



Gender and innovation: state of the art and a research agenda

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Abstract

Purpose – The purpose of this article is to present a framework for research on gender and innovation. The framework is developed based on a review of the current literature in the area; it is applied to provide a context for the articles in this special issue and to offer suggestions for future research.

Design/methodology/approach – The article relies on a literature review of gender and innovation. Additional literature searches on Scopus were conducted to provide an overview of the area. In addition, comparative analogies are sought from research fields of gender and entrepreneurship as well as gender and technology.

Findings – The article presents the scope and issues in the current research on gender and innovation. Based on the overview, research in this area is conducted in various disciplines applying a variety of methodological approaches. In order to make sense of the current research, the paper developed a framework consisting of various approaches to, gender and innovation; these include gender as a variable, construction and process and innovation as a result, process and discourse.

Research limitations/implications – Based on the review, several recommendations for future research are made. First, future research should question the connection between technology and innovation and purposefully seek innovation activity also in low-tech and service sectors and firms. Innovation scholars and policy makers should not primarily target radical and product innovations but should be equally interested in incremental and process innovations. Second, understanding women's innovation activity needs to be embedded in understanding the normative frames and structural factors at play. A particular theoretical call is linked to the study of power and innovation. Third, it is imperative to develop and apply new methodological approaches and new operationalizations of innovation and innovators.

Practical implications – By focusing on gender and innovation, it is possible to discover innovation as a gender biased phenomenon. Policy makers should bear this in mind when developing innovation policies.

Social implications – An understanding of innovation literature and innovation policy as gender biased has important social implications. Discovering gendered structures is important to further develop gender equal societies. Further, innovation may be hampered by biases in the understanding of the concept, including gender biases.

Originality/value – This introductory article puts forward a framework on gender and innovation that helps to make sense of the current state-of-the-art and to develop new research questions that need to be addressed for further theorising within the field.

Keywords Gender, Innovation, Research agenda, Review

Paper type Research paper



Introduction

Innovation is increasingly seen as one of the main ways to enhance economic growth and thus create prosperous nations and regions (Lundvall, 1992; Fagerberg *et al.*, 2005; Verspagen, 2005). Further, innovation is considered crucial for technological development within industries and sectors (Malerba, 2002), and is also suggested to be decisive for single firms that want to recreate their business model to maintain their competitive advantage over time, particularly in dynamic markets. Within the entrepreneurship literature, innovation is a central aspect, as entrepreneurial processes require some form of innovation (Shane, 2003). This follows from the classical work of Schumpeter (1934) who saw the entrepreneur as the person(s) responsible for producing innovation. However, innovation literature has later focused more upon innovation projects in firms and economic systems, and hence on the issue of organizing for innovation (Fagerberg, 2005).

From the early days innovations have been defined as new combinations of production factors such as the production of new goods, introduction of new processes, opening of new markets, access to new sources of raw materials and intermediates, and re-organisation of an industry (Schumpeter, 1934). This definition can be traced in the influential *Oslo Manual* on innovation research (OECD and Statistical Office of European Communities, 2005) which is widely used and hence has an important impact on how the concept is operationalized, for instance, in the Community Innovation Survey (CIS) (Nählinder *et al.*, 2012). Innovation research has dealt with innovation processes within firms; innovation as taking place in systems of several firms, institutions and governmental bodies; how innovation varies over time and space, and the outcomes of innovation (Fagerberg, 2005). Studies have focused on innovation as an input or output (Smith, 2005), as a process (Pavitt, 2005; Garud *et al.*, 2013) and on the discursive and policy oriented sides of innovation (Doloreux and Parto, 2005; Lundvall and Borrás, 2005).

Although entrepreneurship and innovation are closely related areas, the focus on gender in entrepreneurship and innovation research has been very different. An increasing number of studies on gender and entrepreneurship demonstrate that the phenomenon of entrepreneurship is gendered (Minniti, 2009). This research field has developed from the dominance of quite simple analyses on differences or similarities between women and men to applying gender as a lens through which entrepreneurship is studied. This allows us to move from studying differences between individuals to studying how gender is embedded in processes, meanings and experiences (Carter and Shaw, 2006; Ahl and Nelson, 2010).

