

Gender and Innovation: Mapping the 2020 Research Agenda

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Abstract

Gender has been a central concept in studying innovation during recent decades, generating diverse venues of systematic investigation. This article aims to map the theoretical fundamentals of gender and innovation published in 2020, as well as approaches, methodologies, and concepts tackled in studying the intersection of these two concepts. The review is based on journal articles retrieved from inter- and transdisciplinary scientific journals focusing on the topics at hand and aims to map the research agenda, the methods employed, and the main perspectives used and generated. Although a relatively short period of time, and a challenging one—due to the global COVID-19 pandemic that disrupted, among others, the academic world—, literature published in 2020 encompassed plenty research surrounding gender and innovation, employing diverse and complex methodologies, and multifold perspectives from various countries and disciplines. This paper documents frameworks that generated knowledge about women’s empowerment and its impact on innovation, and lays the ground for future research, as well as for social and professional practice.

Keywords: *gender, innovation, research, women’s empowerment, leadership*

Innovation has driven development and catalyzed change throughout the world, yet it has not been an inclusive research subject until recently in history. Societies can achieve even more impressive and significant results by simply comprehending that humans are capable of innovation regardless of gender, race, class, ethnicity, or other individual characteristics. A will and a further effort to address the unique obstacles that some individuals face in innovating could increase the depth and complexity of innovation research. When faces of innovation are examined through a gendered, racial, ethnic lens, the knowledge society and the whole society have something to gain. Throughout recent years, research focused on women innovators has started to gain traction. Innovation touches on the lives of individuals, groups, organizations, countries, and the world itself, thus they “can benefit from innovation and resilience by



supporting women team leaders in their diverse delivery of innovation” (Zuraik, Kelly, & Perkins, 2020).

The intersection of gender and innovation has become a point of interest for various scholars from across the world (see *Table 1*, following pages), and research found strong connections between the two concepts in organizational practice. Denend et al. (2020) argue that gender diversity is a catalyst in engendering and sustaining innovation, as well as enhancing the collective intelligence of an organization. Reddy and Jadhav (2019) examined the literature surrounding gender diversity on corporate boards, and presented evidence from diverse markets to show research interests and findings in relation to gender quota legislation, managers’ characteristics, firm size and diversity, and other factors that influence women’s representation on corporate boards.

Moreover, innovations related to gender should impact the gender dynamics within a society; Brugere *et al.* (2020) warn that the effectiveness of innovations in this respect weighs upon the extent to which they change gender relations, including how they shift gender roles, and result in women’s empowerment. One comprehensive attempt at evaluating the state of the art in relation to gender and innovation research was carried out by Alsos, Ljunggren, and Hytti (2013), who pointed out the multifold approaches and discourses surrounding these topics. To elaborate the analytical framework, the scholars identify three categories: innovation as output, processes of innovation, and innovation discourses; perspectives found in literature can also be found under gender approaches as variables, gender constructions under interpretive analysis, and in-depth analyses of gendering organizations and systems, as well as interactions. Finally, Alsos *et al.* (2013) classify previous research consulted based on the general perspectives employed: (1) gender differences and similarities in innovation; (2) gendering constructions of innovation; and (3) gendering processes of innovation. The present paper aims to document recent trends in systematic investigations at the intersection of gender and innovation. We review recent literature on gender and innovation, by mapping methodologies employed, approaches, topics and perspectives. Moreover, we place the subjects of recent literature in order to establish whether the conventional divides between the Global North and the Global South in women’s studies or other such discrepancies are noted. Finally, we advance suggestions for future venues of research.

Gender and innovation: research procedure

While the intersection of gender and innovation has not been the core research interest of either research area, there are some cornerstone studies that grounded and advanced such inquiries. Studies surrounding the two concepts have been published in a wide array of journals, and the disciplines, methods, topics approached meet criteria of complexity and diversity. As gender studies have emerged as a field of research mainly studying women, and later encompassed an interest towards studying men, **gender** is often synonym for **women** – in the literature under analysis, gender translates into two approaches: (1) *tackling female subjects/ participants*; and (2) *inclusive approaches, investigating both women and men*. Overall, there is a need for an overview of research and a systematic weaving of knowledge on gender and innovation, as a foundation for further development in research and practice.

To generate the corpus of analysis for the present paper, I used the SCOPUS database to retrieve and select relevant articles. The sequence of steps to reach the final article selection is further detailed. First, I ran a search using the terms *gender* and *innovation*, which generated over 10,000 entries. Then, I restricted the search to journal articles, published in 2020 (*n.a.* articles published January through August and in press), and in English. I then ran a parallel search using the terms *women* and *innovation*, which rendered an identical set of articles. From the gender and innovation results comprising 205 articles, I then used titles, abstracts, and keywords to select the relevant articles for this research. In several cases, the feature of innovation or gender was not evident or did not emerge as a key concept or variable from the title, abstract, or keywords, thus I removed those articles from the corpus. Furthermore, there were articles, mistakenly included in 2020, which had been published before; I removed those, as well. However, I included articles received and accepted in 2018 or 2019 and published later, in 2020. A thick research interest toward recent innovations in women’s health is noteworthy: from aesthetic surgery (Spiegel, 2020) to reproductive health (see, for example, Akpovi *et al.*, 2020 or Hemmerling, Christopher, & Young Holt, 2020), innovative approaches are widely explored in literature. Although the author recognizes the positive effects that medical innovations have upon women’s lived experiences, such topics go beyond the aim of this paper, thus I only analyzed healthcare innovation articles related to ICT, which is closer to the scope of this research. Based on these criteria, the corpus of analysis for gender and innovation journal articles in English, published or to be published in 2020, includes **76** research articles.

