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Shared fabrication spaces as a double-edged sword for entrepreneurship

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Introduction

Both theory and conventional wisdom promote the idea that lower barriers to entrepreneurial entry (e.g., access to knowledge, resources, technology, and markets) can trigger creative entrepreneurial activity (Eesley, 2016; Perry-Smith & Coff, 2011). Thus, the emergence of the "Maker-Movement" – a growing community of creative innovators democratizing the means of production through open access to Shared Fabrication Spaces (SFSs) – is credited with ushering a new industrial revolution and as a powerful enabler of entrepreneurial creativity (Browder et al., 2019).

SFSs – physical community workshops such as Makerspaces and Fab Labs – boost user-led innovation networks that employ private governance structures allowing individuals to access and share information (Halbinger, 2018). Indeed, makers at SFSs often produce solutions valuable not only for themselves but also for others. In the notable Fairphone case, for example, two Dutch makers working in an SFS created an entrepreneurial success story by introducing a conflict-mineral free smartphone, even though they lacked specialized knowledge and did not envisage any commercial path for their project (Akemu et al., 2016). Such examples parallel the process of user entrepreneurship, whereby entrepreneurs are "accidentally" borne out of users' proactive response to daily needs by creating and sharing solutions (Shah & Tripsas, 2007). From that perspective, SFSs promise to support the crucial identity shift from makers to entrepreneurs (cf. Mollick, 2016). This suggests a tight link between makers' innovative and open ideology, their SFS facilities offering unprecedented access to prototyping technology, and a thriving entrepreneurial community. However, despite such anecdotal cases and the logical allure of the idea that makers are high-potential entrepreneurs in-the-making, we know very little about *whether and how do SFS enable entrepreneurial activity?*

In this chapter, we empirically examine this question by conducting a qualitative study at seven different SFSs, where we interviewed 23 individuals who collectively identify themselves as "makers" and who are either users and/or owners of Makerspaces and Fab Labs. The objective of

this analysis is to acquire a deeper understanding of how SFSs relate to entrepreneurship.

Our primary finding is that, although SFSs do indeed lower barriers to nascent entrepreneurial activity (e.g., via cheap access to prototyping facilities, availability of specialized knowledge and learning opportunities, as well as valuable contact with early adopters), they also erect other barriers due to normative and cognitive institutional forces (e.g., requiring conformity to community values, including open sharing of ideas and a community ethos resisting commercialization and profit). We build on these findings to offer several contributions to the literature about makers, entrepreneurship, and community-based innovation.

Theoretical background

Emergent entrepreneurial activity

This study examines how entrepreneurial activities emerge within the context of SFSs. To do so, we draw on a growing consensus that entrepreneurship refers to "the process through which new economic activities and organizations come into existence" (Davidsson, 2015, p. 675). This definition of entrepreneurship is sufficiently broad to capture both commercial as well as social entrepreneurship (Saebi et al., 2019). It is also restrictive enough because, for makers, just like user entrepreneurs (Shah & Tripsas, 2007), there is a key difference between creating products and services to fulfill their own needs as opposed to creating and marketing these products and services for others. Finally, our understanding of what constitutes entrepreneurial activity aligns well with Browder et al.'s (2019) view of maker-entrepreneurs as those makers who commercialize a select subset of projects with market potential. When we discuss enabling and inhibiting forces, we thus refer to factors that affect makers' ability to fulfill such entrepreneurial activities.

The maker movement

Makers include an array of product creators, innovators, tinkerers, and hobbyists that largely focus on Do-It-Yourself/Together activities through experimentation with the resources housed in SFSs (Browder et al., 2019). Collaborative work by makers entails individual-level creation with complete awareness of how to bring an idea or digital file to life without depending on closed processes employed by large corporates or other industrial production facilities. By extension, the maker movement promotes production systems that typically stand in opposition to capitalist processes. Indeed, the rhetoric of "Do-It-Yourself" has strong anti-capitalistic connotations. Furthermore, elements of openness and sharing are at the core of the maker movement. The preeminent statement "if you can't open it, you don't own it" demonstrates the maker's reverence for

ownership, defining ownership as a state that can be achieved only when a person "opens up" the product and knows all ins and outs of its creation (Anderson, 2012).

