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Citation for the original published paper (version of record):

Jones, S., Williams Middleton, K. (2023). Investigating the Gendering of STEM University Entrepreneurial Ecosystems. 3E CONFERENCE – ECSB Entrepreneurship Education Conference: 78-78

N.B. When citing this work, cite the original published paper.

Investigating the Gendering of STEM University Entrepreneurial Ecosystems

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Questions We Care About

Contextualisation is considered key to understanding how, when and why entrepreneurship occurs, as it highlights a spectrum of factors, including situational conditions and the influence of stakeholder groups. However, context is often treated as a mere backdrop of place/space, rather than an integral fabric influencing all aspects of a phenomenon. In this conceptual paper, we focus on the complex context of university Science Technology Engineering and Math (STEM) Entrepreneurial Ecosystems. Despite different initiatives, and theoretical explanations, practice has not always produced what has been desired or expected of these ecosystems. We are curious to unpack potential layers of norms and traditions, practice and policy, by taking a feminist informed engaged scholarship approach, in order to identify why this may be, and develop relevant research questions to co-investigate this context with practitioners.

We do not assume that the lack of promise is a deficiency of practitioners, but rather as linked to the complexity of the context, including the potential for layered bias (explicit or implicit), and often unacknowledged tensions involved in emphasizing equality, diversity and inclusiveness. We subsequently call for close collaboration with practitioners, embedded in day-to-day practice, and an alternative (complementary) approach in the development and investigation of new (research) questions that support both theoretical and practical advances. In doing so our conceptual and methodological focus is on the micro level, to understand the experiences and challenges of individual and/or actor groups in practice. The question we care about is: *How could feminist informed engaged scholarship support us to ask co-created questions and develop solutions, which challenge the gendering of university STEM ecosystems and support inclusion, through collaboration with practitioners?*

Approach

In taking a gender perspective on theory and practice within STEM university EEs, we enter an undertheorized field. We base our thinking on Van de Ven's engaged scholarship approach, which has been extended to include explicitly feminist aims. In focusing on feminist informed engaged scholarship we subsequently respond to calls to recognise the context-dependent nature of entrepreneurship research and theory development *and* to consider gendered social positionality within entrepreneurial contexts.

Implications

We suggest that feminist informed engaged scholarship could guide new research agendas for processes and practices with STEM university EE. This approach has the potential to challenge traditional understandings by foregrounding the gendering of the STEM university EE context. We emphasize approaches that collaborate and co-create with practitioners, and explore the inherent challenges, tensions and trade-offs experienced in these contexts.

Value/Originality

Understanding the day-to-day dilemmas and tensions between policy and practice, principles and pragmatism helps us understand how, and why, achieving gender equality in STEM university EEs continues to be a challenge. Exploring such contexts from the perspective of those involved (including the tensions that a focus on gender equality can bring), helps researchers to ask more relevant (and potentially new/different) questions. It also guides us to ask questions and do research which might be better appreciated, applied, and accessed by practitioners and policy makers.

Introduction: The Questions We Care About

The Entrepreneurial Ecosystems of Science, Technology, Engineering and Mathematics (STEM) based universities host an array of disciplines, competences and perspectives well suited to address and deliver solutions to societal challenges. However, there is only partial understanding of how such entrepreneurship is shaped by context (Parkinson et al., 2017), with context primarily used as a backdrop or physical setting in extant entrepreneurship research (Hussain and Jones, 2022). To explain how, when and why entrepreneurship occurs Welter (2011) argues that contextualisation is key, as it highlights situational conditions, and the influence of specific groups (Zahra et al., 2014).