Methodologies, populations, and areas of research

Throughout time, critics of feminisms and feminist scholars have argued that this kind of research is discriminatory in that it overlooks or dismisses experiences and representations of categories of individuals, groups, or countries, based on conventional divides such as between the Global North and Global South or Western and Eastern countries. Some critiques target the dominance of representations and views of privileged women and the oblivion towards other categories. This paper does not intend to minimize such disconnects or engage in a rhetoric that denies such realities, but aims to merely bridge these divides by mapping populations included in gender and innovation studies published in 2020, across disciplines. Thus, I documented subjects and populations included in every journal article analyzed, and *Table 1* shows how these articles cover various regions and countries. In a few cases, comparative research is conducted from a cross-country perspective, and even trans-regional. The research papers included in this review study populations from Africa, Asia, Europe, Latin and Northern America, and even Oceania, generating a wide variety of perspectives and results.

Table 1. Geographical distribution of studies

Region	Studies
Africa	South Africa (Dietrich <i>et al.</i> , 2020), Zanzibar (Brugere <i>et al.</i> , 2020), cross-country (Brixiová <i>et al.</i> , 2020; Fatou, 2020; Horn, 2020), Kenya (Gichungi <i>et al.</i> , 2020, Lieu <i>et al.</i> , 2020), Maghreb (Kerras <i>et al.</i> , 2020), Ghana (Osei & Zhuang, 2020), Morocco (Bouhazzama & Guenaoui, 2020)

Asia	Taiwan (Chen, 2020), India (Agarwal, 2020a, b; Biju & Pathak, 2020; Farnworth <i>et al.</i> , 2020; Jain, Tandon, & Khandelwal, 2020), Indonesia (Asteria & Herdiansyah, 2020), Laos (Moglia <i>et al.</i> , 2020), Bangladesh (Biswas, Boyle, & Bhardwaj, 2020; Farnworth, Jafry, Rahman, & Badstue, 2020), Pakistan (Zeb & Ihsan, 2020)
Europe	Spain (Groza, Groza, & Barral, 2020; Hernández-Lara & Gonzales-Bustos, 2020, Lieu <i>et al.</i> , 2020), Italy (Arena, Catuogno, Saggese, & Sarto, 2020; Camussi <i>et al.</i> , 2020, De Rosa, Bartoli, Charatsari, & Lioutas, 2020; Martini, Malacarne, Giovanazzi, & Buffa, 2020; Sagesse <i>et al.</i> , 2020), France (Karthas, 2020; Loukil, Yousfi, & Cheikh, 2020; Ottogalli-Mazzacavallo & Boutroy, 2020), cross-country (Kerras <i>et al.</i> , 2020; Lapuente & Suzuki, 2020; Pirra <i>et al.</i> , 2020; Striebing <i>et al.</i> , 2020), Czechia (Čábelková <i>et al.</i> 2020), Germany (Bührer & Frietsch, 2020; Bührer <i>et al.</i> , 2020), United Kingdom (Al-Shaer & Harakeh, 2020; Harrison & Ogden, 2020; Hay <i>et al.</i> , 2020; Martin, Jerrard, & Wright, 2020)
Latin America	Argentina (Carrington <i>et al.</i> , 2020), cross-country (Sifontes & Morales, 2020; Wellalage <i>et al.</i> , 2020), Brazil (Sugiyama & Hunter, 2020), Peru (Santillan <i>et al.</i> , 2020)
Northern America	USA (Bendell, Sullivan, & Hanek, 2020; Dalton & Logan, 2020; Denend <i>et al.</i> , 2020; Link & van Hasselt, 2020; Mamonov & Benbunan-Fich, 2020; Nadeem <i>et al.</i> , 2020; Schuster <i>et al.</i> , 2020; Valenti & Horner, 2020; Verdín <i>et al.</i> , 2020; Zuraik, Kelly, & Perkins, 2020), Canada (Badenhorst <i>et al.</i> , 2020; Cukier & Chavoushi, 2020; Lieu <i>et al.</i> , 2020)
Oceania	Australia (Ward, Prenzler, & Drew, 2020)

In a similar way, methodologies employed in conducting research at the intersection of gender and innovation show a broad spectrum of approaches, both single-method quantitative or qualitative studies and mixed-methods approaches. As displayed in *Table 2*, a wide majority of the articles analyzed in this review are based on surveys, interviews, and secondary data analyses, yet other approaches are also well represented in the sample.

Table 2. Methodologies employed in studying gender & innovation

Research method/ instrument/ technique	Studies
Interviews	Agarwal, 2020a; Biju & Pathak, 2020; Bouhazzama & Guenaoui, 2020; Camussi <i>et al.</i> , 2020; Carrington <i>et al.</i> , 2020; Chen, 2020; Dennis <i>et al.</i> , 2020; Dietrich <i>et al.</i> , 2020; Dixit <i>et al.</i> , 2020; Farnworth <i>et al.</i> , 2020; Farnworth, Jafry, Rahman, & Badstue, 2020; Hay <i>et al.</i> , 2020; Martin, Jerrard, & Wright, 2020; Martini, Malacarne, Giovanazzi, & Buffa, 2020; Sugiyama & Hunter, 2020
Focus groups	Dietrich <i>et al.</i> , 2020; Farnworth <i>et al.</i> , 2020; Farnworth, Jafry, Rahman, & Badstue, 2020; Harrison & Ogden, 2020; Sugiyama & Hunter, 2020
Survey study	Agarwal, 2020b; Asteria & Herdiansyah, 2020; Biswas, Boyle, & Bhardwaj, 2020; Brugere <i>et al.</i> , 2020; Čábelková <i>et al.</i> , 2020; De Rosa, Bartoli, Charatsari, & Lioutas, 2020; Denend <i>et al.</i> , 2020; Dietrich <i>et al.</i> , 2020; Groza, Groza, & Barral, 2020; Mamonov & Benbunan-Fich, 2020; Martinez-Jimenez, Hernández-Ortiz, & Cabrera Fernández, 2020; Moglia <i>et al.</i> , 2020; Osei & Zhuang, 2020; Pirra, Carboni, & Diana, 2020; Sugiyama & Hunter, 2020; Verdín, Godwin, & Benedict, 2020; Zeb & Ihsan, 2020; Zuraik, Kelly, & Perkins, 2020