Innovation research seems to be missing analyses of where innovation takes place, and who participates in innovation activity (Fagerberg *et al.*, 2005). Consequently, the concept of gender and innovation has only recently gained a wider interest among researchers within the management and entrepreneurship fields. One of the reasons for the lack of studies taking a gender perspective to innovation, compared to for instance the increasing number of studies on entrepreneurship and gender, is the apparent invisibility of “people” in innovation. While entrepreneurs are in the limelight in entrepreneurship research, the role of the innovator is under-communicated in innovation research (Brännback *et al.*, 2012). When people are not visible in the discourse, gender easily becomes invisible. In general, the literature presents innovation as taking place in processes, in corporations, as spin-offs from universities and in innovation systems, and does not give the innovator a specific role. However, this does

not mean that gender is irrelevant to studies of innovation. The focus on results, processes and systems, and hence the lack of focus on individuals when it comes to innovation does not imply that gender is absent. As Thorslund and Göransson (2006, p. 7 (our translation)) put it:

All systems are the result of their parts and the smallest parts in an innovation system are individuals. These are both men and women – with the conditions that follow. To include gender in an analysis is not to include one more factor; it is to highlight one part of the system giving effects regardless if it is measured or not.

However, it is challenging to reveal how gender makes an impact when it is hidden within processes, organizations and systems.

The inspiration to develop a special issue on gender and innovation came from organising a stream on “Gender, innovation and entrepreneurship” at the research conference of “Gender, Work and Organization” (GWO) in Keele, UK in June 2010. At the conference we detected the potential, some of the knowledge gaps and, importantly, an interest among researchers in this particular research field. A more focused stream on “Gender and innovation” was organized at the GWO in 2012, and we also held a Professional Development Workshop (PDW) at the Academy of Management Meeting in Boston in August 2012. Both events received considerable interest. Hence, we believe it is time to set an agenda for research on gender and innovation. The purpose of this special issue is to further this agenda by presenting five different studies in this area. The empirical articles in this issue represent five different angles to the topic. They take different perspectives to gender as well as to innovation, and include a diversity of theoretical origins and methods. As such they represent the variety needed to build a strong knowledge base on gender aspects of innovation.

The purpose of this article is to present a framework for research on gender and innovation. We begin by briefly reviewing current literature in the area in order to identify the scope and issues in current research. Next, a framework for the study of gender and innovation is presented, and the articles included in this special issue are discussed in relation to this framework. Finally, we offer some suggestions for future research in this area.

Gender and innovation: scope and issues

While research on gender and innovation has not been extensive, there are some influential studies in adherent research areas. Studies to date have been published in a broad spectrum of journals, representing a variety of disciplines, perspectives and methodological designs. This reflects the inter-disciplinary nature of innovation research (Fagerberg, 2005), but it also means that there is little accumulated knowledge. Hence, there is need for an overview and synthesis of knowledge on gender and innovation as a basis for the development of this area. In this section we briefly discuss the scope of research on gender and innovation along three dimensions: theoretical and disciplinary scope, methodological scope and empirical scope.

To identify the scope of research related to gender and innovation, we undertook several searches in the Scopus database. Table I presents some of the results from this search. First, we identified the journals that included the highest number of articles with “innovation” in the title, abstract or keywords. We note that while typical innovation journals such as *Research Policy* and *Technovation* are on the top of this list,

Search term “innovation” (106,994)	Within these: search term “gender” (2,445)	Within these: search term “women” (4,037)
<i>Research Policy</i> (1,024)	<i>Research Policy</i> (16)	<i>Social Science and Medicine</i> (38)
<i>Health Service Journal</i> (675)	<i>Journal of Advanced Nursing</i> (16)	<i>Journal of Advanced Nursing</i> (32)
<i>Technovation</i> (670)	<i>International Journal of Innovation and Learning</i> (15)	<i>Health Affairs</i> (16)
<i>Technological Forecasting and Social Change</i> (586)	<i>Computers and Education</i> (13)	<i>Journal of Nursing Administration</i> (16)
<i>International Journal of Technology Management</i> (551)	<i>Environment and Planning A</i> (10)	<i>American Journal of Community Psychology</i> (15)
<i>Modern Healthcare</i> (505)	<i>New Media and Society</i> (10)	<i>J. of the American Medical Informatics Association</i> (15)
<i>Healthcare Informatics</i> (425)	<i>Social Science and Medicine</i> (9)	<i>Environment and Planning A</i> (14)
<i>Nursing Times</i> (379)	<i>Development in Practice</i> (9)	<i>Journal of Clinical Nursing</i> (13)
<i>Journal of Product Innovation Management</i> (360)	<i>Nursing Inquiry</i> (9)	<i>Journal of Midwifery and Women S Health</i> (13)
<i>Nursing Standard</i> (349)	<i>Innovation</i> (8)	<i>Research Policy</i> (13)
<i>Technology Analysis and Strategic Management</i> (312)	<i>Geoforum</i> (7)	<i>AIDS Education and Prevention</i> (12)
<i>European Planning Studies</i> (294)	<i>World Development</i> (7)	<i>Nurse Education Today</i> (11)
<i>Energy Policy</i> (289)	<i>European Planning Studies</i> (7)	<i>Journal of Nursing Management</i> (11)
<i>International Journal of Innovation and Learning</i> (261)	<i>Prometheus</i> (7)	<i>Journal of Professional Nursing</i> (11)
<i>Research Technology Management</i> (241)	<i>Nurse Education Today</i> (6)	<i>Journal of Evaluation in Clinical Practice</i> (11)
<i>Science and Public Policy</i> (240)	<i>Small Group Research</i> (6)	<i>American Journal of Public Health</i> (11)
<i>Journal of Advanced Nursing</i> (236)	<i>Gender and Society</i> (6)	<i>Midwifery</i> (10)
<i>Journal of Nursing Administration</i> (225)	<i>Journal of Product Innovation Management</i> (6)	<i>Nursing Outlook</i> (10)
<i>Health Affairs</i> (219)	<i>Information and Management</i> (6)	<i>Nursing for Women S Health</i> (10)
<i>Healthcare Financial Management</i> (214)	<i>Academic Medicine</i> (6)	<i>Canadian Journal of Nursing Research</i> (10)