Nevertheless, recent work has also emphasized the maker movement's potential for "resource combinations" and entrepreneurial experimentation (Browder et al., 2019; Halbinger, 2018). As seen in Browder et al.'s (2019) model, educational experimentation space, technical adeptness, and the community network of valuable contacts afforded to makers via SFSs are expected to set makers up for entrepreneurship.

SFSs: one community, different shades

SFSs are the functional emblems of the maker movement. Bubbling up on the outskirts of traditional corporate ideation and production workspaces, SFSs eradicate tangible and economic barriers to digital product manufacturing. In doing so, SFSs are a direct manifestation of the maker movement's call for democratization of access to production processes, knowledge sharing, and technical skills education. These general-use spaces, open for a wide variety of projects, are mostly independently owned but supported by their maker communities via membership fees and donations (Halbinger, 2018). SFSs hold machinery for digital production as well as traditional labor such as table saws, soldering stations, and hand tools, and are differentiated in that they represent the distinct voice of their local communities as well as the unique character defined by their business model and operating ideologies.

In this study, we refer more specifically to two common models of SFSs: Fab Labs and Makerspaces. Fab Labs are distinct in that they often are hosted by a society, school, or another parent organization. They also abide by a Charter of Values written for the Fab Lab network, born at the MIT Centre for Bits and Atoms and now comprising more than 1,200 Fab Labs (Browder et al., 2019). Fab Labs have the mission to "combine entrepreneurial innovation, research, and education under a single roof" (Browder et al., 2019, p. 465).

Makerspaces, on the other hand, are more independent and can exist as non-profits living off of volunteers or as for-profits collecting fees for membership access and classes (Browder et al., 2019). As such, these types of spaces may manifest with various differences, but still "cultivate a culture of open exchange of information and experimentation" (Halbinger, 2018, p. two). Table 6.1 provides an overview of the differences between the Fab Labs and Makerspaces.

Empirical setting and methods

SFSs have not been given sufficient research attention to date and we, therefore, utilize an exploratory-qualitative research design (Edmondson & McManus, 2007).

Table 6.1 Differences between Fab Labs and Makerspaces

	Fab Labs	*Makerspaces*
Access to machines	Access to high-quality machinery for users paying for access, gaining free or discounted access on open days, or are using machines as an employee or fellow of the associated organization. Organization of use determined by waiting lines or machine reservation mechanisms.	Access to high-quality machinery for members that pay membership fees. Open days showcase machine use and projects aim to recruit new members but do not allow the use of machines without training.
Education	Education of technical skills and Fab Lab norms and values offered to both regular users and the public.	Education of technical skills and Makerspace norms and values offered to members for free or paid and to the public for a fee.
Values and Norms	Embrace of formal openness and sharing by using open source software for open-source design documentation to be shared.	Embrace of informal open work culture and sharing of information and ideas between members within the respective Makerspace community or to the public during showcase events.
Project Ownership	Communal ownership unless stated otherwise.	Private ownership unless formal cowork partnerships agreement.
Membership Costs	Access to the machines and community is given via conformity to community ethos, belonging to the associated organization, and/or time, energy, and opportunity cost spent waiting to access resources.	Financial costs linked to formal contracts. Conformity to community ethos and the time and energy spent on the social process of becoming part of the community.

Research setting and data sources

Our research was set in SFSs located in Amsterdam, Rotterdam, Utrecht, and London as we collected data in and around seven SFSs (see Table 6.2). Although each SFS is distinct, they all share the basic function of SFSs (e.g., providing tools, machines, and education programs to their members and the public). In addition, all spaces were explicitly self-defined by their owners and members to belong to the maker movement, essentially linking their identity to the global community of makers. At the same time, the communities within these SFSs were typically novel and constantly changing. In this specific context, our study was aimed at collecting rich,

Table 6.2 SFSs Examined

SFS Name	*SFS Type*	*Location*	*Year Opened*	*Year Closed*
De Waag	Fab Lab	Amsterdam, NL	2007	
Protospace	Fab Lab	Utrecht, NL	2008	
ZB45	Fab Lab	Amsterdam, NL	2013	2019
iFabrica	Makerspace	Amsterdam, NL	2013	2015
RDM	Makerspace	Rotterdam, NL	2013	
Makerversity Amsterdam	Makerspace	Amsterdam, NL	2016	2018
Makerversity London	Makerspace	London, UK	2014	

Note
While three out of the seven makerspaces we studied eventually closed down, investigating their survival and performance went beyond the scope of our study and we, therefore, do not speculate about it here.

detailed, and thick interview data, shedding light on the experience of making as it unfolds within SFSs and as part of the entrepreneurial journey.