Experiment	Bendell, Sullivan, & Hanek, 2020; Gichungi <i>et al.</i> , 2020
Content analysis	Agarwal, 2020a; Arena, Catuogno, Saggese, & Sarto, 2020; Dennis <i>et al.</i> , 2020; Kravets, Preece, & Maclaran, 2020; Striebing <i>et al.</i> , 2020; von Hippel & Cann, 2020; Ward, Prenzler, & Drew, 2020
Document analysis	Carrington <i>et al.</i> , 2020; Kalpazidou Schmidt, Ovseiko, Henderson, & Kiparoglou, 2020; Lieu <i>et al.</i> , 2020; Martin, Jerrard, & Wright, 2020; Ottogalli-Mazzacavallo & Boutroy, 2020; Sprang, Swan, & Coker, 2020
Field research & observations	Arena, Catuogno, Saggese, & Sarto, 2020; Camussi <i>et al.</i> , 2020; Carrington <i>et al.</i> , 2020; Loukil, Yousfi, & Cheikh, 2020; Martin, Jerrard, & Wright, 2020
Ethnographic studies	Badenhorst <i>et al.</i> , 2020; Camussi <i>et al.</i> , 2020; Dennis <i>et al.</i> , 2020
Secondary data analysis	Al-Shaer & Harakeh, 2020; Brixiová, Kangoye, & Tregenna, 2020; Bühner & Frietsch, 2020; Hernández-Lara & Gonzales-Bustos, 2020; Kerras <i>et al.</i> , 2020; Lapuente & Suzuki, 2020; Link & van Hasselt, 2020; Loukil, Yousfi, & Cheikh, 2020; Nadeem, Bahadar, Gull, & Iqbal, 2020; Santillan <i>et al.</i> , 2020; Schuster <i>et al.</i> , 2020; Sifontes & Morales, 2020; Valenti & Horner, 2020; Wellalage, Fernandez, & Thrikawala, 2020
Systematic literature review	Burke & Cowling, 2020; Kamberidou, 2020; Kuschel, Ettl, Díaz-García, & Alsos, 2020; Pannell & Zilberman, 2020

The areas of research tackled in the journal articles under investigation are diverse and reflect inter- and transdisciplinary interests, often overlapping; designed in a deductive manner, based on topics reflected in the content of the articles, *Table 3* documents scientific materials grouped under umbrella areas of leadership, technology, gender diversity in organizations, agriculture and environment, research, data, and patents, STEM education, culture and communication, and gender-based violence as major research directions identified in these articles.

Table 3. Areas of research approached in gender & innovation research

Major area of research	Studies
Leadership	Al-Shaer & Harakeh, 2020; Asteria & Herdiansyah, 2020; Biju & Pathak, 2020; Burke & Cowling, 2020; Cukier & Chayoushi, 2020; Fatou, 2020; Groza, Groza, & Barral, 2020; Hernández-Lara & Gonzales-Bustos, 2020; Kalpazidou Schmidt, Ovseiko, Henderson, & Kiparoglou, 2020; Kravets, Preece, & Maclaran, 2020; Lawton, 2020; Loukil, Yousfi, & Cheikh, 2020; Martin, Jerrard, & Wright, 2020; Lapuente & Suzuki, 2020; Sugiyama & Hunter, 2020; Valenti & Horner, 2020; Zeb & Ihsan, 2020
Technology	Arena, Catuogno, Saggese, & Sarto, 2020; Asenbaum, 2020; Bendell, Sullivan, & Hanek, 2020; Čábelková <i>et al.</i> , 2020; Camussi <i>et al.</i> , 2020; Denend <i>et al.</i> , 2020; Dietrich <i>et al.</i> , 2020; Gichungi <i>et al.</i> , 2020; Hay <i>et al.</i> , 2020; Jain, Tandon, & Khandelwal, 2020; Kamberidou, 2020; Lieu <i>et al.</i> , 2020; Mamonov & Benbunan-Fich, 2020; Pirra, Carboni, & Diana, 2020; von Hippel & Cann, 2020; Wang, 2020
Gender diversity in organizational settings	Badenhorst <i>et al.</i> , 2020; Biswas, Boyle, & Bhardwaj, 2020; Kalpazidou Schmidt, Ovseiko, Henderson, & Kiparoglou, 2020; Martinez-Jimenez, Hernández-Ortiz, & Cabrera Fernández, 2020; Nadeem, Bahadar, Gull, & Iqbal, 2020; Wellalage, Fernandez, & Thrikawala, 2020; Zuraik, Kelly, & Perkins, 2020