Note: No. of articles in brackets

Table I. Scopus search in abstract, title and keywords – journal articles only

the list also includes a number of journals on medicine and health related research, as well as journals within various technology areas and engineering. This clearly illustrates the above mentioned multidisciplinary nature of innovation research. Business and management, economics and social sciences account for only 32 per cent of articles focusing on innovation[1]. Further we searched for the terms “gender” and “women” within the identified articles on innovation. Results for both these search terms are reported in Table I. Among the 106,994 articles with innovation in the title, abstract and key words, only 2,445 included the word “gender” in the article. Similarly, 4,037 of these articles include the word “women”. Again, the journals including the highest number of articles fitting the search criteria include a variety

of fields, including medicine, health and engineering. However, some social science journals appear on the top 20 list referring to the search term “gender” and “women” such as *Environment and Planning A*. Interestingly journals on nursing become more apparent on the list indicating that these journals are more concerned with gender in relation to innovation than other health related journals.

While the criteria specified for the articles in Table I requires innovation to be mentioned in the title, abstract or key words, it is sufficient for the search terms “gender” or “women” to appear only once in the text. Hence, the majority of these articles do not focus on gender specifically but include gender only as a control variable or mention it in an example. If we specify for both innovation and gender to be mentioned in title, abstract or key words in the search, then the number of articles fitting the criteria is reduced to 615, with no journal containing more than four articles. The comparable number of articles for our search on innovation and women is 1,306. These numbers give a more accurate reflection of the number of articles focusing on gender and innovation. Still, a high proportion of these articles are within medicine, nursing and psychology, and technology/engineering.

No entrepreneurship journals appeared in the lists presented in Table I. This indicates a very weak link between research on gender related to entrepreneurship and research on gender related to innovation. A specific search in the present journal, *International Journal of Gender and Entrepreneurship*, resulted in a handful of articles; all of which were treating innovation as a characteristic related to women’s (and men’s) entrepreneurship (Dabic *et al.*, 2012) or their business ideas (Braun, 2010; González and Husted, 2011). As innovation is a key issue in the entrepreneurship literature, the dearth of studies focusing on gender and innovation in such literature is surprising. However, there should be transfer value between studies on gender perspectives on entrepreneurship and new studies on gender and innovation.

In the following section we will focus on the scope of gender and innovation research as expressed within the social sciences, including the business, management and economics literatures. Table II gives an overview of the different topics covered within this area as related to innovation and gender. While a great variety of issues are covered, some topics seem to be studied more than others. These include the influence of gender on university scientists’ involvement in innovation related activities such as patenting, commercialization, academic entrepreneurship and university-industry relationships; the influence of gender on innovation activity; social innovation and public sector innovation, and gender differences in the adoption of innovation. Except for the diversity literature, research on the role of gender in innovation within private firms and on gender and innovation in entrepreneurial contexts seems to be scarce. Further, there is also limited research with a gender perspective on innovation policy, innovation systems and innovation support schemes.

There is considerable heterogeneity in gender and innovation studies, with a wide range of theoretical bases and a variety of methods applied. Within the economics literature, the most prominent studies are those based on science and innovation areas, using quantitative methods including surveys and/or register data. This situation is similar for the literature on the role of gender diversity in innovation. In other areas, such as the literature on innovation policy, organizational and public sector innovation, qualitative methods, particularly case studies, are widely used. The influence of feminist or gender research is more prominent in the European social science studies, where for