Sampling and data collection

Our interest was to first identify SFS makers in order to detect the activities performed in their SFSs and to uncover the link between such activities within SFSs and entrepreneurial action. Therefore, the first step of data collection was to enter a variety of SFSs and determine which spaces are most appropriate to observe the phenomenon of interest. Importantly, we did not try to establish the entrepreneurial potential of makers at this stage and remained open to looking at both commercialized and non-commercialized maker activities.

We selected our interviewees among users and visitors of SFSs during regular and open days, workshops, public events, and trainings. Interviewees were selected based on their experience with the SFSs in question and their role within the community. This was done to ensure that the data collected were sourced from individuals with nuanced rich knowledge about SFS activities and the associated maker community, which would not be available if sourced from one-time visitors or makers who had not spent sufficient time learning technical skills and community norms. In addition, individuals with different roles within an SFS and its maker community were targeted so that the research would not show solely a one-sided view of SFS culture and activities, but rather offer a holistic understanding.

With our first site visits, we commenced on two rounds of semi-structured interviews with open-ended questions that gradually became more specific. The first round of interviews included spontaneous encounters with individuals "on the spot" (15–30 minutes). This stage also included data generation from online sources about the space, such as websites, online video tutorials, or presentations

provided and created by SFS maker communities, and member recruitment processes gleaned from online promotional material and sign up pages. Additionally, social events were attended to both meet the makers and those in charge of the spaces as well as observe important interactions between makers and managers concerning their projects.

Meanwhile, the second round of interviews was scheduled and included more extensive questioning (30–90 minutes). These interviews were conducted through snowball sampling where first-round interviewees referred to valuable individuals from their maker community who could best speak to the reality of maker activities and their potential for enabling entrepreneurship. Our final sample consisted of 23 individuals who represent SFS users, managers, or founders (see Table 6.3).

The issues addressed in the interviews expanded to include the following themes: (one) experience and relationship with respective SFS as well as selection or recruitment processes; (two) decision-making motivations for joining a space and staying (or not), as well as the ultimate mission of each Makerspace and Fab Lab; (three) selection procedures and educational efforts; (four) understanding community practices and values around key themes such as openness, sharing of information, and collaboration; (five) the accrued benefits and associated costs for joining Makerspaces and Fab Labs; and (six) the experience of and attitude toward entrepreneurship and project commercialization.

Data analysis

Our data analysis followed a three-step procedure aiming to inductively explore patterns that emerge from the data through systematic and iterative comparison and contrasting (Gioia et al., 2013; Strauss & Corbin, 1998).

Each interview transcript was first reviewed by employing extensive open coding leading us to a large variety of codes that were then reviewed again to determine the similarities between each data segment and how they fit together. These first-round codes were also triangulated with data collected from online sources and physical documentation of services provided by SFSs.

The second layer of coding followed whereby similar comments and themes were categorized together. Second-order codes that had emerged from this data analysis were used to identify related themes found from the first layer of statements, categories, and evidence. At this stage, data and word frequencies were mapped through NVivo software, utilizing visualization tools such as word maps and keyword frequency tables that allowed a deeper and more granular understanding of the phenomena. The coded data were reviewed in and out of context to ensure that the code's meaning corresponded to the meaning of the passages it captured.

Finally, this coding process led us to overarching aggregate dimensions that defined the scope of the inductive framework developed in this study

