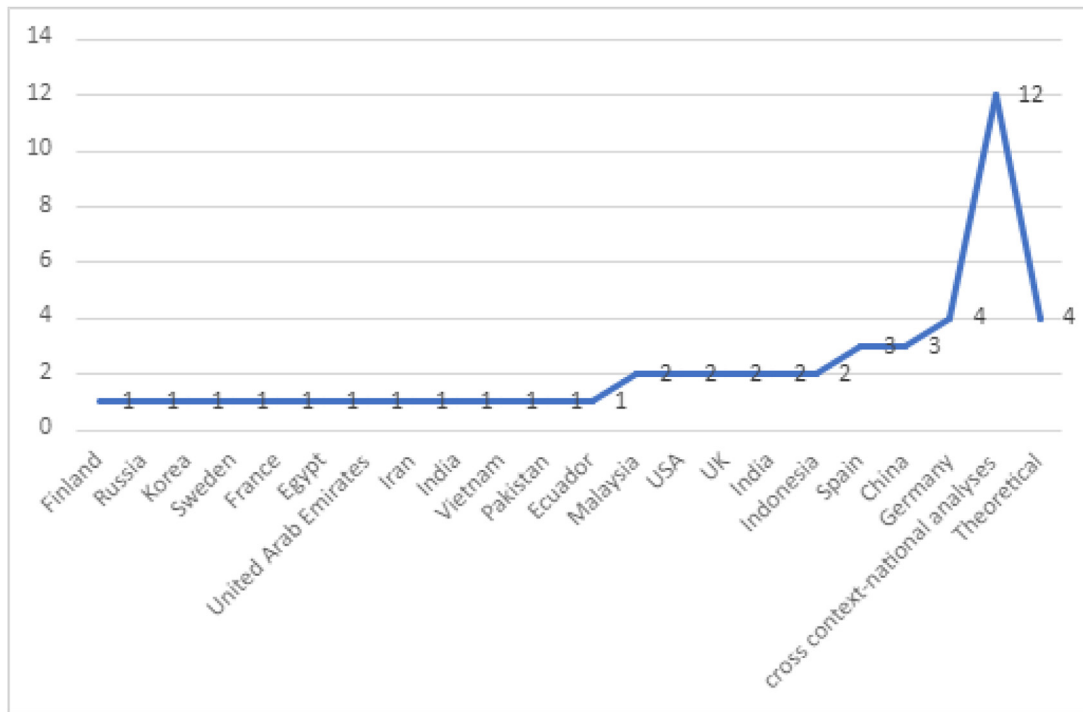


Fig. 3. Analyzed countries by paper. Source: authors' elaboration.

Also, the samples' size considered in the analyzed papers for empirical investigations vary significantly, ranging, as an example, from 6 women business founders interviewed (Gupta & Etzkowitz, 2021) to data collected from more than 45,000 firms (Laguir & Den Besten, 2016).

Finally, the range of the investigated countries is also wide. The majority of papers is focused on data from a single country (e.g., US, Sweden, France), but there are also papers, in particular those published more recently, that expand the horizons of their analyses making cross context-national investigations (Fig. 3).

In the Appendix, a selection of the dataset papers, including their Scopus citation scores, is provided. With the exception of a limited number of papers, in general, the citations of the papers in the dataset are few (often less than 50, even for the older papers). This low number of citations can indicate that the management community engaged with this topic remains relatively small. This observation underscores the nascent stage of research at the intersection of female entrepreneurship, innovation, and gender issues.

Analysis of the selected papers

With the aim of presenting a complete picture of the state of the art of research on innovation in women-owned firms, the authors have identified two main themes according to how innovation is considered in each paper. Specifically, the two themes can be outlined as follows:

- Theme 1 – Factors affecting innovation in women-owned firms.
- Theme 2 – How innovation affects women-owned firms' outcomes.