In this conceptual paper we focus on the context of university STEM Entrepreneurial Ecosystems and consider their socio-historical gendering, and the potential of feminist informed engaged scholarship to help us identify relevant issues and research questions in collaboration with practitioners and other ecosystem actors. Entrepreneurial Ecosystems (EEs) represent a new and undertheorized area (Wurth et al, 2016). Taking a gender perspective on theory and practice within EEs is yet another level of emergence (McAdam et al, 2019; Brush et al, 2019). We ground our perspective in Van de Ven's engaged scholarship (2018), which we extended to include explicitly feminist aims (Rouse & Woolnough, 2018). Although engaged scholarship has been used to investigate STEM educational settings such as university Engineering education (Shawcross and Ridgman, 2019) and the institutionalization of STEM subjects in teacher education (Heath et al, 2022), little extant research employs a feminist lens. In focusing on feminist informed engaged scholarship we subsequently respond to calls to recognise the context-dependent nature of entrepreneurship research and theory development (Yamak et al., 2019) *and* to consider gendered social positionality within entrepreneurial contexts (Marlow and Martinez Dy, 2018).

In foregrounding context, we focus on STEM university entrepreneurial ecosystems and the challenges, opportunities and tensions faced particularly as actors aim to be inclusive and supportive of gender equality. In principle, a STEM university EE context would be gender neutral, with support and development of STEM entrepreneurs and ventures would be based upon equal access to resources and support, and equal chance of successful outcomes (Brush et al, 2019). As a servant to society, universities are assumed to seek and promote equality and inclusion in their entrepreneurial ecosystems, given that any individual can be argued as capable of creating new value (Bakkar and McMullen, 2023), and that diverse ecosystems are 'healthy' ecosystems (Twine, 2018). However it is recognized that both entrepreneurship *and* STEM disciplines are both masculinized contexts, resulting in specific gendered dynamics, expectations and outcomes (Twine, 2018). Similarly, different national contexts will also have distinct socio-historic and socio-economic conditions, which will inevitably influence the development of their university ecosystems (Pezzi and Mondrago, 2020). For the purpose of this paper, we focus on Scandinavia, and consider the suggested 'gender paradox' of STEM entrepreneurship in this context (Stoet and Geary, 2018), which offers some insights into the potential tensions and challenges of STEM university EEs.

There is a growing emphasis on the need for inclusive policies to drive and support university entrepreneurial ecosystems more broadly (O'Brien et al, 2019), and we argue that this is particularly important for technology-based universities, given the historically masculinized foundations of many STEM disciplines (Miller et al, 2021). We further argue that, to understand the gendering of context from the perspective of those embedded within such contexts (Rouse and Woolnough, 2018) we need to collaborate closely with practitioners, to develop questions and research that addresses pressing issues in practice. Indeed, Purely academic research is 'radically under-used' in practice and policy (Rouse & Woolnough, 2018: 429), due to issues of access, relevance and timeliness; and this has been an ongoing concern for decades (Van de Ven, 1989). Collaborative approaches are therefore, important, as they encourage research to be *used* and applied by practitioners. This is because co-created research topics that arise in practice rather than in theory, which is especially important for equality-orientated research and action-orientated social change (Warren et al, 2018). Indeed, engaged scholarship

approaches often seek to challenge societal norms through specific changes in organizational activities, cultures and values (Beaulieu et al, 2018). Through co-creation and collaboration, practitioners have the impetus and motivation to apply research findings, which address a specific and agreed problem, and where there is a tangible need to make evidence-based changes.

In calling for research collaboration with practitioners, embedded in the day-to-day practices of EEs, we also recognize that, despite different initiatives, and theoretical explanations, practice has not always produced what has been desired or expected. We do not assume this is a deficiency of the practitioners, rather we recognize this as linked to the complexity of the context, the potential for multi-level bias (explicit or implicit), and the often unacknowledged tensions involved in emphasizing equality, diversity and inclusiveness. We subsequently argue for an alternative (complementary) approach to involving practitioners in the development and investigation of new (research) questions that support both theoretical and practical advances. In doing so our conceptual and methodological focus is on the micro level, to understand the experiences and challenges of individual and/or actor groups in practice. The questions we care about hinge on this, and we therefore ask: *How could feminist informed engaged scholarship support us to ask co-created questions and develop solutions, which challenge the gendering of university STEM ecosystems and support inclusion, through collaboration with practitioners?*