Table 6.3 Sample

Respondent	*SFS Affiliation*	*Role*	*Profession/Education*
R1	Makerspace and Fab Lab	SFS User	Product Designer
R2	Makerspace	SFS Manager	Industrial Designer
R3	Makerspace and Fab Lab	SFS User	Software Designer
R4	Makerspace	SFS User	Industrial Designer
R5	Makerspace	SFS User	Software Engineer
R6	Makerspace	SFS User	Artist
R7	Fab Lab	SFS User	Administration
R8	Makerspace and Fab Lab	SFS User	Product Designer
R9	Makerspace	SFS User	Product Designer
R10	Makerspace and Fab Lab	SFS User	Product Designer
R11	Fab Lab	SFS User	Biologist
R12	Fab Lab	SFS Manager	Industrial Designer
R13	Makerspace	SFS User	Product Designer
R14	Makerspace	SFS User	Digital Media
R15	Makerspace and Fab Lab	SFS User and Manager	Jeweler
R16	Makerspace and Fab Lab	SFS User	Product Designer
R17	Makerspace and Fab Lab	SFS Manager	Metal Worker
R18	Fab Lab	SFS User	Biologist
R19	Fab Lab	SFS User	Engineer
R20	Makerspace and Fab Lab	SFS User	Artist
R21	Makerspace and Fab Lab	SFS Manager	Product Designer
R22	Makerspace	SFS Owner and Manager	Product Designer
R23	Makerspace	SFS Owner and Manager	Business Administration and Product Designer

(Gioia et al., 2013). At this stage, reviewing relevant literature served to enrich the meaning of our identified themes and linked them more closely to the research question we aimed to answer. For instance, theory about normative and cognitive barriers to entrepreneurial entry (Lounsbury et al., 2019) informed our analysis of statements about community values and the sharing culture of SFSs. All the while contrasting them with theory about economic barriers to entrepreneurship (e.g., lack of capital to purchase materials and opportunity costs of making; Foss et al., 2019), which informed our understanding about productivity, technological resources, and space. Figure 6.1 presents the data structure.

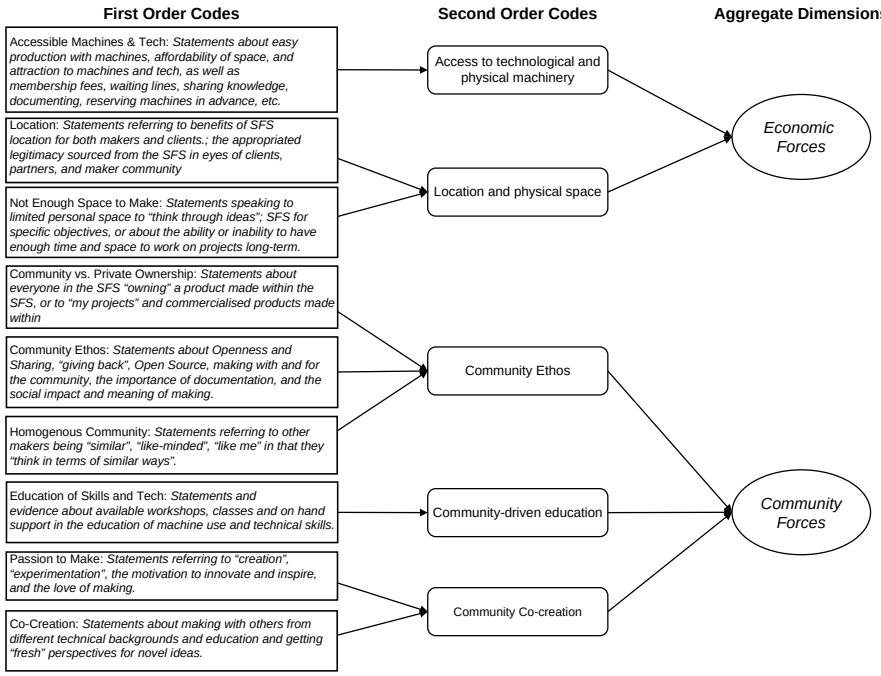

Figure 6.1 Emergent Data Structure.

Findings

The emergent structure presented in Figure 6.1 defines two central elements that link SFSs and entrepreneurial activity. First, Economic Forces that encompass themes such as access to technology and physical machinery. Second, Community Forces that include themes dealing with community ethos, educational activities, and co-creation. Below, we elaborate on each of these elements in turn.

SFS economic forces and makers' entrepreneurial activities

The Economic Forces identified in our data refer to barriers and opportunities to gain necessary resources. Nascent entrepreneurs face a social context where heterogeneous resources must be assembled, reassembled, and experimented under uncertainty. Foss et al. (2019, p. 1208) state that "good" institutions provide contexts with "low transaction costs when they search for resources, bargain over terms at which they can acquire or contract for these, monitor resources, etc." Through this perspective, we

analyze our findings to demonstrate that much like entrepreneurs facing institutional contexts when starting ventures, makers operate by collecting, bargaining, and monitoring resources within SFSs as their primary context.