Theme 1 – Factors affecting innovation in women-owned firms

Despite the relevance of research on innovation, factors that are able to affect innovation in women-owned firms still need wider attention by management scholars. Papers associated with this theme aim to take a step forward in the conversation, depicting the role that firm-specific factors, industry-specific factors, and/or human

capital factors may have in influencing innovative activities in women-owned firms. Interestingly, the vast majority of clustered papers are not strictly focused on the analyses of solely female entrepreneurship; instead, they perform broader investigations, often comparing male- and female-owned firms.

In this regard, Chávez-Rivera et al. (2024); Marvel, Lee and Wolfe (2015); Mas-Tur and Soriano (2014), and Protogerou, Caloghirou and Vonortas (2017) can be cited; they analyze how a firm's innovation can be driven by a number of factors, such as the nature of the firm's operations, or the context/industry in which the firm operates, as well as by human capital resources.

Results from these studies clearly highlight the gendered nature of innovation activities and research. According to Marvel et al. (2015), indeed, an entrepreneur's gender cannot be considered as a key element to define the innovative potential of new ventures. However, "innovation is a gendered process with differences in individual education type, interfirm network ties, as well as new firm regional location" (p. 656). Moreover, both Marvel et al. (2015) and Protogerou et al. (2017) measured innovation by considering product innovation and R&D expenditures, thus not considering process-oriented and organizational innovations which are, instead, important in low-tech and service sectors where many women-owned firms are grounded. In the same vein, Mas-Tur and Soriano (2014) explain their results by considering that women generally run small businesses. For these reasons, the paper by Nählinder, Tillmar and Wigren (2015) is also worth mentioning. These scholars, indeed, by using gender-neutral terms to operationalize innovation and grounding their study on a traditionally defined female sector, i.e., healthcare and care services, verify that there are no substantial differences between men and women in terms of innovativeness. Such a result is, therefore, achieved, according to the authors, by developing a study that is not gender-biased itself, thanks to the development of a gender-aware operationalization of innovation.

The other papers clustered in this theme develop a more focused analysis, verifying the effects of more specific factors on innovation. For example, worth noting are those papers that stress the relevance of external relationships and networking for firm innovativeness. In this regard, the papers by del Mar Fuentes-Fuentes, Bojica, Ruiz-

Arroyo and Welter (2017) and Ruiz-Ruiz-Arroyo, del Mar Fuentes-Fuentes, Bojica and Rodríguez-Ariza (2012) are of particular interest. Focusing on the case of Spain, the scholars highlight women-owned firms' ability to establish and maintain close relations with other entrepreneurs and customers, as well as with managers operating in various industries; thus, acquiring fruitful external knowledge is strictly connected to their ability to innovate. Along this line, we can cite the paper by Nair (2020) according to which women entrepreneurship innovations can be fostered through stakeholders' involvement and engagement.

This theme also includes those clustered papers that mainly delve into the entrepreneur's characteristics to better understand how personal characteristics may affect the firm's innovation. Laguir and Den Besten (2016), for example, investigating more than 40,000 French male- and female-owned firms in the manufacturing and services sectors, analyze how diverse types and mixtures of entrepreneurs' characteristics (i.e., education, work experience, gender, motivations, nationality, and age) affect the upgrading of micro and small enterprises (MSEs), defined here as the firm's growth through innovation. Results show that when the gender variable is taken into consideration, firms run by educated and experienced women tend to upgrade at a slower rate in comparison to men. However, when the main reason leading women to fund a business is related to the desire for independence or to escape joblessness, the likelihood of women upgrading tends to increase. In alignment with this perspective, Gkypali and Roper's (2024) study delves into solo-preneurship. By contrasting the experiences of men and women, it reveals that entrepreneurial self-efficacy does not influence innovation intention for women as it does for men.

Interestingly, the dataset also shows clustered papers that go beyond the "traditional" entrepreneurs' characteristics, which investigate variables that are still overlooked.