STEM University Entrepreneurial Ecosystems and Gender

For the purposes of this paper, we build on the Bruyat and Julien (2001) definition of entrepreneurship, understood as a dialogic between the individual and the creation of new value, situated in an environmental context. This definition is consistent with our desire to investigate the individual-level experience of the process of value creation and emergence within the socially constructed context. Our chosen context, STEM university Entrepreneurial Ecosystems (EEs), are recognized as central to developing early-stage ideas, bridging research and innovation, with multiple actors helping to transfer and transform technologies to society (Meyer et al, 2011).

There are debates about how to define EEs, however they are broadly conceptualized as representing the communities and cultures that entrepreneurs interact with in a given context or place (Cavallo et al., 2019). For this paper, we recognize an EE as a system of structures that include institutional support mechanisms and processes to support entrepreneurial activity, as well as social networks that support and guide those individuals who are seen as the primary drivers of value creation. Such contexts facilitate and are also influenced by factors such as entrepreneurial finance, government policy, guidance and protection of intellectual property rights, and entrepreneurship education (Hechavarria and Ingram, 2019). A university EE then, has an academic institution as one of the central institutional structures; housing systems that support faculty and student entrepreneurial activity; and also connection to the broader regional innovation systems (Bercovitz & Feldman, 2008).

Likewise, STEM can be difficult to define as the acronym is often seen as simply grouping Science, Technology, Engineering and Mathematics, to distinguish them from other disciplines, such as the arts and humanities. However, Martín-Páez et al, (2019:800) argue that ‘the capacity to recognize and appreciate the connections that exist between (STEM disciplines)’ is important, and such grouping and ‘the integration of knowledge areas involves obtaining a final product greater than the sum of its individual parts’. STEM entrepreneurship subsequently suggests innovations based on a combination or integration of STEM disciplines and knowledge. Typically, STEM oriented entrepreneurial activity is recognized as high-growth and opportunity-based, and entrepreneurial ecosystems enabling such activity (such as Silicon Valley) have helped develop some of the wealthiest companies (and individuals) in the world. They have also been highlighted as being highly gendered (Brush et al, 2019).

Gender is a debated concept, however there are two main approaches to conceptualizing gender within the extant entrepreneurship literature: gender as a variable and gender as a social construction (Henry et al, 2016). Gender as a variable is primarily used in quantitative research, and is conflated with sex, with the variables male and female often being, homogenous and binary (Henry et al, 2016). In contrast, gender as a social construction considers what it is to *be* a man or a woman in society, and the

expectations and roles associated with this (West and Zimmerman, 1987). Such societal perceptions are often uncritically (and unconsciously) mapped onto discourses of masculinity and femininity in a binary way. However, such social constructions of gender are dependent upon social and historical context, which can change over time and from location to location. In this way we can conceptualize certain contexts as being gendered, i.e. that they are positioned (socially constructed) as masculine (and uncritically linked to men) or feminine (and uncritically linked to women), rather than being gender-neutral (Jones, 2014). As such entrepreneurship in STEM disciplines carries a gendered double liability for women (who are socially linked with femininity), as both entrepreneurship *and* STEM subjects are uncritically positioned as masculine (Kubberød et al, 2021). Indeed, in their 14 year EE panel study, Hechavarria and Ingram (2019) concluded that, although globally women benefit more from EEs than men, innovation-driven EEs can negatively impact women), whilst others argue that the male-dominated STEM sector magnifies gender dynamics for women (McAdam et al, 2019).