Access to technological and physical machinery

The most visible motivation for joining an SFS is access to high-tech equipment including CNC machines, laser cutters, 3D printers, and other production tools to experiment and create. The industrial quality equipment cannot be procured, maintained, nor physically hosted by just one person. The majority of our respondents expressed that projects could only succeed with the use of the free or affordable equipment accessed in SFSs. As a longboard maker and entrepreneur explained: "I use all the machines whenever I want. This machine here is 30,000 Euros, the other is 100,000 so if I didn't have this place, I would have never been able to make these skateboard molds or cut these decks up" [R13]. These tools enable entrepreneurship because they entail large cost reductions in bringing ideas to life, allowing makers to create impressive prototypes and reach low production levels for affordable sums. As one maker joked, "where do you put a laser cutter? Mom, can I use the kitchen? No! You need this" [R21].

Location and physical space

The physical layout, location, and designated personal space, if provided, proved to be an impactful economic force with the potential to aid and inhibit entry into entrepreneurship among makers in our sample. Thus, notions of proximity and reputable location played into makers' reasoning when choosing a certain SFS. For example, one member described, "the venue is quite important to get clients here easily" [R3]. Others explained that location reputations transferred over to their personal reputation so that they were able to demonstrate legitimacy in new relationships outside the Makerspace, "being able to use [the name and place] in describing what I do and say 'I have a desk space at [a reputable location]', gets people to respond 'Oh ok, you're serious'" [R5]. Thus, makers took location considerations very seriously as these aspects of the space seem to feed into their legitimation work.

Physical space also refers to the available workspace within an SFS dedicated to one sole maker or team. Interviewees explained that because the thinking processes are done in private areas such as home, their Fab Lab work tends to concentrate on the execution of an already formed idea. Fab Labs are then often only helpful for the execution of a short-term or limited part of a project, as one interviewee stated: "At the Fab Lab, you don't have that much space. You come for a certain activity, and then you pick up your

stuff and leave again. It's more of a visit, not a dedicated desk or space and you can't leave your stuff so your products can't be too big. It's kind of more for learning how to use the machine, or testing" [R15]. This is less of an issue in Makerspaces as makers pay fees for private space within a collaborative area.

In sum, makers coordinate resources for their projects whereas SFSs provide some of these resources (e.g., access to machinery and space to work) and limit others (e.g., providing no storage space). SFS Economic forces are therefore providing mixed support for makers' entrepreneurial ambitions.

SFS community forces and makers' entrepreneurial activities

SFS community forces are inductively derived from themes discussing Community Ethos, Community-Driven Education, and Community Co-Creation. Taken together, these emergent themes capture the intangible elements that shape makers' projects and their potential for entrepreneurial activity. In other words, these are cognitive and normative dimensions of culture that "structure and animate social practices among categories of actors with common goals, orientations, and stakeholders" (Lounsbury et al., 2019, p. 1220).

Community ethos

Community Ethos was quite homogeneous within and among the SFSs studied. Although variety was found in the interpretation and manifestation of maker values across different SFSs, the essence remained consistent; openness and sharing are used as a primary methodology for innovative creation and as a radical way of producing and educating new independent makers. One entrepreneurial maker acknowledges, "Everyone here is the same like me. They think the same way about certain things like me and they also know that you come a lot further when you help each other out" [R13].

Making is an empowering act to "break open" technology and products, shift away from buying from corporations, proactively and independently create, share the knowledge gathered from the making process, and be part of a community contributing to something larger than itself – the Maker Movement. This is echoed in MakerShare's "Community Guidelines," which provide maker "Dos and Don'ts," "by sharing your project(s), you become a member who contributes to the maker community [...] What makes community possible is our shared values: openness, resourcefulness, ingenuity, generosity, creativity, resilience and self-directedness."