Topics on gender and innovation	Examples of studies
Conceptual/reviews	Blake and Hanson (2005), Ranga and Etzkowitz (2010)
Science based innovation	Busolt and Kugele (2009), Frietsch <i>et al.</i> (2009), Hunt <i>et al.</i> (2013), Colyvas <i>et al.</i> (2012), Lažnjak <i>et al.</i> (2011), Rosa and Dawson (2006), Abreu and Grinevich (2013), Perkmann <i>et al.</i> (2013)
Gender differences in patenting	
Commercialization	
Academic entrepreneurship	
University-industry relationships	
Innovation activity within firms	Kushnirovich and Heilbrunn (2013), Dezsö and Ross (2012), Galia and Zenou (2012), Miller and Del Carmen Triana (2009), Turner (2009), Østergaard <i>et al.</i> (2011), Danes <i>et al.</i> (2007), Kariv (2010), Sonfield <i>et al.</i> (2001), Truss <i>et al.</i> (2012)
Preferences for innovation	
The effect of diversity on innovation	
Innovation in small businesses	
Innovative start-ups	BarNir (2012), Gicheva and Link (2013)
Innovation policy measures	Gray and James (2007), Lindberg <i>et al.</i> (2012), Lindberg and Udén (2010), Marlow and McAdam (2012), Vehviläinen <i>et al.</i> (2010)
Regional innovation systems	
Incubators and science parks	
Organizational innovation	Abrahamsson (2002), De Vries <i>et al.</i> (2006), Yang and Konrad (2011)
Influence of gender on org. change	
Public sector innovation	Maddock (2009), Nählinder (2010), Bianchini <i>et al.</i> (2002), De Bruijn and Volman (2000), Hoffmann (2002), Saunders and Quirke (2002), Fonn <i>et al.</i> (2001), Fonn and Xaba (2001), Onyango-Ouma <i>et al.</i> (2001)
Teaching	
Health care	
Social innovation	Akin (2003), Beck (2009), Breward (2002), Silva (2000), Beckwith (2001), Daly (2010), Fox <i>et al.</i> (2009), True and Mintrom (2001), Woodward (2003), Bhaskar (2011)
Social change	
Social movements	
Diffusion of institutional innovation	
Consequences of innovation	
Innovation adoption	Boneva <i>et al.</i> (2001), Carpenter and Casper (2009), Doss and Morris (2001), Drotner (2000), Egyir <i>et al.</i> (2011), Galdwin (2002), Mitra <i>et al.</i> (2001)

Table II.
Topics on gender and innovation in the literature

instance one strategy has been to deconstruct concepts (Lykke, 2010) as seen in, for instance, the contribution by Pettersson and Lindberg (2013). If we reflect on the early days of research on gender and entrepreneurship, the literature was critiqued for being too case study oriented, utilizing too few quantitative methods, having simplistic data analysis strategies and using inherently gendered concepts and measures (Brush, 1992; Carter, 1993; Dolinsky *et al.*, 1994). While the level of methodological rigor varies, the general impression is that the literature on gender and innovation does not have the same limitations, as there are several well-designed studies. However, critique has been put forward in relation to the inherent gender bias of the measurements used (Nählinder *et al.*, 2012) and with regard to the empirical scope of innovation policies (Kvidal and Ljunggren, 2013). These issues are also addressed by Pettersson and Lindberg (2013).

Taking a geographical stance, we see that the Nordic perspective is currently quite strong, as evidenced by the contributions to this special issue. This was also reflected in all 15 submissions initially considered for this issue, as well as in the previously mentioned conference streams we organized. In particular, there are several Swedish contributions, something that can be attributed to the Swedish Governmental Agency for Innovation Systems, VINNOVA's, engagement in supporting research on gender and innovation. Sweden has, for several years, had a policy for enhancing women's participation in innovation activities. Special policy programs such as

TIGER (aiming at utilizing gender perspectives to strengthen innovation clusters) have been combined with research funding, which have enabled studies on different means and policies. This has spurred a large bulk of research based on the Swedish empirical context (also in entrepreneurship and gender, for example, Bourne (2010)). VINNOVA's efforts have resulted in a number of reports (Thorslund and Göransson, 2006; Petterson, 2007; Fürst Hörte, 2009; Danilda and Thorslund, 2011), books (Andersson *et al.*, 2012), research articles (Lindberg, 2008; Lindberg and Udén, 2010; Lindberg *et al.*, 2012) and PhD theses (Nyberg, 2009; Lindberg, 2010). The results from these efforts are discussed by Pettersson and Lindberg (2013).

However, the large majority of published articles on innovation are Anglo-Saxon. The USA, the UK, Australia and Canada accounted for a very large proportion of articles resulting from our Scopus search on innovation and gender reported in Table I. Interestingly, another fairly large group of articles taking a gender perspective on innovation examines innovation in developing economies, particularly related to self-employment and small businesses, social innovations and the adoption of innovations (Fonn *et al.*, 2001; Fonn and Xaba, 2001; Onyango-Ouma *et al.*, 2001; Galdwin, 2002; Egyir *et al.*, 2011). Interestingly, the context of developing economies seems to contribute to the visibility of women as innovators.