STEM (university) EEs are therefore gendered, built on masculinised assumptions of both entrepreneurship and women's perceived role as innovators, (Richards & Mattioli, 2021). Feminist analyses suggest that 'legitimacy is deeply entwined with gender', (O'Dwyer, 2022:153), leading not only to direct bias but also bias by omission, veiled by gendered access to discipline specific requirements, qualifications and networks, which in turn generate biased policies that can increase gender inequality (O'Dwyer, 2022). It has subsequently been argued that actively involving women in entrepreneurial and innovative processes more broadly, within institutions and organizations, can lead to deeper and more sustainable societal change (Le Loarne-Lemaire et al, 2021). Understanding gender and its construction in STEM university EEs, is therefore vital, not only from a gender equality perspective, but because it is argued that STEM sectors drive future economic and employment growth, and are relatively highly paid (Diekmann et al, 2015:534), whilst gender imbalance in opportunity-based high-growth entrepreneurship negatively effects productivity and wellbeing (Kuschel et al, 2020).

Gender Equality and STEM in Scandinavia

We contextualize our thinking with a focus on Scandinavia. In line with Welter et al (2019), we argue that locating research within a specific context helps us understand the 'who', the 'why' and the 'when' of entrepreneurship more broadly. Furthermore, Welter (2020:27), suggests that the gender-context debate is moving from 'contextualizing gender', to focus on the 'gendering of contexts'. Here we (briefly) offer some insights into the historical developments in gender equality in the Scandinavian context, before considering the gendering of the Scandinavian STEM university EE context.

Comprising Denmark, Norway and Sweden, Scandinavia has long been viewed as one of the most gender equal regions in the world. In narrowing our view to the Scandinavian context, one might assume a more gender-neutral or gender balanced perspective, given national policies and norms associated with this region. For example, Scandinavia was the first region to introduce quotas for women's political representation in parliament in the 1980s (Dahlerup & Freidenval 2005), while Sweden was the first country to prioritize and formalize shared parental leave in the 1970s (Duvander et al, 2020) and Norway was the first country to introduce gender quotas on boards of listed companies in 2005 (Seiersted and Huse, 2017), and. However, despite these seemingly positive and continuing gender-equality initiatives, there remains, what some have called, a 'gender equality paradox' in Scandinavia, that negatively impacts the number of women undertaking STEM education, despite a high level of gender equality (Stoet and Geary, 2018). In Scandinavia this has been linked to a better of range of well-paid employment opportunities for women (McNally, 2020), parental attitudes, and gendered educational dynamics (Puggaard and Baekgaard, 2016). However, some have critiqued the gender equality paradox, warning against naïve interpretation of this paradox and arguing that we should tentatively draw on these findings, with more being done to test their robustness. (McNally, 2020). Likewise, researchers have criticized broader gender equality initiatives such as gender quotas on boards, as perpetuating or reinforcing gender inequality, leading to ethical tensions (Terjesen and Sealy, 2016). Others also argue that resultant changes from these gender equality initiatives have been slow and incremental rather than radical (Dahlerup & Freidenval 2005).

While we should address it tentatively, the STEM gender paradox, reveals that the more gender equality that exists in a country, the fewer girls undertake STEM education (Stoet and Geary, 2018), with knock-on gendered effects of those entering STEM professions more broadly. It is further argued that a history of male-dominance in STEM sectors has created a work environment whose values, practices and culture can actively exclude women (Kubberød et al, 2021). As a result, when women *do* pursue STEM disciplines and careers, they leave the sector at higher rates than their male counterparts, supposedly leading to a ‘leaky pipeline’ within STEM domains (Goulden et al, 2011). However, the leaky pipeline metaphor (introduced in the US in the 1970s) had been critiqued by Swedish scholars, who argue that its dominance as a model in Western science education and research, fails to engage with intersections of gender, ethnicity, social class and *nationality* (Mendick et al, 2017: 481, our emphasis). Others argue that it is a misleading metaphor, as it suggests ‘a linear and one-way movement’, whereas students move ‘in as well as out of STEM trajectories’ (Lykkegaard and Ulriksen, 2019:1600). Subsequently, policy initiatives that focus on women in STEM (or lack of them) can also lead to tensions around freedom of choice, which position women and girls as making the ‘wrong’ choices’ (Mendick et al. 2017). However, STEM gender inequality does seem to stubbornly persist in Scandinavia (as in many other countries in the Global North) and can be seen to influence STEM education and career development, despite the many initiatives in technical universities, to encourage women into sectors such as engineering, dating from the 1970s (Nordvall, 2023).