In our sample, accepting this ethos becomes a precursor for gaining access to desired resources of machinery and knowledge. Makers are even selected for their ability and desire to uptake the community ethos, as an SFS manager

explains, "I think attitude as a member for sure is a big deal, you have to feel comfortable with this thought [of openness and sharing], you have to like or get the idea that this co-working thing is something that you have to be ok with" [R2]. SFSs formally grant access to resources through membership requirements, but selection processes also informally classify if a maker "fits in" [R1] with objectives and values. One Makerspace founder explains that the following thought process affects how makers are allowed into the Makerspace: "Do you come in and work from the space quite a bit? It's not essential but it's kind of a good sign if you're there a lot of the time. Are you up for talking to people? Do you come for the Friday breakfasts and do you come into the pub? [...] People who say yes to all of [those questions] are generally who we want to have in the space" [R1].

In sum, SFS communities tend to harbor like-minded people that hold values of openness and sharing, but these values are paradoxically protected to an extent that they become quite sterilized and may even reverse from stated openness to practiced exclusivity. As our respondents reported: those who do not believe in the community ethos "smell that this is not for them, so they leave" [R20]. Evidently, across all SFSs studied, makers often acknowledged that entrepreneurial projects were strategically distanced from the community as a response. In Fab Labs, makers with clear entrepreneurial ambitions paid full price for machine use and did not document online, whereas in Makerspaces, entrepreneurial makers would use their SFSs "early in the morning or late in the day [when projects are] confidential and they don't want to have them on their screens" [R3] for others to see.

Community-driven education

SFS maker communities are providers of formal and informal education. Both Fab Labs and Makerspaces host paid and free formal education programs, events, and workshops for community members and the external public. The educational segments vary in themes and structure but always aim to teach useful and relevant skills while staying in line with the mission of the SFS and community ethos.

Makers describe the SFSs as not solely a space to make, which is what first comes to mind, but as a primary location to learn, thereby establishing the SFS as a "new school" [R18]. One commercial Makerspace emphasizes this specific educational aspect even in their name, "Makerversity" and their website that states "Makerversity: campuses for creative businesses." In this way, Makerversity specifically aims to teach and facilitate learning among creative and maker ventures. The formal educational initiatives can thus effectively encourage entrepreneurship by making available not only education that will support the success of projects but steer those projects toward venture creation. Still, formal education workshops are also vessels that transfer knowledge of community ethos to community members. One

Makerspace facilitator explained: "I'm very clear about open source and the whole maker culture. […] I want them to contribute. So if they use a file made by someone else, they have to reference it and share their own files" [R14]. In this way, community norms and values are taught hand-in-hand with technical skills and production processes.

SFSs are also sites of informal community-driven education through social interactions between makers. Unsurprisingly, community attitudes toward entrepreneurship are present throughout these informal interactions as well. As a Fab Lab facilitator explained while showing others how to use a machine: "[this] should be a place to experiment and share. It's not experiment and sell" [R20].

Community co-creation

Co-creation is the practice of passionately creating collectively within and with a community of makers. The maker community motivates makers to co-create and disapprove of fellow community members that do not co-create. One maker expressed annoyance in others who did not "understand" the core of making because "you cannot expect instructions or just repeat experiments, you got to get your hands dirty and experiment towards finding solutions. The point is to create and explore, not repeat and publish" [R23]. The potentiality to discover co-creation opportunities and partnerships enables entrepreneurship in that makers lacking certain skills can find teammates with those necessary talents to bring projects to fruition. Finding complementary talents was helpful, for example, in the case of "Linked Locked," a venture started in iFabrica that creates bicycle parking solutions. This venture formed by two fellow makers who decided to work together during a Cycle Hack event after having known each other through regular interactions at iFabrica.

However, co-creation within SFSs can also inhibit entrepreneurship by acting as an additional conduit transmitting values that push makers away from entrepreneurship. When makers team up to co-create, their values and ambitions can often clash. For instance, one maker spoke about working with another maker who wondered about commercializing their product, he said: "can I make money from [making]? This feels like a dirty question" [R1]. A couple of other makers expressed their experience with a third member saying: "We had some trouble with [Z who is] a true hacker in that they're very paranoid about people starting a business. There's this feeling that if you do so, you're like a sell-out" [R21 and R22].

Overall then, to the extent that co-creation is a meeting point between makers with different knowledge and skills, it seems to support entrepreneurial activity. Nevertheless, to the extent that community co-creation is also a meeting point of different value systems and ambitions, it serves to promote the prevailing ethos within which entrepreneurial activity is often frowned upon.