For example, by comparing early and established women entrepreneurs from Germany and Ireland, Schneider, Möhring and Proskunina (2019) introduce the "Ego development" variable and study the relations between this variable and innovation orientation, showing the existence of only one, although weak, statistically significant relationship in the case of German women entrepreneurs. Nouri, Imanipour and Ahmadikafeshani (2019) interviewed 19 Iranian women entrepreneurs, founders of high-tech businesses in biotechnology, and extended the heuristics and biases in innovation-related decisions, verifying that overconfidence bias is significant in entrepreneurs' innovation-related decisions. Also, worth mentioning are Bendell, Sullivan and Marvel (2019) who analyze 383 nascent female and male entrepreneurs running firms in high-technology business incubators in the US; they verify how gender moderates the relationship between self-leadership strategies and innovative outcomes. Specifically, due to the masculine environment that characterizes high-technology industries, Bendell et al. (2019) hypothesize that the high-growth women entrepreneurs may be less prone to establishing their intellectual property goals as high as their male counterparts.

Finally, within this niche of studies investigated in this paper, what the authors consider to be a kind of frontier on the topic, is that developed by Owalla, Nyanzu and Vorley (2021) who add to the conversation also the variable related to the ethnicity of the woman entrepreneur herself, founding that ethnic minority women-led SMEs are actually more likely to be engaged in innovation activities, with their firms, than their ethnic majority counterpart.

Accordingly, the following hypothesis is presented:

Hp. 1. Firm-specific, industry-specific, and human capital specific factors significantly affect innovation in women-owned firms, in light of gender-specific differences.

Theme 2 – How innovation affects women-owned firms' outcomes

The main aim of studies falling in this thematic area is that of understanding how the implemented innovation process may affect women-owned firms' outcomes, in terms, for example, of strategies, financing or internationalization. In doing so, many of the here considered papers base their analysis on the comparison among men- and women-owned firms.

In this regard, Ruiz-Arroyo et al. (2012) can be cited; in particular; they delve into issues related to firms' growth focusing their attention on the investigation of more than 8,000 new ventures, located in 49 countries. In their analysis, the authors find that women and men show high differences in their firms' growth expectation. Specifically, women seem to be less ambitious and do not aspire to grow as much as their male counterparts. Such results can be explained by considering that women are more likely to establish their firm in more traditional sectors in comparison to men, where innovation is often relegated to a marginal role. Interestingly, in the attempt to take a further step in research on innovation and gender, the authors propose to study innovation that is motivated by different variables for women and for men; in pursuing innovation, women are more often driven by personal/intrinsic factors, rather than by contextual ones. Ruiz-Arroyo et al. (2012) study can be also read in relation to Hoang, Nahm and Dobbie (2021). In this latter study focused on the Vietnamese socioeconomic context, growth in terms of productivity is considered. In particular and differently from Ruiz-Ruiz-Arroyo et al. (2012), the authors find out that the gender of the firm's owner does have an impact in terms of influence on the productivity of employees of the SMEs in Vietnam, especially if this impact on innovativeness is controlled for.

The relevance of innovation and the entrepreneur's gender in relation to the firm's growth is underlined also by Amoroso and Link (2018). Analyzing European firms, the authors conclude that both innovation and the entrepreneur's gender are a fertile ground on which firms' employment growth is built. Related to this, the authors also verify that the women-owned firms belonging to their sample tended to show a lower performance as they have a lower tendency to innovate and to commercialize innovations in comparison to their male counterparts. Dai, Byun and Ding (2019), conversely, point out a positive link between women entrepreneurs in new venture teams and new venture innovation performance. Strohmeier, Tonoyan and Jennings (2017) take a step further and, by comparing 900 German firms, show that firms led by women generally demonstrate less breadth and depth of innovation compared to those led by men, albeit with notable exceptions. While female-led firms were less likely than male-led firms to introduce product or process innovations, they were equally likely to implement marketing or organizational innovations, even after accounting for numerous individual- and firm-level controls. Moreover, firms led by men and women in less innovative industries show similar levels of innovation depth. By focusing on the case of Chinese women entrepreneurs, Huang, Li, Wang and Li (2022) show that innovativeness has a leading role in driving firms' performance and, interestingly, innovative entrepreneurs are better able to identify market opportunities allowing firms' sustainable growth.

