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Citius, altius, fortius? Community-enabled bricolage and the growth of entrepreneurial ventures

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Abstract

Because of human, financial, and social capital constraints, many entrepreneurial ventures have to engage in bricolage, that is, they have to make do with the resources they already have available or can access at minimal or zero expense. In this context, we introduce volunteer communities and the outputs they produce?usually for free?as a previously undocumented bricolage opportunity. We hypothesize that entrepreneurial ventures drawing on volunteer communities may improve their sales and productivity vis-à-vis peers that do not. Linking accounting data to a pan-European survey containing information on collaboration between entrepreneurial ventures and the community producing open source

software, we find that drawing on this volunteer community positively impacts venture productivity as hypothesized, but has a negative effect on sales. We discuss implications for theories of entrepreneurial bricolage and firm-community collaboration, and highlight insights for entrepreneurial practice.

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Abstract

Because of human, financial, and social capital constraints, many entrepreneurial ventures have to engage in bricolage, that is, they have to make do with the resources they already have available or can access at minimal or zero expense. In this context, we introduce volunteer communities and the outputs they produce—usually for free—as a previously undocumented bricolage opportunity. We hypothesize that entrepreneurial ventures drawing on volunteer communities may improve their sales and productivity *vis-à-vis* peers that do not. Linking accounting data to a pan-European survey containing information on collaboration between entrepreneurial ventures and the community producing open source software, we find that drawing on this volunteer community positively impacts venture productivity as hypothesized, but has a negative effect on sales. We discuss implications for theories of entrepreneurial bricolage and firm-community collaboration, and highlight insights for entrepreneurial practice.

Keywords

Bricolage; volunteer communities; entrepreneurial ventures; growth; firm-community collaboration; open source software

INTRODUCTION

The acquisition of resources necessary to sustain growth is one of the fundamental challenges that entrepreneurial ventures are faced with (Baker & Nelson, 2005; Shepherd, Douglas, & Shanley, 2000). While their higher levels of agility and independence from inertial organizational structures and technological trajectories equip them with unique advantages to potentially displace incumbents, at the same time, a lack of diversified expertise, complementary assets, slack resources, or links to suppliers, complementors, and customers presents a challenge that entrepreneurial ventures will often struggle to overcome on their own (e.g., Colombo & Rossi-Lamastra, 2012; George, 2005; Stinchcombe, 1965). Accordingly, entrepreneurial ventures have no choice but to engage in bricolage, that is, "making do by applying combinations of the resources at hand to new problems and opportunities" (Baker et al., 2005: p. 333). Notably, resources at hand are usually "available cheaply or free, often because others judge them to be useless or substandard" (p. 336).

Recent empirical work on the organization of innovative activity (e.g., Dahlander & Frederiksen, 2011; Jeppesen & Frederiksen, 2006; von Hippel & von Krogh, 2003) points toward one resource-at-hand currently overlooked by the entrepreneurial literature: tapping into existing communities of volunteers. In such communities, diverse agents with shared interests aggregate to jointly generate products and services that may even outperform the products and services of competing firms. For example, the continuously growing open source software (OSS) movement comprises thousands of developers who either in their free time or as part of their professional jobs contribute to the development of software products that in many areas rival the quality or competing commercially available products. Yet, such community-based innovation processes involving the free sharing of knowledge are not limited to the software context. For example, Henkel and Maurer (2009) document them for biotechnology, Perkmann (2009) in pharma,

Kloppenburg (2010) in agriculture, Alexy and Reitzig (2012) in the automotive industry, and Füller (2010) for a wide range of consumer products including, amongst others, shoes and furniture.