These persistent issues are also evident in ‘gender-related patterns and dynamics’ in regional innovation systems in Scandinavia (Lindberg, et al, 2022). Historically, this recognition of the role of gender has driven initiatives across Scandinavia and the Nordics to support girls and young women into STEM disciplines (see for example Puggaard and Baekgaard, 2016) and employment, including STEM entrepreneurship. Indeed, getting more women into STEM education is an ongoing a gender equality policy objective in all Nordic countries (which includes Scandinavia), with women currently accounting for a third of STEM graduates in the Nordics (Nordic Co-operation, 2023).

Such issues and tensions are obviously a concern for STEM universities seeking greater equality and diversity, and also for the development of more inclusive STEM university EEs. However, a background in STEM is not *necessarily* a pre-requisite for women’s STEM entrepreneurship in Scandinavia (Kubberød et al, 2021). It is further argued that the ‘skills gap’ that underpins arguments for increasing STEM education more broadly, is a fiction, and that STEM graduates ‘often find themselves in non-graduate occupations’ (Mendick et al, 2017: 483). Likewise, evidence from the World Bank poverty and inequality platform (the Gini index) shows that there is greater equity for girls for science literacy measures in some Scandinavian countries, than most of Western Europe, and that Scandinavia has the highest representation of women scientists (Hanson and Krywult-Albanska, 2020). Indeed, Nordvall (2023) suggests that universities of technology have focused on encouraging girls to study Engineering disciplines at university, since the 1970s. They have also sought to address STEM gender inequalities, for both faculty and students. In doing so, Nordvall argues that they have taken either a Recruit or Reform approach to gender inequality. As the name suggests, Recruitment focuses on recruiting more women faculty and students, but not always robustly evaluating the experiences or outcomes for these new recruits through, for example tracking them through their program of studies or considering attrition rates of the recruited women faculty. Reform has focused on reforming the systems and culture within universities of technology, and these have seemingly proved harder (and less popular) than recruitment initiatives.

Despite the apparent focus on gender-equality, and the willingness for government and institutions to champion it, there has been active push-back on gender equality initiatives in Scandinavia, including calls to exclude gender studies teaching and research from Higher Education in Sweden (Martinson, 2022), and a rise in ‘strong versions of normative individualism’ (Holst, 2018: 102), which complicate the contours of gender equality in Scandinavia. Such complexities and paradoxes make Scandinavia a highly relevant context, to understand and theorize gender from both academic *and* practitioner perspectives.

Feminist informed Engaged Scholarship: The Questions *They* Care About

To understand the complex context within which STEM university EEs operate we argue it is important to draw on the knowledge and expertise of those who experience it on a daily basis – the practitioners who work in entrepreneurship support organizations such as technology transfer offices, innovation offices, incubators and business support units, venture capital funders, and also those who experience EEs as users/beneficiaries of this support via universities (both faculty and students). Focusing on *their* challenges and experiences and using this as a driver for research is very different from the traditional approach, where we read the literature, identify a gap/knowledge proposed there by other researchers, and build our research questions around that theoretical or knowledge gap.

Engaged scholarship is broadly defined as ‘a form of collaborative inquiry between academics and practitioners that leverages their different perspectives to generate useful knowledge’ (Bowen and Graham, 2013: 55), and is based upon a knowledge engagement, rather than a knowledge transfer paradigm (Bowen and Graham, 2013). We suggest that such collaborative approaches represent a form of community engaged scholarship, which is argued as being more rigorous than traditional scholarship (Warren et al, 2018). Although universities seem to value and encourage community-engaged scholarship, some argue that they actively discourage it (Bell and Lewis, 2022). Bell and Lewis (2022) suggest such discouragement is based on several factors including epistemic bias, and ideas of who is qualified to control knowledge production, and decide what counts as knowledge, with universities as knowledge gate keepers. They further argue that this epistemic bias is sustained through gendered and raced norms based on ‘masculinist ideals that permeate academia and have direct and indirect effects on engaged scholarship’ (Bell and Lewis, 2022: 8). While Bell and Lewis’s work is based on the US context, we could argue that, given the masculinised history of universities of technology (Nordvall, 2023), such epistemic and gender biases might also be at play in this context.