Differently, Lins and Lutz (2016) work on gender differences in terms of entrepreneurial characteristics and the firm's innovativeness regarding access to venture capital. The authors contend that newly established women-owned firms experiencing high levels of R&D activities tend to benefit from less venture capital than their male counterparts with similar characteristics. Moreover, this difference tends to be exacerbated when the observed firms have low R&D activities. According to the authors, one intriguing possible explanation for explaining this gendered gap in financing is related to "structural dissimilarities due to individual characteristics and business features" (Lins & Lutz, 2016, p. 362). Interestingly, among the new

financial instruments that women entrepreneurs can use, crowd-funding initiatives can be mentioned. Widely investigated in recent years by scholars dealing with various disciplines, but still scanty analyzed in relation to female entrepreneurship, is the topic of crowdfunding which, according to Mollick and Robb (2016), is a viable solution for supporting women entrepreneurs' financing strategy and, consequently, in properly sustaining their pursuit of innovative solutions.

Finally, this cluster also includes those papers that can be considered pioneers in this field of research, as they investigate gender, innovation, and internationalization together, and thus their intertwined relationship. Alves et al.'s (2017, 2021) analysis, as an example, is based on GEM data and shows that not only are women less involved in high-tech sectors, but also the lack of involvement in innovative activities indicates women-owned firms have less chances of growing through exporting activities. Also, Machado, Braga, Correia, Braga and Silva (2023) analyze such a relationship and, although the interdependence between internationalization and innovation is tested, a non-significant link between female entrepreneurship and internationalization emerges; this result can be attributed to various challenges including high capital access constraints and cultural and social barriers.

Accordingly, the following hypothesis is presented:

Hp. 2. The implementation of innovation processes positively influences the growth of women-owned firms, with gender-specific differences affecting strategies, financing, and internationalization.

Discussion

This study provides an analysis of the state of the art of management research on innovation in women-owned firms published up to 1st April 2024 by means of a SLR. The in-depth review of the papers belonging to the dataset shows that researchers are mainly focusing around two key thematic areas: one related to the analysis of factors that affect innovation in women-owned firms, and one based on the analysis of how innovation can affect women-owned firms' outcomes.

Hereafter, details of the main findings derived from this review are outlined.

First of all, despite the strong political and social emphasis on female entrepreneurship and innovation, both of which are perceived as key drivers of economic growth, these topics are still primarily investigated separately. Leading scholars (Alsos et al., 2013; Brush et al., 2022; Jennings & Brush, 2013) have called for more focused studies on the intersection of these areas. However, the limited number of papers ($n = 48$) identified confirms that their interconnections are still in their nascent phase.

The second finding is that the analyzed published works, primarily comparing women- and men-owned firms, reaffirm the "traditional" results; women-owned firms are generally less innovative than their male counterparts. However, several scholars (e.g., Marvel et al., 2015; Mas-Tur & Soriano, 2014; Protogerou et al., 2017; Strohmeyer et al., 2017) have highlighted the need to consider the nature of a firm's operations, industry context, the entrepreneur's human capital and external connections. In line with this, Marvel et al. (2015) and Strohmeyer et al. (2017) demonstrate, for example, that women entrepreneurs are as innovative as their male counterparts under similar conditions of human capital and external ties, and in less innovative industries.