Differences and similarities across Makerspaces and Fab Labs

Several additional insights emerged as we compared and contrasted Makerspaces and Fab Labs along the dimensions of our findings. Very clearly, both Makerspaces and Fab Labs source a set of core values as well as functional practices from the maker movement, thereby constructing a powerful economic and cultural context that simultaneously promotes and restricts makers' entrepreneurial activities. Where these SFSs differ is mainly in the degree to which they enforce community values and ideals upon their members. For instance, whereas Fab Labs often require total openness and sharing as a condition for accessing tools and technology, Makerspaces are more lenient toward deviant members and often promote sharing and openness as means to support an entrepreneurial project (e.g., eliciting feedback) rather than enforce community values. Indeed, while still frowned upon, Makerspace members do find creative ways to protect proprietary product and company information without necessarily feeling or being labeled as a "sell-out." Similarly, unlike Fab Labs, Makerspaces offer private space, which allows for storage and enables longer-term projects. Thus, the general pattern of our findings points to Makerspaces as a slightly more flexible context than Fab Labs, affording relatively more potential for entrepreneurship in return to higher membership costs.

Discussion and conclusions

Delving into the world of makers, this study addresses the question of *whether and how SFSs enable entrepreneurial activity among makers?* We find contradictory forces that both enable and inhibit emergent entrepreneurial action in SFSs. Like previous studies, our findings show how SFSs provide arenas of collaborative creation, lowering economic barriers by virtue of their accessibility, affordability, and resource-rich environments (Browder et al., 2019; Eesley, 2016; Perry-Smith & Coff, 2011). Indeed, SFSs can enable makers to create a solid foundation for impressive social and commercial ventures (e.g., Akemu et al., 2016; Halbinger, 2018).

However, the process by which entrepreneurship emerges from SFSs is not as straightforward as previous studies seem to suggest. Several features of SFSs in our sample and the Maker Movement more generally are negatively affecting makers' view of entrepreneurship. Openness and sharing, anti-capitalist sentiments, and negative perceptions of profit-seeking activities are deeply embedded within the SFS community ethos, transmitted through community-driven education, and promoted alongside opportunities for co-creation, all of which eventually coalesce to dampen entrepreneurial ambitions. Consequently, in the context of SFS communities, entrepreneurship is often seen as a "dirty" activity associated with "selling-out."

This core finding – that SFSs represent a double-edged sword for entrepreneurship – links our study to a growing stream of literature documenting

how, despite favorable economic starting positions, the emergence of entrepreneurs from within innovative communities meets formidable challenges (Jain et al., 2009; Mollick, 2016). Much like scientists (Jain et al., 2009) or open-source software community members (Mollick, 2016), makers often operate within an environment that is socially incompatible with entrepreneurship.

SFSs afford makers unprecedented access to advanced production facilities but they also ask to share designs and discoveries with the community. SFSs provide much-needed space for tinkering and co-creating with other community members but at the same time limit maker's capacity to create for others outside this community. SFSs enrich makers' experience through formal and informal educational activities but next to skill acquisition they also transmit a powerful anti-commercial ethos.

It is not that being a maker necessarily implies wholesale adoption of the maker ideology or that all SFSs necessarily inhibit entrepreneurship without distinction (e.g., see differences between Makerspaces and Fab Labs). Instead, what our findings suggest is that the process by which makers become entrepreneurs is more challenging than initially anticipated and presents multiple tensions between economic and community forces. Indeed, makers must juggle and work with and around these tensions to overcome the paradoxical interplay of entrepreneurial making in SFSs. For instance, we found that some makers use SFS facilities covertly (e.g., early in the morning or late in the day) to avoid resistance to their entrepreneurial projects. This suggests a fascinating direction for future research but also a clear practical implication for makers and SFS managers who can become more attuned to the complex interactions between community needs and goals.

Overall, our study provides a sobering perspective that urges future research to look beyond the initial resemblance of maker and user entrepreneurs (Shah & Tripsas, 2007), move past the initial enthusiasm around making in SFSs (Browder et al., 2019), and further explore alternative models that recognize the unique tensions of community-based entrepreneurship (Mollick, 2016). To paraphrase one of our interviewees: To the extent that makers wish to become entrepreneurs, SFSs should first become places to experiment and sell and not just experiment and share.

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