In this section we have described the interdisciplinary nature and various methodological approaches adopted for the study of innovation and gender. The articles in this special issue are no exception since they are positioned within the social sciences and apply several research methods. The studies are linked to political science (Rönblom and Keisu, 2013), geography (Pettersson and Lindberg, 2013), business and management (Foss *et al.*, 2013; Wikhamn and Knights, 2013) and business management and sociology (Poutanen and Kovalainen, 2013). The articles also have a pronounced feminist or gender theoretical approach.

Towards a framework for research on gender and innovation

The two key concepts in this issue – gender and innovation – need to be defined and conceptualized in order to advance research in this area. In the current literature, there are several different perspectives taken on gender as well as on innovation. This is also shown in the diversity of the literature as described in the previous section, as well as in the variety of perspectives taken in the articles in this issue.

As accounted for at the beginning of the article, innovation literature is interdisciplinary and includes a number of different perspectives. For the purpose of constructing an analytical framework we distinguish between three categories:

- (1) innovation as an “output”, i.e. the new products, production methods, organizational forms, etc. that result from innovation processes (Smith, 2005);
- (2) the “processes” through which these innovations are created (Garud *et al.*, 2013); and
- (3) the innovation “discourses” appearing, particularly in a policy context (Doloreux and Parto, 2005).

Among the articles in this issue, all three categories are represented.

Further, in relation to innovation, gender should be seen as neither unambiguous nor straight forward. Feminist theory has presented several perspectives to

gender (Harding, 1986; Lykke, 2010). For the purpose of this article, we differentiate between three (partly overlapping) perspectives:

- (1) Treating gender – sex – as a “variable” (empiricist feminism), often with a focus on differences and similarities between men and women.
- (2) Interpretive analyses of how gender is “constructed” through negotiations and practices and a focus on “femininity” and “masculinity”, and sometimes applying a more social constructionist approach.
- (3) In-depth analyses of how gender is being produced and reproduced in organizations and systems through gendering “processes” (doing gender, West and Zimmermann, 1987) where gender is created and recreated in interactions between individuals (Brush *et al.*, 2009).

In this perspective, the social construction of gender and innovation is under constant change and context dependent. All of these perspectives are represented in this issue, thus providing a necessary broad view on gender perspectives to innovation.

Table III presents a categorization of issues or perspectives related to gender and innovation building upon these two sets of perspectives. These categories give some indication of the different research paths and questions that can be pursued in the field. In the following section, we discuss some of these paths under the three headings of:

- (1) gender differences and similarities in innovation;
- (2) gendered constructions of innovation; and
- (3) gendering processes of innovation.

These three headings follow the gender perspectives presented in Table III.

Gender differences and similarities in innovation

The combination of adopting the perspectives of gender as a variable and innovation as a result is probably the dominant approach in empirical research on gender and innovation. This perspective is reflected in studies of innovation in men- and women-owned businesses, as well as in the literature on gender differences on patenting, commercialization, etc. in the university context. This literature is often quantitative, comparing the tendencies of women and men to contribute to innovation. For example, studies have shown that male researchers are more likely than female researchers to engage in industry cooperation (Azagra-Caro *et al.*, 2006; Bozeman and Gaughan, 2007). However, other factors, such as having a government or industry research grant, are much more strongly related to industry involvement than gender (Bozeman and Gaughan, 2007), implying that there may be more complex relationships between gender and involvement in industry innovation. For example, a study by Whittington (2011) showed that “academic mothers” are less likely to patent. Hence, this suggests that it is the intersection of gender and family responsibilities that impede women’s ability to innovate.

The same variable perspective to gender can be used in relation to an innovation process perspective. For instance, the study by Foss *et al.* (2013) may provide a partial explanation for women’s inactivity in innovation. Based on their study, women are equally innovative in generating new ideas compared to men, but women’s ideas are more seldom implemented in the organization. Further, their study indicates that women

Innovation as	Variable	Gender as Construction	Process
Result	Differences between male and female scientists in patenting, commercialisation, etc.	How the concept of innovation is gendered What counts as an innovation	How changes in constructions of gender influence innovation outputs
	Differences between men and women-owned businesses in implemented innovations	How gendered understandings influence innovation outcomes	Changes in gendered understandings of innovation outputs
Process	Identifying actors in innovation processes and their gender	Revealing how innovation processes are gendered	How understandings of gender are created and recreated in innovation processes
	Frequency of participation of men and women in innovation processes in an organization	How gendered understandings of innovation influence on innovation processes	Changes in gendered understandings of innovation processes
	Differences in preferences for innovation between men and women		How the understanding of innovation is created and recreated throughout gendered innovation processes
Discourse/ policy	Identifying players in innovation discourses/ policy and their gender	Revealing how innovation discourses are gendered	How gender is produced and reproduced in innovation discourses
	Identifying actors and their gender within innovation discourses	How gendered understandings of innovation influence innovation policy	How gendering innovation and innovation processes influence innovations discourses
	Frequency of men and women-owned businesses in achieving innovation results or receiving innovation support	The impact of gendered innovation policies on different types of innovation and innovation in different contexts	