Building on the previous point, the third finding reveals a consensus among many scholars within the dataset: both entrepreneurship and innovation are inherently gendered. This acknowledgement underscores the need to address the gendered nature of research in these fields (e.g., Ruiz-Arroyo et al., 2012; Strohmeyer et al., 2017). Nählinder et al. (2015) further support this approach by proposing

for the first time "a gender-aware operationalisation of innovation" and showing no substantial gender differences in innovativeness when using a gender-neutral operationalization of innovation. These aspects stress the need to develop a deeper consciousness related to the understanding of the complexities involved in studying gender dynamics in entrepreneurship and innovation. The need to study this interconnection adopting a gender-aware perspective is, thus, a necessity that has to be caught by scholars.

Overall, despite the strong political and social attention towards female entrepreneurship and innovation, these findings highlight the complex and intertwined relationship between gender, innovation, and entrepreneurship, emphasizing the need for more integrated research approaches that consider these elements together rather than in isolation. By integrating gender, innovation, and entrepreneurship can we deeply contribute in supporting the economic boost at the international level.

Conclusions and implications

This study makes a pioneering contribution to the field of female entrepreneurship by addressing a significant gap in management research that is related specifically to the understanding of the crucial intersection among entrepreneurship, innovation, and gender issues. By offering a comprehensive exploration of studies that have focused on this intersection over time, this paper not only enhances our understanding, but also paves the way for future research avenues.

In particular, this study provides numerous contributions and implications for future research on female entrepreneurship. The results offer insightful considerations on the limitations of existing research, highlighting areas for further investigation. Specifically, the authors emphasize the importance of focusing on the sectors of analysis, the operationalization of innovation-related variables, and the gendered approach toward innovation.

Regarding the investigated sectors, it is interesting to point out that those sectors in which women entrepreneurs are, typically, more involved (e.g., the service sector) are generally perceived as "un-innovative", therefore not deserving of investigation under the innovation lens. However, as different types of innovation do exist (i.e., soft types of innovation, such as organizational innovation, as well as process or marketing innovation), it is time for scholars to rethink the concept of innovation, shedding light on the traditionally defined "female" sectors, which can be innovative, thus providing a clear and comprehensive picture of all the facets that innovation may have.

The discussion related to the investigated sector is then strictly linked to another aspect that deserves attention, i.e., the way in which innovation is measured. Many of the selected papers operationalize innovation activities by using indicators such as R&D expenditures or the degree of product novelty. Such measures, indeed, do not allow capturing all the facets that innovation may have and which can be measured with non-economic indicators. At the same time, it is important to consider that different entrepreneurs' characteristics (and related variables) can affect innovation for men and women and should be considered. Following those studies that investigate the differences in the principal antecedents for innovative behaviors between men and women employees, scholars' attention should focus on investigating if and how the different internal variables relate; for example, how the personality, as well as the desires and personal needs, can affect innovation differently in the case of women- and men-owned firms. Among the other factors, it is worth mentioning the role of motivation, which has had little investigation to date. Stemming from the awareness that it is necessary to overcome the traditional "opportunity vs. necessity" dichotomy, future research could consider the dynamics of motivation during the entrepreneur's lifetime and how they affect innovation. At the same time, the context in which the firms are grounded should be considered in

detail as the firm’s geographical location can play a key role in its innovation activity (e.g. Poggesi & Mari, 2024). Finally, gender biases could have contributed to the above-mentioned results. For this reason, as advocated by several scholars in the dataset, adopting a gender-neutral approach in this kind of research (e.g., in terms of survey questions or during direct interviews) is needed and could lead to different results. At the more general level, it is interesting to point out that the gender question is often avoided, with a general tendency to omit the social construction of gender, thus presenting the historical dichotomy between women and men.