Since the outputs of most volunteer communities are available for free (see above cites), entrepreneurs may choose to rely on these communities as a bundle of resources at hand. Accordingly, an emerging stream of entrepreneurship literature is now exploring how entrepreneurial ventures take advantage of volunteer communities, for example in the software industry. Gruber and Henkel (2006) explore qualitatively how entrepreneurial ventures may mitigate some of the liabilities of newness and smallness by building business models on top of efforts of volunteer communities developing OSS. Relying on a quantitative research design, Piva et al. (2012) show that entrepreneurial ventures collaborating with the OSS community achieve higher innovation performance in comparison with their non-collaborating peers. Jointly, these contributions point toward the potential of incorporating volunteer communities to significantly contribute to the development of entrepreneurial ventures. Yet, theoretical elaborations in this space are still preliminary, and robust empirical evidence is lacking. In particular, extant literature falls short of explaining *whether entrepreneurial ventures building on outputs produced by volunteer communities may outperform similar others* who, for idiosyncratic reasons (Baker *et al.*, 2005; Garud & Karnøe, 2003), have chosen not to do so. Put differently, our research question is whether bricolage through collaboration with volunteer communities can improve the performance of new ventures.

To analyze this question, we rely on a pan-European survey on firms in the software industry capturing whether or not respondent firms do bricolage with OSS community resources by offering OSS-based products and services (see Bonaccorsi, Giannangeli, & Rossi, 2006 for more information). We match this with accounting data to test whether or not bricolage through

engagement with this volunteer community has positive effects on firm performance, which we measure through sales growth and labor productivity. To do so, we resort to generalized method of moments system estimates to detect the treatment effect of engagement of entrepreneurial ventures in the software industry with the OSS community.

Our findings partially confirm our hypotheses. We find that OSS-based ventures do not outgrow their non-OSS-based peers, but they are more productive. In doing so, we are able to extend extant theorizing on entrepreneurial bricolage (e.g., Baker *et al.*, 2005; Senyard, Baker, & Davidsson, 2011) as well as apply insights from this stream of work to related research on collaboration with volunteer communities, and organizing for innovation more generally. For example, for literature on open innovation, which has mainly focused on large firms (Dahlander & Gann, 2010), we show how the promise of openness may also apply to entrepreneurial ventures. In doing so, we also empiricize recent theorizing describing collaboration with volunteer communities as a mechanism to overcome resource constraints (Alexy, George, & Salter, 2011a).

THEORY AND HYPOTHESES

Most entrepreneurial ventures struggle for survival (Shepherd *et al.*, 2000; Stinchcombe, 1965). Especially ventures aiming to grow in size will often find that they lack essential resources, which, however, are readily available to more prosperous competitors. Accordingly, many entrepreneurial ventures have to engage in bricolage, that is, they have to "make do" and work with resources at hand which they have or can attain for free, or by spending within their limited discretion (Baker *et al.*, 2005).

However, having to engage in bricolage by itself is not necessarily detrimental. Rather, in that it may allow seemingly disadvantaged start-ups to achieve higher performance than

competitors that hold more advantageous resource positions (Baker, Miner, & Eesley, 2003; Senyard *et al.,* 2011). First, having to "muddle through" may allow bricoleurs (i.e., entrepreneurs engaging in bricolage) to discover entirely new opportunities unimaginable in situations of high resource availability (Baker *et al.*, 2005). Second, bricolage may, under certain conditions, be a more promising approach to innovation by allowing entrepreneurs to incorporate or react to needs and opportunities from their environment and include valuable knowledge from external actors (Garud *et al.,* 2003). Accordingly, recent research has begun to empirically explore how bricolage may contribute to achieving innovative new firms' growth ambitions (Senyard, Baker, & Steffens, 2010).

Relatedly, the increasingly prominent concepts of open and user innovation (Chesbrough, 2003; von Hippel, 1988, 2005) emphasize how firms can increase their performance by re-organizing their innovative activity to allow for the inclusion of externally created knowledge (Laursen & Salter, 2006; Leiponen & Helfat, 2010). Specifically, this literature point out that in many competitive circumstances and industries, actors will exist outside the firm who engage in problem-solving activity directly related to the business of the focal firm and who are willing to freely share their findings with others (von Hippel, 1988; von Hippel *et al.*, 2003). Notably, these externals may not only include individuals, but also universities or commercial firms (Füller, 2010; von Hippel, 2005).