Agriculture & environment	Agarwal, 2020a, b; Asteria & Herdiansyah, 2020; Bell, Daggett, & Labuski, 2020; Brixiová, Kangoye, & Tregenna, 2020; Brugere <i>et al.</i> , 2020; Colverson <i>et al.</i> , 2020; De Rosa, Bartoli, Charatsari, & Lioutas, 2020; Farnworth <i>et al.</i> , 2020; Farnworth, Jafry, Rahman, & Badstue, 2020; Martini, Malacarne, Giovanazzi, & Buffa, 2020; Moglia <i>et al.</i> , 2020; Nadeem, Bahadar, Gull, & Iqbal, 2020; Osei & Zhuang, 2020; Pannell & Zilberman, 2020
Research, data, & patents	Badenhorst <i>et al.</i> , 2020; Bühler & Frietsch, 2020; Link & van Hasselt, 2020; Sagesse, Sarto, & Viganò, 2020; Sifontes & Morales, 2020; Striebing <i>et al.</i> , 2020; Valenti & Horner, 2020
STEM education	Dalton & Logan, 2020; Dixit <i>et al.</i> , 2020; Kerras <i>et al.</i> , 2020; Kuschel, Ettl, Díaz-García, & Alsos, 2020; Pirra, Carboni, & Diana, 2020; Santillan <i>et al.</i> , 2020; Sifontes & Morales, 2020; Verdín, Godwin, & Benedict, 2020
Culture & communication	Chen, 2020; Dennis <i>et al.</i> , 2020; Harrison & Ogden, 2020; Karthas, 2020; Ottogalli-Mazzacavallo & Boutroy, 2020; von Hippel & Cann, 2020
Gender-based violence	Carrington <i>et al.</i> , 2020; Sprang, Swan, & Coker, 2020; Viveiros & Bonomy, 2020

Gender and innovation: Theoretical frameworks and concepts

In mapping the contributions brought to innovation knowledge through a gendered lens, I developed an output table (*Table 4*) classifying the main directions and perspectives identified in analyzing the journal articles. Further, this section presents the main theoretical and empirical contributions brought to the field in 2020.

Table 4. Theoretical frameworks and concepts at the intersection of gender & innovation

Theoretical frameworks & concepts	Studies
Women's empowerment through leadership	Asteria & Herdiansyah, 2020; Biswas, Boyle, & Bhardwaj, 2020; Bouhazzama & Guenaoui, 2020; Brixiová, Kangoye, & Tregenna, 2020; Denend <i>et al.</i> , 2020; Fatou, 2020; Groza, Groza, & Barral, 2020; Hernández-Lara & Gonzales-Bustos, 2020; Kalpazidou Schmidt, Ovseiko, Henderson, & Kiparoglou, 2020; Lapuente & Suzuki, 2020; Lawton, 2020; Martin, Jerrard, & Wright, 2020; Martinez-Jimenez, Hernández-Ortiz, & Cabrera Fernández, 2020; Plambeck & Ramdas, 2020; Sagesse, Sarto, & Viganò, 2020, Sugiyama & Hunter, 2020; Valenti & Horner, 2020; Wellalage, Fernandez, & Thrikawala, 2020
Women entrepreneurs' impact on innovation	Arena, Catuogno, Saggese, & Sarto, 2020; Bell, Daggett, & Labuski, 2020; Bendell, Sullivan, & Hanek, 2020; Biju & Pathak, 2020; De Rosa, Bartoli, Charatsari, & Lioutas, 2020; Dixit <i>et al.</i> , 2020; Farnworth <i>et al.</i> , 2020; Hernández-Lara & Gonzales-Bustos, 2020; Kamberidou, 2020; Link & van Hasselt, 2020; Lapuente & Suzuki, 2020; Loukil, Yousfi, & Cheikh, 2020; Martini, Malacarne, Giovanazzi, & Buffa, 2020; Osei & Zhuang, 2020; Zeb & Ihsan, 2020; Zuraik, Kelly, & Perkins, 2020
Technological innovations targeting women	Asenbaum, 2020; Čábelková <i>et al.</i> , 2020; Chen, 2020; Dietrich <i>et al.</i> , 2020; Gichungi <i>et al.</i> , 2020; Hay <i>et al.</i> , 2020; Jain, Tandon, & Khandelwal, 2020; Kerras <i>et al.</i> , 2020; Lieu <i>et al.</i> , 2020; Mamonov &

	Benbunan-Fich, 2020; Sprang, Swan, & Coker, 2020; von Hippel & Cann, 2020; Wang, 2020
Women’s empowerment through agricultural entrepreneurship	Agarwal, 2020a, b; Bouhazzama & Guenaoui, 2020; Brixiová, Kangoye, & Tregenna, 2020; De Rosa, Bartoli, Charatsari, & Lioutas, 2020; Colverson <i>et al.</i> , 2020; Farnworth <i>et al.</i> , 2020; Farnworth, Jafry, Rahman, & Badstue, 2020; Gichungi <i>et al.</i> , 2020; Moglia <i>et al.</i> , 2020; Osei & Zhuang, 2020; Pannell & Zilberman, 2020
Research, data, & patents	Badenhorst <i>et al.</i> , 2020; Bühler & Frietsch, 2020; Bühler, Schmidt, Palmén, & Reidl, 2020; Link & van Hasselt, 2020; Loukil, Yousfi, & Cheikh, 2020; Sagesse, Sarto, & Viganò, 2020; Schuster <i>et al.</i> , 2020; Sifontes & Morales, 2020; Striebing <i>et al.</i> , 2020; Valenti & Horner, 2020
Institutions as social innovation	Carrington <i>et al.</i> , 2020, Horn, 2020; Kravets, Preece, & Maclaran, 2020; Ottogalli-Mazzacavallo & Boutroy, 2020; Sugiyama & Hunter, 2020; Ward, Prenzler, & Drew, 2020
Women in STEM education	Dalton & Logan, 2020; Dixit <i>et al.</i> , 2020; Kuschel, Ettl, Díaz-García, & Alsos, 2020; Pirra, Carboni, & Diana, 2020; Santillan <i>et al.</i> , 2020; Sifontes & Morales, 2020; Verdín, Godwin, & Benedict, 2020
Innovative methodologies in studying women	Bühler, Schmidt, Palmén, & Reidl, 2020; Camussi <i>et al.</i> , 2020; Colverson <i>et al.</i> , 2020; Cukier & Chayoushi, 2020; Dennis <i>et al.</i> , 2020; Harrison & Ogden, 2020