Table III.
Combinations of perspectives on gender and innovation – examples of issues

may suffer from a lack of collegial support in executing their ideas, a finding which is also supported by Poutanen and Kovalainen (2013). A possible explanation – supported by research within organizational studies – may be that women are not perceived as innovators, and consequently their ideas do not get heard in the first place, or they are deemed inferior to men's ideas and therefore never proceed to the implementation phase (Cooper, 2012). Hence, it is not women who are lacking innovation capability but organisational practices that condition or inhibit women's innovative behaviour.

Taking a "gender as variable" perspective to the innovation discourse may allow us to explore how policy measures target women and men. For instance, studies show a gender bias in the recipients of research grants (Viner *et al.*, 2004). One important reason for this may be the in-built gender bias embedded in policy and research on innovation. Several scholars have pointed to the fact that studies considering similarities and differences

between women and men in innovation outcomes may be inherently gender biased as they tend to focus on certain disciplines or industries, which have gender attached to them (Nählinder *et al.*, 2012; Kvidal and Ljunggren, 2013). Poutanen and Kovalainen (2013) and Wikhamn and Knights (2013) encourage us to be aware of the challenges of the “similarity and difference” discourses, and be careful when notions of femininity and masculinity are attached to women and men. They advocate more advanced understandings of gender than the simple differentiation between women and men. This is important as it will make it easier to avoid the counterproductive gender essentialism[2].

Gendered constructions of innovation

Feminist studies have demonstrated how the concept of innovation is highly gendered, implying that there is a strong male connotation (Blake and Hanson, 2005; Marlow and McAdam, 2012; Nählinder *et al.*, 2012). This is evidenced by the types of innovations supported by public bodies and in how innovation is measured in national statistics. As a result of gendered constructions of innovation, public support for innovation or R&D is mainly given to men or provided by men. Previous studies confirm that there is a strong association between masculinity, science and engineering, and innovation and that these processes are intertwined (Wajcman, 2010; Dautzenberg, 2012; Marlow and McAdam, 2012). Recently the innovation concept has been broadened both in research and policy to cover more areas than technology and patents and, thereby, include service sector innovations and open innovation processes. However, the contributions in this special issue continue to demonstrate how gendered constructions of innovation and strong male and masculine connotations continue to be reproduced in different ways and in different domains. For example, open innovation is generally presented as a more inclusive and feminine approach to innovation, but upon closer analysis it seems to reaffirm the norm of masculine organizational practices (Wikhamn and Knights, 2013). In a similar way, Rönnblom and Keisu (2013) reveal how the ambitions to broaden the understanding of innovation in the university context result in a conventional representation of innovation and academic entrepreneurs as men. This is due to academia’s strong focus on innovation outputs (Rönnblom and Keisu, 2013). Hence, as shown by Wikhamn and Knights (2013), gender inequalities are rooted in the dominance of masculine discourses, and gendering therefore is not just about including more women in innovation processes, but also relates to how innovation is interpreted and understood.

Gendered constructions of innovation are linked to definitions of innovation. While current definitions may seem gender neutral, it has been argued that the way in which they are operationalized and measured is strongly gendered with masculine connotations (Nählinder *et al.*, 2012; Pettersson and Lindberg, 2013). The same holds true in relation to who are acknowledged as innovators and what is acknowledged as innovations. For instance, Wikhamn and Knights (2013) show how the change from “hard” to “soft” product could be viewed as acknowledging other actors in the organization as contributing to innovation. However, as masculine discourses still dominate, this possible change is hampered. These studies demonstrate how innovation conceptualized as products and technology taking place in manufacturing strongly influence our views of innovation.

Gendering processes of innovation

Applying a “process” or “doing gender” approach when studying innovation may imply studying the “gendering” processes of innovation. Poutanen and

Kovalainen (2013) show how women both are absent and are made absent in innovation processes, even if they occupy an R&D position and are responsible for innovation work. In addition, they provide an example of how a product can be gendered and thereby create a niche for the female inventor in a male-dominated industry. The female inventor reclaims her position by gendering the product. Consequently, even if women are able to push themselves through the innovation pipeline, their role as innovators is not taken for granted. Hence, how this position is claimed, and how the various forms of resistance are presented are crucial when trying to understand the gendering processes of innovation. Pettersson and Lindberg (2013) in their work on innovation policy in Sweden, demonstrate how spaces are created for feminist resistance where hegemonic masculine discourses are contested. As a consequence of this resistance, existing gender stereotypes in policies, processes and networks of innovation are challenged. Further, they argue that challenging these stereotypes can lead to a democratisation of innovation by extending the type of actors who take part in the process.