Crucially, similar-minded externals are likely to aggregate in volunteer communities. While sometimes simply the result of homophily (e.g., McPherson, Smith-Lovin, & Cook, 2001), these communities also foster an increased joint problem solving ability since members can give each other feedback and coordinate efforts, which allows for specialization in certain tasks and reduces the amount of duplicate work. In turn, volunteer communities may be able to jointly create products that rival commercially-produced alternatives in quality, yet are available

for free to the general public (Brown & Duguid, 2001; Dahlander *et al.*, 2011; Jeppesen *et al.*, 2006; Muniz & O'Guinn, 2001).

Our argument rests on the linking of the two largely disconnected literatures on entrepreneurial bricolage and volunteer communities. Clearly, volunteer communities as described may represent a resource at hand (Baker *et al.*, 2005) since entrepreneurs will usually be able to access them at zero purchasing cost. Rather, more often than not, they will be able to do so for free (Alexy & Leitner, 2011b), and only have to engage in minimal customization of their outputs to ensure technical compatibility with the products or services of the venture (Gruber *et al.*, 2006). However, it is also clear that not all growth-oriented entrepreneurs will choose to access these communities. Rather, it should be bricoleurs who would choose to access these communities. First, because of idiosyncratic cognitive differences resulting from varying levels of knowledge and experience, and varying visions of the future, they should be more likely to perceive them as a potential opportunity (Baker *et al.*, 2005). Second, because of differences in resource endowments, they should be more likely to enact this opportunity, especially when they would otherwise simply lack the resources to provide the product or service they aspire (Alexy *et al.*, 2011a).

In turn, we argue based on three main reasons, that accessing volunteer communities will allow bricoleurs to overcome some of the liabilities of newness and smallness and make their ventures grow faster and be more productive than peers who do not draw on this resource at hand. First, it increases the sheer number of people on who bricoleurs can draw to supply components to the products and services they aspire to provide. Thus, with the same amount of resources available inside the firm, working with volunteer communities will allow the venture to produce more output faster (Laursen *et al.*, 2006; Leiponen *et al.*, 2010), positively affecting its sales and productivity. Second, the skills present and components provided by volunteer

communities may address knowledge or resource gaps faced by the entrepreneurial venture which it may fill by combining the community's output with its own products and services (Jeppesen & Lakhani, 2010). In doing so, the venture may become able to address a wider range of customers (Gruber *et al.*, 2006) because it can focus the scarce attention of its few employees on extending the community-provided resource into several different applications, further increasing productivity and sales. Similarly, bricoleurs who can access the diverse external knowledge embodied in volunteer communities will acquaint themselves with a more potential opportunities than they could have identified otherwise, allowing them to further improve the performance of their venture (Gruber, MacMillan, & Thompson, 2012). Third, because the communities themselves attain high benefits from producing these components, they will invest heavily into assuring high quality (von Hippel, 2005) and may further even be happy to provide free support (Lakhani & von Hippel, 2003), thereby increasing productivity of the bricoleur.

Taken together, we thus suggest:

H1: Entrepreneurial ventures incorporating the outputs of volunteer communities will show higher sales growth than comparable firms that do not engage in this form of bricolage.

H2: Entrepreneurial ventures incorporating the outputs of volunteer communities will show higher productivity growth than comparable firms that do not engage in this form of bricolage.

DATA AND METHODS

Context

As the empirical context of our study, we selected the software industry, since the existence and relative importance of the volunteer community producing open source software (OSS) should allow us to discern the effects of bricolage more clearly. While this setting shares some idiosyncrasies, as we have made clear in the introduction, it is nevertheless an ample

representation of community-based innovation in that the processes and motivations for participation are identical to other innovating volunteer communities.

Data sources and sample

To test our hypotheses in this space, we required data on the business activity of entrepreneurial ventures, and in particular on whether or not they relied on OSS in assembling their products and services. To do so, we draw on the ELISS II database, a survey administered to the owner-managers or chief technology officers of 6,000 randomly selected software companies located in five European countries (Finland, Germany, Italy, Portugal, and Spain). The sample is further stratified by firm size and geographical area. In total, the database contains 918 respondent firms. Using firm name and location, we then retrieved accounting data for 377 ELISS II firms for the years 2001-2009 from Amadeus, we combined these new data with ELISS II survey data and we built an unbalanced panel dataset. This dataset included 264 entrepreneurial ventures (i.e., independent firms established within the last 25 years). Because of missing data in the regressors, we can only rely on 136 entrepreneurial ventures for our estimations.