Women’s empowerment through leadership

Current trends in challenging the *status quo* in leadership involve shaking the gender binary, removing dichotomous roles, attitudes, and behaviors, while boosting women’s participation and numbers in the economy. Degendering as a way of gender mainstreaming does not mean overlooking or dismissing individual differences, but rather “applying or implementing gender-neutral standards and policies in the workplace” (Kamberidou, 2020). Studying practices of supportive management and organizational climate in relation to propelling women towards leadership roles, Biswas, Boyle, and Bhardwaj (2020) observed that adopting such practices influences attitudes about the promotion of equity and diversity in leadership roles.

Cultural factors influence attitudes toward leadership; cultural norms conceal women’s contributions, whereas men are privileged to be considered the standard in leadership. Farnworth, Jafry, Bharati, Badstue, and Yadav (2020) explored ways in which women are challenging these norms to become innovators; based on the concept of *doxa*, ideas taken for granted and unquestioned, the scholars found that women’s transition from mere workforce members to innovators and managers is troublesome. They generated a typology of women’s strategies to increase their managerial power, moving from a stance of keeping silent to making decisions through *acquiescing, murmuring, quietly co-performing, actively consulting, and managing/controlling following men’s decisions* (Farnworth *et al.*, 2020). Zeb and Ihsan (2020) observed that women’s entrepreneurial traits, like risk-taking and persistence, weighed heavily on the performance of women-owned firms in Pakistan. These findings are counter to conventional narratives, as women in this study are found to “prefer to take risks and have a strong desire to achieve their goals by facing all the hurdles” (*ibid.*).

Exploring stereotypes and traits also represents a venue worth researching. Biju and Pathak (2020) investigated intrapreneurial behavior linked to innovation and found that such expectation from women leaders causes them stress. These women did express a struggle to “be perceived and accepted as intrapreneurs” (*ibid.*) and confessed resorting to projecting

unnatural masculine characteristics in behaviors and attitudes, in order to suppress their natural behavior and be deemed intrapreneurial. On the other hand, Martin, Jerrard, and Wright (2020) showed that maternal roles can come as a bridge between feminine and masculine stereotypes in the workplace, as features of maternal behavior, such as nurturing and empathy, can be capitalized on in “their relationships with external and internal contacts and fundamental to business operation” (*ibid.*).

The gender lens in leadership studies does not only generate results that substantiate the existence of bias against women, some results overcome conventional wisdom by shedding a negative light on women. In their firm-level study of Latin American countries, Wellalage, Fernandez, and Thrikwala (2020) rejected the integrity hypothesis among women owners, finding that they do not just receive bribes at the same rate as their male counterparts, but oftentimes they receive higher bribes. Whether gender can be a factor in explaining the relationship between corruption and firm-level innovation remains largely unanswered, but data shows that product innovation is enhanced when bribes are paid to female owners. Another interesting study showed that women’s presence on boards may result in lower bonus and equity-based compensation, as they are prone to conservatism in financial practices (Al-Shaer & Harakeh, 2020). However, this finding can be seen as an improvement in the quality of companies’ governance systems. Martinez-Jimenez, Hernández-Ortiz, and Cabrera Fernández (2020) also investigated gender diversity on boards and firm performance and found a positive relationship between the two variables, yet cautiously suggesting a negative relationship between diversity and effectiveness – also measuring innovation.

Historic appointments of women to leadership positions are noteworthy because we live in a time when women are entering educational and professional venues previously almost exclusively populated by men in unprecedented numbers (*see* women’s leadership in the field of surgery in Lawton, 2020), thus “blazing a trail for many more women to come” (*ibid.*). Women are still significantly underrepresented in leadership positions, and this imbalance in leadership and workplace experience is reflected – among others – in health technology companies: here, Denend *et al.* (2020) suggested that women are overtly excluded from networks of influence through blocking communication and through bias, which makes them experience “a less meritocratic and inclusive workplace” (*ibid.*).

Women entrepreneurs’ impact on innovation

For women’s leadership and entrepreneurship to be a sustainable goal, a multi-dimensional approach is needed to encompass individual, social, economic, political, ecological factors that enable women to close the educational gender gap, to participate to the economy equally to their male counterparts, and to gain full citizenship. Asteria and Herdiansyah (2020) focused on environment innovation capabilities of women and found that these former factors are essential to women’s power to “foster abilities and explore [their] leadership in mobilizing their communities” (*ibid.*). Similarly, Nadeem, Bahadar, Gull, and Iqbal (2020) empirically linked women’s *ethics of care*, their sensitivity towards the others and to the environment, to generating environmental innovation on a corporate level, as gender diversity was found to have an influence upon process and product innovation.