Taking a process perspective to gender allows for examination of the processes in which the relationship between gender and innovation is changed and transformed. Changes in the gendered understanding of innovation outputs pave the way for a broader perspective to innovation outputs, and hence toward including service innovation and social innovation as legitimate innovation outputs. When these changes are slow, it may be due to the inherent power structures related to the gendering of innovation where the masculine discourses are dominant (Wikhamn and Knights, 2013). A process perspective can help us examine how the discourse of innovation is created and recreated throughout gendered innovation processes, as well as how gender is produced and reproduced in innovation discourses.

Applying feminist literature

The three perspectives on gender presented here follow, to a large extent, the conceptual development of gender as found in feminist literatures (Harding, 1986; Lykke, 2010). This development has lead researchers interested in gender in relation to entrepreneurship, innovation and other areas to claim that we should focus less on gender differences and similarities, and put more effort into understanding how gender is embedded in concepts, processes and research (Carter and Shaw, 2006). Calls are made for research that does not only use gender as an explanatory variable but instead examines “how gender is *accomplished*”, i.e. focusing less on gender as a variable and more on the process of doing gender (Ahl, 2006, p. 612; Achtenhagen and Tillmar, 2013). The perspectives opening up for seeing gender as constructed and represented in processes, organizations, discourses and policy, and not being exclusively tied to individuals with particular sexes, have been important in examining gender in relation to innovation. In the majority of innovation research dealing with innovations, innovation processes or innovation systems, actors are made invisible (Thorslund and Göransson, 2006; Brännback *et al.*, 2012). Hence, these perspectives are needed to reveal innovation as fundamentally gendered.

However, their invisibility does not mean that there are no actors in innovation. As pointed out by Thorslund and Göransson (2006), and referred to in the introduction to this article, processes, organizations and systems consist of actors, i.e. human beings. Identifying these actors is one way of examining gender in innovation. For instance,

the counting of women and men involved in innovation processes, the comparison of women and men with regard to the extent to which their ideas for innovations are considered and implemented in organizations, and examining the extent to which women and men are given a voice in innovation discourses, are some ways in which we can analyse innovation as strongly gendered and consider the consequences of this. Consequently, there are also important contributions to be made by taking gender as a variable approach to innovation. However, these analyses should be done with sensitivity to more advanced understandings of gender and their contributions. A difference between men and women in innovation needs to be interpreted against contextual and structural arrangements.

Conclusions, implications and suggestions for further research

Gender in innovation has remained invisible due to the fact that most studies on innovation are about products, processes or organisations, and not about people. Yet, the extant research focusing on innovation from a gender perspective has clearly demonstrated innovation to be a highly gendered field. Following Wajcman (2010) we also argue that innovation is both a source and a consequence of gender relations.

In this article we have provided a broad overview to the novel questions that need to be asked and addressed within the gender and innovation research field. First, in order to further theorizing on gender and innovation, it is important to demonstrate how gender is done in the context of innovation. Second, all authors of this issue have demonstrated how gender and innovation intersect, and how the desire to have a more inclusive innovation concept still has not yielded the required results. The gendered innovation processes and gendering of innovation practices are “sticky”. Third, the contributions also highlight the resistance made to find new emancipated paths for women in innovation.

The issue of power is crucial both in gender research and feminist theory. The “stickiness” of masculinity with innovation, and the difficulties in opening up innovation processes and discourses to embrace broader understandings of innovation and to involve more types of actors, can be seen as a result of the gender hierarchy as embedded in the gendered constructions of innovation. However, the role of power is seldom addressed in innovation literature. Among the important questions that should be addressed are: who has power in organisations, who are listened to and whose ideas are brought forward? The relevance of analyses of power in innovation studies is highlighted in the study by Poutanen and Kovalainen (2013), and the consequence of hierarchies of gendered discourses is also illustrated in the article by Wikhamn and Knights (2013). This is an important area for the emerging research field of gender and innovation.

Fourth, in the same way as the collective work on gender and entrepreneurship challenges the dominant views within mainstream entrepreneurship theory and research in several ways (Jennings and Brush, 2013) increased research on gender in relation to innovation has the potential to provide new insights to the broader innovation literature. Hence, this special issue offers a contribution to the general innovation literature by identifying important areas for future research, which become visible when a gender perspective is applied.