What has been previously discussed also allows insightful food for thought for policy makers to emerge. First, results from this SLR point out that, among other factors, networks – formal as well as informal – and interorganizational partnerships play a key role in fostering innovation and it is of peculiar relevance in the case of women-owned firms. To properly complement existing knowledge-management systems associated with women-owned firms, the adoption of web 2.0 tools should be encouraged to allow a fruitful collective creation of connections and sharing of creativity processes and information. Therefore, policy makers should encourage women entrepreneurs to leverage such partnerships, which should include establishing fruitful ties both with private and with public parties. Second, considering the sector of activity, policy makers should, on the one hand, devote more attention to service sector dynamics, bringing to light the essence of women entrepreneurs’ innovation in a sector that, in these terms, is hardly considered. On the other hand, policy makers should also focus on the educational side to develop specific instruments that can support girls’ approach to scientific disciplines in their educational path. As an example, policy makers should develop targeted tools that can augment women’s access to STEM fields (scholarships, internships, etc.) and eventually to support them in entering an innovative entrepreneurial career after graduation.

In conclusion, the authors do believe that the results of this work offer a clear analysis of management research on innovation in women-owned firms, representing an interesting starting point for scholars and practitioners.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Michela Mari: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Sara Poggesi:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Gianpaolo Abatecola:** Writing – review & editing, Writing – original draft, Methodology. **Caroline Essers:** Writing – original draft.

Appendix A selection of papers from the dataset

Author(s)	Publication year	Journal	Theoretical framework	Aim	Sample	Gender of the firms’ owners	Investigated Country	Methodology	How innovation is measured	Analyzed Variables	Thematic Area	Scopus citations
Alsos et al.	2013	Int. J. Gend. Entrep.	Gender and innovation	The purpose of the article is to present a framework for research on gender and innovation. The framework is developed based on a review of current literature in the area.	Theoretical	Theoretical	Theoretical	Theoretical	Theoretical	Theoretical	Theoretical	201
Mas-Tur and Soriano	2014	Serv. Bus.	KIBS	The purpose of this study is to determine the characteristics of YICs that enhance their innovation and, specifically, if the use of knowledge-intensive business services (KIBS) helps drive innovation.	189 YICs	Men and Women	Spain	Binary logistic regression	Innovation as function of Use of KIBS, Size of business, Sector, Competition in the sector, Age of the entrepreneur, Gender of the entrepreneur.	Use of KIBS; Size of the YIC; Sector in which the YIC operates; Degree of competition in the sector; Age of the entrepreneur; Gender of the entrepreneur.	I Theme	55
Marvel et al.	2015	IEEE Trans. Eng. Manag.	Gender and innovation	This paper explores the entrepreneur gender –innovation relationship in new ventures. It investigates individual education, interfirm network ties, and firm regional location using	4265 Korean firms	Men and Women	Korea	Regression analysis	Patent activity and R&D intensity of each firm.	Patents applied; R&D intensity; Male entrepreneur; Female entrepreneur; Individual education; N/W heterogeneity; Regional location; Firm age; Firm size; Marketing intensity; Capital structure;	I Theme	38