In a European setting, Lapuente and Sukuzi (2020) discovered that female leaders in the public sector display more pro-innovation attitudes than men and are more willing to challenge the status quo. Subjects of less studies than women on corporate boards, women who

are public leaders are more motivated to do something useful for society, more open to new ideas than their male counterparts, while also being less willing to take risks. Zuraik, Kelly, and Perkins (2020) advance an interesting research design aimed at showing the impact of gender and leadership style and innovation behaviors and outcomes. They found that women leading teams were seen as less effective in leading innovation than their male counterparts and suggest enhancing organizational support to generate greater innovation and increase visibility as leaders. Moreover, research shows gender solidarity in social support and financial backing. Groza, Groza, and Barral (2020) found crowdfunding to be a financing tool that lends women entrepreneurs access to female investors who were once supported in their financial endeavor.

In tackling leadership development programs for women entrepreneurs, Dixit *et al.* (2020) discussed a framework that maps essential competencies to be taught; thus, female leaders must be visionary, delegative, inquisitive, decisive, receptive to feedback, and must nurture learning agility, cognitive ability, self-reflection, tolerance, self-development, as well as be apt to build partnership networks and save face (*ibid.*). Moreover, Fatou (2020) found that a vital way of empowering female entrepreneurs is by developing skills in the areas of vocational training and *soft skills*.

Technological innovations targeting women

Studies correlating innovation and gender or specifically women overwhelmingly show that ICTs play a pivotal role in the dynamics of gender equality and empowering women. Kerras, Sánchez-Navarro, López-Becerra, and de-Miguel Gómez (2020) explored how the gender gap in digital education and use weighs negatively on gender equality and called for more efficient inclusive education and training, in order to enable women as users and producers of knowledge and technology, researchers, educators, and entrepreneurs.

Technological innovations in healthcare improve women's lived experiences. Hay *et al.* (2020) studied WhatsApp use to support women/mothers who take care of HIV patients and found it to facilitate communication and support participation in group activities that ease their burdens. Arena, Catuogno, Saggese, and Sarto (2020) explored the link between women in managerial positions in hospitals and adoption of innovation, arguing that gender mainly fosters adoption of eHealth, but warns about the rivalry between team and line managers of the same gender that obstructs such technology adoptions.

Chen (2020) examined online dating as an innovation in interpersonal communication, meant to reverse gender roles from real life and found that these still governed most subjects' online behavior, but a few of them actually switched to a reversed version and took it to real life contexts. Video gaming was also tackled in 2020 research; Čábelková, Strielkowski, Rybakova, & Molchanova (2020) found that time spent by women playing video games correlates positively with the novelty component of their emotional creativity.

Von Hippel & Cann (2020) discuss a different approach, tackling behavioral innovation related to household activities, facilitated using technology. Mostly developed by women, this type of innovation was investigated through user-generated content analysis posted on discussion forums dedicated to household activities. Gender differences in technology adoption and use can be analyzed in various ways. Complementary to the previous findings presented, Mamonov and Benbunan-Fich (2020) studied home security technology and identified a gender layer; more specifically, they found that *perceived novel benefits* – so aspects of novelty

related to the device/technology – have a significant effect upon women in adopting and using it, explained by the fact that “women tend to view home as a place that offers comfort, privacy and security from the outside world” (*ibid.*).

Women’s empowerment through agricultural entrepreneurship

In many cultural settings, women who disrupt norms are at risk of social exclusion. Farnworth, Jafry, Rahman, and Badstue (2020) emphasized the need for male support in women’s entrepreneurial endeavors and found that women who innovate relied heavily on family support to take risks and innovate. The scholars build on the importance on women’s networks and argue that a basic empowerment process, as simple as a training, can fuel women to take initiative and seek innovation. Social capital was found as a crucial factor in entrepreneurial growth performance and rural poverty alleviation by Osei and Zhuang (2020), whose results showed that family, business partners, and community members are intangible resources that are vital to rural female entrepreneurs’ performance when seeking growth.

Agarwal (2020a, b) looked into women-only group farming as a driver for women’s empowerment, and found that this innovation has granted Indian women a higher economic and social status, as well as “enhanced their status within families and communities as contributors to family income” (*ibid.*). In agricultural entrepreneurship, women outperformed men in gaining trust by generating better loan repayment records. Brixiová, Kangoye, and Tregenna (2002) observed that women entrepreneurs face a more restricted access to credit than men, which weighs on their entrepreneurial performance, and argue that certain economies would benefit from removing obstacles to female land ownership. Female entrepreneurship plays a vital role in the development of sustainable mountain tourism, as well, through their networking abilities and characteristic “elements of authenticity, experientiality and innovation” (Martini, Malacarne, Giovanazzi, & Buffa, 2020).

Not only is women’s empowerment in agriculture, under certain circumstances, an innovation, but the adoption of innovation by women also has an empowering role (such is the case of new technology for women seaweed producers, studied by Brugere *et al.*, 2020). Moglia *et al.* (2020) also explored gender differences in the adoption of new practices, and women included in the study reported greater challenges than men when tackling the agricultural marketplace; however, women manifested a more favorable attitude towards non-farming practices and the modern, non-traditional economy compared to men. In an analysis of Italian female farmers’ entrepreneurial identity, De Rosa, Bartoli, Charatsari, and Lioutas (2020) observed that most women reported adopting one or more innovations, but a few of them introduced innovations “while simultaneously searching for new markets and new organizational arrangements” (*ibid.*), thus emphasizing the need for innovation support services. Other studies showed that the adoption of new technology turned out to be detrimental to women’s control of production and benefits; however, designing economic policies that target them and enhance their access to funds will enhance their agency (Gichungi *et al.*, 2020).