The need for counterintuitive approaches and research designs is claimed to advance the entrepreneurship research field in general (Zahra, 2007). This fits well with the need for gender and innovation research. Due to the strong association of innovation and

technology with masculinity (Wajcman, 2010), the issue of gender is often presented as the problem of women's underperformance (Lindholm Dahlstrand and Politis, 2013; Marlow and McAdam, 2013) – women are seen as less innovative than men – and we do not expect or seek contradictory evidence. Innovation activity is especially studied in high-technology and manufacturing industries since these industries are considered to represent the fields where innovation occurs. We continuously need to question the “natural” connections between innovation and technology, and to investigate innovation activity in service industries, public sector activities and in other female-labelled industries (Borins, 2001; Nählinder *et al.*, 2012).

Although researchers have acknowledged the variety of different types of innovations, the strategy literature has shown that process or organisational innovations are important for cost leadership strategies (Porter, 1985) or that business model innovations (Hamel, 2000) are more important for value creation than product innovations. Yet, innovation studies continue to focus on product and technological process innovations (Fagerberg, 2005). More attention should be placed on analysing the incremental innovation processes, the process-oriented innovations taking place at the grassroots level in organisations. It is time to look beyond the immediate and self-evident and start probing the unexpected.

Studies focusing on individual women involved in innovation are not sufficient to explain current patterns of women's innovation. Instead, there is a need to critically investigate the normative frames underlying our theory development and empirical enquires (Ahl and Marlow, 2012). This call suggests that we need more research on structural factors such as education and social expectations, and the socialization processes of women, for example in academia or science, in relation to their career perspectives and roles in innovation. Furthermore, epistemological conditions and ontological issues related to gender and innovation should be more thoroughly explored as different perspectives of gender (and innovation) represent different epistemological and ontological assumptions.

There are also methodological challenges that need to be overcome. Many high-tech firms portrayed as leaders in innovation activity are managed by teams that include both men and women (Rosa and Dawson, 2006; Dautzenberg, 2012). As studies often rely on single informants, typically CEOs, women are concealed in the studies (Marlow and McAdam, 2012). There are different roles assigned for women and men in the innovation pipeline (Duberley and Cohen, 2010): men are predominantly active in technology start-ups and in venture capital firms (Dautzenberg, 2012), while women are active in technology transfer offices. As argued above, identifying the actors of innovation may be one important approach to studying gender in innovation.

Another important methodological challenge is the gendered nature of the innovation concept itself. It is not only researchers who see “nuts and bolts” when they visualize innovations – but also the informants. Hence, approaching research participants with survey or interview questions that aim to probe various aspects of innovations easily push the informants to emphasise certain innovations and downplay others. We need to look for more gender neutral concepts to use when we empirically examine innovation and related issues (Nählinder *et al.*, 2012), and to develop methods to examine what people do, rather than how they talk about it. One approach could be to conduct research that involves the actors as well as their interactions.

On a policy level, many national science and innovation policies have become open to the broader definition of innovation, at least in the Nordic countries. For example,

the Finnish Funding Agency for Technology and Innovation (Tekes) explicitly states to promote “a broad-based view on innovation: besides funding technological breakthroughs, Tekes emphasises the significance of service-related, design, business, and social innovations”. Tekes has research programmes that focus on the health care, tourism, leisure and other service sectors. As such, the policy field seems to have been opened up for women-dominated sectors and women as innovators. On the other hand, Tekes claims to fund “spearhead R&D and innovation projects. The main target group of Tekes consists of SMEs seeking growth in internationalization” (www.tekes.fi). This intersection of broad-based innovation with a strong emphasis on firms focusing international growth may again reproduce the role of manufacturing and technology as the main sectors where innovation is to be found.

It is imperative that there is awareness building in the policy domain. If accepting the discourse that innovation is crucial for competitive advantage, nations and business need to optimise their usage of resources; excluding women from contributing to innovation is a waste of human resources. If unwanted and unconscious gendered processes make this happen, then nations and businesses need to be encouraged to implement actions or systems allowing women to make these contributions. Hence, there is a political agenda in generating new knowledge and awareness in the field. We encourage other countries to follow Sweden’s footsteps and to develop research projects and particular initiatives to focus the role of gender in innovation activity.

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Notes

1. Scopus search with the search term “innovation”, limited to journal articles. Search conducted on 26 April 2013.
2. Gender essentialism represents beliefs, often mistaken, that differences between males and females are stable, unchanging, fixed at birth, and due to biological differences rather than environmental factors (Smiler and Gelman, 2008). The criticism of gender essentialism points to the fact that masculine characteristics are not necessarily descriptions, and that male and feminine characteristics cannot be appointed to (all) women.

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