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Author(s)	Publication year	Journal	Theoretical framework	Aim	Sample	Gender of the firms' owners	Investigated Country	Methodology	How innovation is measured	Analyzed Variables	Thematic Area	Scopus citations
Protogerou et al.	2017	Research Policy	Gender, innovation and performance	This paper empirically explores the determinants of product innovation and R&D intensity of young firms by defining a model that considers the joint effect exercised by factors that are both internal and external to the firm on its innovative performance.	3962 firms	Men and Women	10 European countries	Tobit regression	In this study, we use two innovation indicators covering both the input and output side of the innovation process. As an input measure, we utilize the share of R & D expenditure in firm turnover. Innovation output is measured as the degree of radicalness or novelty of product innovation.	VC funding; Government funding. Product innovation; R & D intensity; Founder's characteristics; Educational attainment; Professional experience; Prior industry experience; Prior experience in R&D; Team diversity in functional expertise; Team diversity in occupational background; Technical and marketing expertise; Technical and general management expertise; Technical and finance expertise; Gender; Team foundation; International sales; Size; Employees with university degree; Employees training; Venture capital funding; Networking with universities; Formal technology collaborations; Price competition; Market dynamism; Low & medium-low tech manufacturing; High & medium-high tech manufacturing.	I Theme	137
Amoroso and Link	2018	Small Bus. Econ.	Gender and the economic performance of firms	This paper studies the impact of gender on employment growth controlling for the innovation activity of young and knowledge-intensive entrepreneurial firms.	3540 firms	Men and Women	10 EU Countries	Regression analysis	The share of new or significantly improved products or services in the period 2007–2009 to total sales.	Size; demand; competition; price competition; quality competition; business cycle; sector export int; sector R&D int; abilities; risk aversion; funding capability; network capability; owner exp; self-employed; uni/gov exp; first job.	II Theme	25
Bendell et al.	2019	J. Small Bus. Manag.	Self-Leadership	The study applies a gender-aware framework to examine the self-leadership strategies that men and women as early-stage high-growth entrepreneurs employ as they develop innovations.	383 founders	Men and Women	USA	Regression analysis	The sum of self-reported intellectual proprietary assets in the following four areas: patents, patents pending, trademarks, and copyrights.	Intellectual Property; Firm Age; Parent Entrepreneur(s); Education; Experience; Venture Commitment; Gender; Self-Goal Setting; Self-Cueing; Self-Dialogue.	I Theme	35
Nair	2020	J. Bus. Res.	Gender, innovation and stakeholder engagement	The main objective of this paper is to examine whether women entrepreneurship innovations can be fostered	Theoretical	Theoretical	Theoretical	Theoretical	Theoretical	Theoretical	Theoretical	56

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(Continued)

Author(s)	Publication year	Journal	Theoretical framework	Aim	Sample	Gender of the firms' owners	Investigated Country	Methodology	How innovation is measured	Analyzed Variables	Thematic Area	Scopus citations
Dai et al.	2019	Entrep. Theory Pract.	Team Diversity and New Venture Innovation Performance	This paper explores the question of whether and how gender diversity in teams affects firm innovation performance.	132 firms	Men and Women	China	OLS regressions	Innovation performance was measured using a questionnaire with the following four items: (a) "the degree of newness of our firm's products/services"; (b) "the use of the latest technological innovations in our new products/services"; (c) "the speed of development of new products/services"; (d) "the number of new products/services that our firm has introduced on the market"; and (e) "the number of new products that are first-to-market (early market entrants)."	Innovation performance; New venture team gender diversity; New venture team functional diversity; Female employee presence; firm age; firm size; R&D; past growth; team size; environmental dynamism.	II Theme	74
Huang et al.	2022	Journal of Innovation & Knowledge	Social cognitive theory	This study analyzes the relationship between female entrepreneurs' innovativeness and entrepreneurial performance.	558 Chinese entrepreneurs	Women	China	SEM	Measurement of organization-level innovativeness and set the individual-level innovativeness questions to include three items, such as: "I can quickly come up with many creative ideas".	Innovativeness; Opportunity Recognition and Development; Psychological Capital; Gender Stereotypes; Entrepreneurial Performance. Control variables: Age, education level, marital status, fertility status, and enterprise development stage.	II Theme	24
Gkypali and Roper	2024	Technological Forecasting and Social Change	Entrepreneurial self-efficacy (ESE)	This paper empirically analyzes the relationship between, and the determinants of, innovation and growth intentions using data on a large sample of UK solopreneurs.	1212 solopreneurs	Men and Women	UK	Linear regression,	Binary variable taking value 1 if the firm intended to develop and introduce a product/service innovation within the next three years and zero otherwise.	Sales Growth Intentions; Innovation intentions; Innovation performance; Previous Sales Growth; Firm Age; ESE; Product Innovation Capability; External finance capability; Operational Strategy Capability; Operational Management Capability; Gender; BAME owned; Breadth; Export; External Finance; Business advice; Profitability.	II Theme	0

Source: authors' elaboration.

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