Research, data, & patents

The concept of *critical mass* is important in assessing women’s ability to create change. As Sagesse, Sarto, and Viganò (2020) suggest, women on corporate boards can have a positive impact on innovation input, by limiting others’ biases and improving their own ability to

generate innovation, but they can do so when their board representation reaches a critical mass. The presence of one woman is not nearly enough – it might even be a case of tokenism. Research and data spending, as a measure of increasing innovation, can be thus enhanced by women when they are represented in a substantial manner. Valenti and Horner (2020) agreed that critical mass among female directors is imperative in effecting changes, as they are found to generate investments in innovation that eventually return as patents. However, in the case of tech firms, Loukil, Yousfi, and Cheikh (2020) found that women are risk-averse agents and avoid such investments. Similarly, Bendell, Sullivan, and Hanek (2020) investigated gendered decisions regarding firm investments in technology. They found that female entrepreneurs in small- and medium-sized companies were less likely to engage in risks of purchasing the technology.

Female inventors still face bias in getting their innovation recognized, as data suggests that they are less likely to have patent applications granted than male applicants. To support this claim, Schuster et al. (2020) found some bias against female inventors during grant prosecution. Link and van Hasselt (2020) discovered that women-owned firms of small dimensions are associated with fewer patent applications. Sifontes and Morales (2020) designed a longitudinal study to explain the rate of female participation in patenting across Latin America. They found that only one in five patents with female involvement are granted and advanced a set of variables that influence the patenting activity and outcome. According to Sifontes and Morales (2020), the success of female patents in certain technological fields might be explained by the rise of female researchers in life sciences, women’s involvement in patenting is more likely when the applying comes from the academic sector rather than the industry, and their participation is more frequent in case of internal collaborations. When it comes to commercial patents, Hernández-Lara and Gonzales-Bustos (2020) found that the presence of women on corporate boards positively impacts research and data and patents. In their study on family companies, the researchers observed that female directors have a better influence on innovation when they do not belong to the family; this finding shows that women who lead such companies from outside the family tree *“can act freely and more independently than when they belong to the family of control”* (Hernández-Lara & Gonzales-Bustos, 2020).

On the other hand, Bühner, Schmidt, Palmén, & Reidl (2020) investigated German programs designed to increase female researchers’ participation in science-production, and found efficiency in enhancing women’s representation as researchers, as well as improved publication and citation rates. Bühner & Frietsch (2020) emphasize this concrete scientific benefit of gender equality programs by documenting the increase of women’s representation in research, of women’s authorship, as well as high citations and excellence rates. Striebing et al. (2020) carried out a similar analysis in innovation systems across Europe and found that higher education degrees have been the main driver of increase for women among researchers.

Institutions as social innovation

Sugiyama and Hunter (2020) investigated programs empowering women to drive change in the way they participate in their community’s economy, and thus identified three main factors contributing to women’s advancement: economic agency, enhanced physical integrity, and psychosocial growth. Kravetz, Preece, and Maclaran (2020) showed how social entrepreneurship is impacted by gender and emphasized the role of media and forums that encourage these types of innovations in gendering it.

One social innovation of the twenty-first century, documented by Ottogalli-Mazzacavallo and Boutroy, 2020, regards women in male sports, and shows how manless teams gained traction and became institutionalized. Through manless teams, women mountaineers brought a unique contribution to restricting inequalities in sports, through expanding a network of human and material resources. Similarly, Ward, Prenzler, and Drew (2020) investigate women in male professional fields.

Other remarkable institutional innovations are analyzed in Badenhorst *et al.* (2020) exploration of gendered layers in women academics' peer reviews – networks of support, Horn's (2020) innovation targeting women's health, or Carrington *et alii*'s (2020) account of women's police stations in Argentina as empowerment instruments.

Women in STEM education

Various programs have been developed in Europe to empower young women to enter challenging professional fields such as STEM, but much work is needed to overcome the biases involved in taking and then experiencing these educational and professional routes. Pirra, Carboni, and Diana (2020) analyzed support networks that target secondary school students, aiming to raise awareness on women's potentialities in STEM. Wang (2020) warns about the issue of ethics in developing technology. The scholar argues in favor of gender-sensitive approaches, to ensure fair participation and representation in STEM education and professions.

Verdín, Godwin, and Benedict (2020) surveyed engineering students to assess innovation self-efficacy beliefs; they found positive and significant correlations for female students in terms of interest in pursuing a career in several engineering fields and at least one of the five innovative skills studied: questioning, observing, experimenting, idea networking, and associational thinking. Verdín *et al.* (2020) uncovered and highlighted a strategic opportunity for STEM education: there is an opportunity to nurture these skills and enhance women's disposition toward innovating in the field of civil engineering.

Linking STEM education to entrepreneurship, Kuschel, Ettl, Díaz-García, and Alsos (2020) elaborated a series of research directions: (1) to define and explore the traits of women's entrepreneurship within STEM; (2) to expand research on entrepreneurship as a career option for STEM graduates; (3) to investigate STEM entrepreneurship beyond women's early recruitment and detrimental characteristics; (4) to advance research on gender and technology in entrepreneurial ecosystems; and (5) to build on scholarship on feminist approaches in STEM.

Innovative methodologies in studying women

Methodologies proposed for studying gender or women in relation to innovation are various and engender a series of innovations. Based on previous research, Bühner, Schmidt, Palmén & Reidl (2020) elaborate a matrix including indicators that show the relationship between gender equality and benefit areas (see *Table 5*), which could serve as a framework for investigating the dynamics between different areas of innovation and gender equality – both from a scientific perspective and from a practical one.