Specification of the econometric model.

To test our hypotheses, we estimate the following augmented Gibrat law dynamic growth model:

$$LnPerformance_{i;t} = b_0 + b_1 LnPerformance_{i;t-1} + b_2 LnAge_{i;t-1} + b_3 DOSS_{i;t-1} + b_4 GraduateShare_i + \varepsilon_{i;t} \quad \textbf{(1)}$$

In Eq. (1) $LnPerformance_{i,t}$ indicates either the sales or the productivity (measured as the sales-per-employee ratio) of firm *i* at time *t*. $LAge_{i,t-1}$ is the logarithm of firm's age at *t-1*. $DOSS_{i;t-1}$ is the key explanatory variable: a dummy equal to one if firm *i* was already engaged with the OSS community at *t-1*. To build it we relied on two survey questions asking whether responding entrepreneurial ventures supplied OSS-based products and/or services and released them under an OSS license and when they started doing so. Accordingly, $DOSS_{i;t-1}$ assumes the

value of one if firm *i* did so at *t-1*, and zero if it did not. $GraduateShare_i$ is a time invariant control variable. It is the share of graduate employees in firm *i*. $\varepsilon_{i;t}$ are the usual independent and identically distributed (i.i.d.) disturbance terms.

The inclusion in the model of the lagged dependent variable as one of the covariates and the possible endogenous nature of the relationship between incorporating the outputs of the OSS community and firm sales (productivity) require the use of appropriate estimation techniques. We thus resort to the GMM-system (GMM-SYS) estimator developed by Blundell and Bond (1998). Accordingly, we simultaneously estimate first difference and level versions of Eq. (1). As the instruments, we use appropriately lagged values of the endogenous variables for first difference estimates and appropriately lagged differences for level estimates. This method alleviates the typical problem of weak instruments characterizing the first GMM-difference (GMM-DIF) estimator. Moreover, it preserves information from the level equations enabling consistent identification of time-invariant covariates. We formulate the weakest possible assumption. We consider the variable $DOSS_{i;t-1}$ as potentially correlated with error terms, and treat it as endogenous accordingly.

RESULTS

The results of the econometric analysis are illustrated in Table 1. In the table we present the estimates of the equations including the control variables only (Models 1 and 2) and the control variables plus the key explanatory variable (Models 2 and 4). In models 1 and 2 the dependent variable is the logarithm of firm sales, while in models 3 and 4 it is the logarithm of firm labor productivity.

Insert Table 1 about here

The weakly significant (p-value=0.097) coefficient of $DOSS_{i;t-1}$ in model 2 indicates that, in contrast with our expectations, entrepreneurial ventures incorporating the outputs of volunteer communities show lower sales growth than their peers. Hence, hypothesis H1 is not confirmed. Conversely, the positive and significant (p-value=0.057) coefficient of $DOSS_{i;t-1}$ in model 4 suggests that entrepreneurial ventures incorporating the outputs of volunteer communities show higher labor productivity thus providing support for hypothesis H2.

DISCUSSION, LIMITATIONS, AND CONCLUSION

With this study, we make two contributions to the literature on entrepreneurship and innovation. First, we theoretically argue and empirically demonstrate that volunteer communities are an important resource at hand around which considerable entrepreneurial activity may materialize. Recent work on volunteer communities in the context of research on the organization of innovative activity has documented them as an important potential source of entrepreneurial activity (e.g., Dahlander *et al.*, 2011) and creators of high-quality, *gratis* products or product components (e.g., Füller, 2010). The wider literature on entrepreneurship, however, has so far not fully appreciated the potential impact of volunteer communities. By portraying them through a lens of entrepreneurial bricolage (Baker *et al.*, 2005), we make clear how these communities represent resources at hand that are also available to non-members, based on which these can devise more productive entrepreneurial ventures. In doing so, we also extend recent research which has begun to quantify the contribution that entrepreneurial bricolage may bring to young, entrepreneurial ventures (Senyard *et al.*, 2010). Building on our findings, future empirical work may compare how bricoleurs differ from entrepreneurs nested within the community with regard to opportunity recognition and realization. In addition, our results might open an interesting avenue for research on bricolage. In particular, they seem to suggest that, primarily, bricolage is