Reluctance to support and encourage engaged approaches might also reflect suspicion of the specific values, principles and processes that engaged scholarship is based on, which include social justice and citizenship (Beaulieu et al, 2018). Such values may be viewed as subjective or activist, given that engaged scholarship encourages ‘faculty to integrate their role as expert with their role as citizen’ (ibid: 5). However, engaged scholarship has been criticized as being positivist, and ‘skewed to the interests of power holders and unlikely to transform underlying social relations’ (Rouse and Woolnough, 2018: 429). With this in mind we draw on Rouse and Woolnough’s concept of engaged-activist scholarship to bridge the gap between engaged scholarship and feminist concerns.

Feminist approaches privilege situated knowledge, being broadly based on an epistemology that recognizes knowledge is historically and socially embodied, and that certain voices have been excluded from research, as ‘not knowing’ (Jones, 2014). While feminist research does not necessarily focus *only* on women and the diversity of their experiences, it is more commonly used to articulate and amplify the voices and experiences of women as a disadvantaged and/or minority group, with a view to encouraging equality of focus and concern, given that research has historically been done by white, Western men, for white Western men (Jones et al, 2019).

This is cogent with an engaged-activist scholarship approach that seeks to harness and mobilize the situated knowledge of academics *and* practitioners in different contexts. It also recognizes the activist roots of feminist scholarship, which align well with the suggested social justice and citizenship concerns of engaged scholarship (Beaulieu et al, 2019). Feminist approaches are not monolithic and include such perspectives as Islamic feminism, Black feminism, post-colonial feminism, liberal feminism and social feminism. We are subsequently mindful of the suggested feminist underpinning of gender equality initiatives in Scandinavia. Holst (2018: 103) argues that the influence of Anglo-American style liberal feminism has been limited in the Scandinavian context. Instead Scandinavia has developed “a social-democratic- tempered approach to radical feminist ideas and patriarchy conceptions (that has a) pragmatic outcome, negotiation and compromise orientation...and (stresses) shared values and community ideals’ (Holst, 2018: 104).

To help us address the questions we, as academics *and* practitioners, care about we are in the early stages of developing a feminist informed engaged scholarship approach to investigate the gendering of STEM university EEs within and across three Scandinavian universities. We have begun initial engagement and conversations with incubation and other practitioners such as coaches, innovation office staff, external private and public organizations and students, to experiment with a feminist informed engaged scholarship approach, which we hope will help us to understand the complexity and challenges of the context, and to develop research questions, methodologies and methods for a future large-scale project.

Conclusion

We suggest that feminist informed engaged scholarship could help us to develop new approaches that actively and consciously critique and change the processes and practices with the STEM university EE in collaboration with practitioners. As such this approach has the potential to challenge traditional understandings of context, as a mere backdrop to entrepreneurship, by foregrounding the gendering of the STEM university EE context. We emphasize approaches that collaborate and co-create with practitioners, to explore the inherent challenges, tensions and trade-offs experienced in acknowledging, and trying to enable/build, gender equality in practitioner and university settings within STEM EEs.

Understanding the day-to-day dilemmas and tensions between policy and practice, principles and pragmatism helps us understand how, and why, achieving gender equality in STEM university EEs continues to be a challenge. Exploring such contexts from the perspective of those involved on a daily basis, and the issues they face (including the tensions that a focus on gender equality can bring), helps us as researchers to ask more relevant (and potentially new/different) questions. It certainly helps us to ask questions and do research which might be better appreciated, applied, and accessed by practitioners and policy makers.

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