Table 5. Framework for innovation and gender equality

<p>Gender equality and scientific benefits Interdisciplinarity and thematic diversity</p>	<p>Gender equality and economic benefits Increased creativity and organizational innovation Better strategic decision-making</p>
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Higher share of publications Higher share of citations Scientific excellence Better dissemination of research results Social responsiveness	Increased overall competitiveness Better financial performance Positive employment effects and job satisfaction More effective recruiting and retention Increased organizational attractiveness, brand image and reputation Better networking and access to customers and markets Stronger adherence to ethics and rules of conduct
Gender equality and environmental benefits More sustainability initiatives Higher environmental consciousness in consumption More eco-innovations	Gender equality and societal benefits Combating gender discrimination through symbolic commitment to equality Empowerment and confidence More corporate social responsibility More supportive and philanthropic behavior

Source: Bühner, Schmidt, Palmén, & Reidl (2020)

Colverson *et al.* (2020) discussed methodologies employed in measuring empowerment – focusing on rural areas –, and posited that “genuine empowerment requires a sustained process that includes working with men and communities to change gender norms that hold women back and enhance women’s ability to act upon their own decisions” (*ibid.*). Another empowerment mechanism is proposed by Cukier and Chavoush (2020), who advance factors of enhancing women’s entrepreneurship through an inclusive innovation ecosystem, the Women Entrepreneurship Knowledge Hub. Though this ecosystem is already in place, the scholars propose new ways to bring women entrepreneurs together, to advance knowledge, and share best practices within the network. One last yet very novel approach belongs to Harrison and Ogden (2020), who document women’s lived experiences through the feminist research method of ‘knit “n” natter’, a technique that nurtures participants’ creativity, disruptive expertise, and feminization of the academic space, by disrupting traditional knowledge production and power relations in place.

Discussion and conclusions

Alsos, Ljunggren, and Hytti (2013) warned about the invisibility of research on gender and innovation, since the lion’s share of innovation studies identified by them largely focused on products, processes, organizations, and not on the human dimension. However, contributions substantiate the idea that innovation is a highly gendered research and practical field. The dynamics of gender and innovation constitute a resourceful object of investigation, as innovation is a gendered process, and gender-related phenomena might reflect innovations.

Through this review, I laid out current questions being explored in the field of gender and innovation research. Various concepts and variables interplay in this research area, and there are further questions to be posed, reflected on, and answered. The issue of defining gender, analyzing power relations, questioning the doxa might prove crucial in gaining in-depth understanding of gender and women’s relationship to innovation. Discourses and processes need to embrace broader understandings of both gender and innovation, and feminist methodologies involved in exploring this generous field might prove fruitful in generating valuable knowledge.

It is also important to point out that such studies are valuable beyond the knowledge community, they also have practical implications on innovation industries, as well as social

implications as they further an empowerment agenda. Organizations would benefit from propelling women toward leadership positions and masculine roles, as diversity of ideas and perspectives can prove to increase performance and bring about change. The concept of representation also matters in organizational or wider settings, as role models can engender positive effects, such as enhancing visibility of female leaders and their innovations, which communicates that this is a feasible career option for women and that innovation is not out of reach due to a gender impairment.

Is bias such a great obstacle in women's way toward entrepreneurship, leadership, and innovation? Do women self-sabotage when incubating these kinds of ambitions, due to lacking agency? Is their natural behavior not an innovation driver? What does it entail for women to be as innovative as their male counterparts are deemed? Can the innovation industry stop romanticizing risk-taking behaviors? How can women practically fight resistance met on their paths to innovation? What can organizations and broader settings do to tap the insufficiently explored potential of human resources? These and many others are questions that need further systematic investigation, and whose answers – as complex as they may be – could be found in future contributions to innovation studies.

Although an exhaustive review of publications on the topic within the last two years is beyond the scope of the present paper, SCOPUS was consulted to identify more recent influential articles for 2021 published on the topic. The procedure entailed a similar search to the previous one, narrowing the *gender* and *innovation* results by *year* (2021), and organizing them by *relevance*. The top five articles were then selected. Through computational topic modelling of data from a women's network in Silicon Valley, Schmitt et al. (2020) studied the inclusion of women in tech and digital innovation, showing that women are overwhelmingly focused on exploiting, rather than exploring digital innovation potentials; this shows that women remain underrepresented in positions related to exploring new market opportunities, but express great interest in assessing how organizational and human resources can help them advance their careers. Le Loarne-Lemaire et al. (2021) carried out a systematic literature review on women's role in innovation related to climate change and argued that women involved in technological innovation processes display greater productivity and results, that women in science would accelerate development of relevant innovation, and that more female board members would be highly beneficial in the first against climate change. In a survey-based research, De Rosa et al. (2020) analyzed patterns of innovation adoption among Italian female-owned farms and emphasized the importance of innovation support services and entrepreneurial orientation in effective innovation. Women-owned SMEs in Pakistan were studied by Mehta et al. (2021), who found them impressively engaged in open innovation practices. Based on a survey of nearly 30,000 SMEs, Owalla, Nyanzu, and Vorley (2021) took an intersectional approach in exploring women-led SMEs in the United Kingdom and found them actively engaged in innovation activities, calling for “a holistic approach towards inclusive innovation policymaking” (p. 702).

It is, thus, crucial to raise awareness on the above-mentioned issues in policymaking. Individuals, groups, organizations, even countries need to optimize the ways they use resources to perform – excluding women or minimizing their contributions to innovation might counteract the purpose of progress. Admittedly, there are various factors involved in generating new knowledge and building/ raising awareness on gender and innovation issues, but they should also advance onto political agendas.

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