about increasing productivity rather than sales. We would argue that this would be perfectly in line with the definition of bricolage as "making do" – yet, much work on bricolage actually hypothesizes an effect on sales (e.g., Senyard *et al.*, 2010). Potentially, the result we find may be an artifact of our context or the type of bricolage we study, however, it is clear that more research into this matter is needed. Finally, for entrepreneurial practice, our results highlight a substantial potential of designing new ventures around existing volunteer communities, the long term success of which should depend on establishing suitable management practices and mutually beneficially relationships with these communities.

Second, by linking the literature on bricolage to work on the organization of innovative activity, we can enrich current debates around this topic. Most prominently, the increasingly prominent concept of open innovation, like entrepreneurial bricolage, also proposes collaborative methods aimed at improving ventures' performance at providing new and improved products and services (Chesbrough, 2006; Dahlander *et al.*, 2010). However, contributions to this literature have tended to focus on larger firms and multinationals. We contribute to this debate by showing that open innovation, in particular when no money is exchanged (see Dahlander *et al.*, 2010), *is* in fact a form of bricolage for small, entrepreneurial ventures. Thus, in using *gratis* open innovation practices such as engagement with volunteer communities, entrepreneurs may be able to bridge crucial resource and knowledge gaps, and substantially widen their opportunity space. Notably, this argument is in line with recent theoretical endeavors (Alexy *et al.*, 2011a)—which we further substantiate empirically—describing collaboration with volunteer communities as a mechanism to achieve innovation in the face of substantial resource constraints.

An obvious limitation of our study is that the empirical analysis is focused entirely on one industry and one specific community. However, this also implies that we can hold certain external factors, such as the appropriability regime (Teece, 1986), relatively constant. In

addition, we have argued above why we are convinced the volunteer communities in software should not be fundamentally distinct from other innovative volunteer communities. More importantly, we only study bricolage here as an aggregate process materializing in the inclusion of the outputs produced by volunteer communities. However, it is clear that bricolage is an ongoing process in the course of which opportunities fade and new ones materialize (Baker *et al.*, 2005). Accordingly, we strongly call for qualitative research, ideally comparative case studies, to scrutinize in-depth the processes that lead entrepreneurs to draw on volunteer communities, and allow them to do so successfully.

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Table 1: Effects of incorporating the outputs of volunteer communities on sales and productivity growth of entrepreneurial ventures

	$LnSales_{it}$						$LnProductivity_{it}$					
	Model 1			Model 2			Model 3			Model 4		
Constant	5.610	(1.459)	***	9.203	(0.922)	***	6.382	(0.594)	***	8.252	(0.725)	***
$DOSS_{i;t-1}$	-			-0.433	(0.257)	*	-			0.558	(0.293)	*
$LnSales_{i;t-1}$	0.565	(0.132)	***	0.241	(0.095)	**	-			-		
$LnProductivity_{i;t-1}$	-			-			0.489	(0.053)	***	0.260	(0.079)	***
$LnAge_{i;t-1}$	0.048	(0.167)		0.126	(0.239)		-0.071	(0.101)		0.186	(0.112)	*
$GraduateShare_i$	0.113	(0.168)		0.429	(0.226)	*	-0.352	(0.173)	**	-0.541	(0.264)	**
No. Observations	495			495			495			495		
No. Groups	136			136			136			136		
Hansen test	58.98(69)			74.62(95)			58.06(70)			78.02(96)		
AR(1)	-2.09**			-1.83*			-2.40**			-1.97**		
AR(2)	0.21			1.22			-1.04			-1.16		

Legend: * p< .10; ** p< .05; *** p< .01. Estimates are obtained through a two-step GMM-SYS estimator with finite sample correction for standard errors (see Windmeijer, 2005). Standard deviations and degrees of freedom in parentheses.