Creating Something from Nothing: Resource Construction through Entrepreneurial Bricolage

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A field study of 29 resource-constrained firms that varied dramatically in their responses to similar objective environments is used to examine the process by which entrepreneurs in resource-poor environments were able to render unique services by recombining elements at hand for new purposes that challenged institutional definitions and limits. We found that Lévi-Strauss's concept of bricolage—making do with what is at hand—explained many of the behaviors we observed in small firms that were able to create something from nothing by exploiting physical, social, or institutional inputs that other firms rejected or ignored. We demonstrate the socially constructed nature of resource environments and the role of bricolage in this construction. Using our field data and the existing literature on bricolage, we advance a formal definition of entrepreneurial bricolage and induce the beginnings of a process model of bricolage and firm growth. Central to our contribution is the notion that companies engaging in bricolage refuse to enact the limitations imposed by dominant definitions of resource environments, suggesting that, for understanding entrepreneurial behavior, a constructivist approach to resource environments is more fruitful than objectivist views.●

Most organizational entrepreneurship is characterized by severe resource constraints. The majority of new firms begin with very limited resources, generally less than $5,000 (U.S. Department of Commerce, 1992) and either no employees or only a family member to share the work (Ruef, Aldrich, and Carter, 2003). While some firms in high-growth sectors are able to fund entrepreneurial activities through the venture and public capital markets, such resources are not widely available to new firms (Holtz-Eakin, Joulfaian, and Rosen, 1994; National Venture Capital Association, 2001). Even the very small proportion of new firms that experience growth often find it difficult to attract specific human, financial, or other resources when they are needed (Penrose, 1959; Aldrich and von Glinow, 1992), creating scarcity even within apparently flourishing firms. Nonetheless, many entrepreneurs embrace or even pursue new challenges despite their inability or refusal to attract the new resources these challenges seem to demand (MacMillan and McGrath, 1997; Mahoney and Michael, 2005). Sometimes their firms survive and even flourish, solving problems and exploiting opportunities despite resource constraints.

Leading "open-systems" models (Boulding, 1956) in organizational theory don't provide a useful explanation for how entrepreneurs sometimes manage to construct resources from nothing. Common theoretical assumptions about the nature of resources and resource environments offer little guidance for understanding how entrepreneurs may bring value to otherwise worthless resources and on occasion even grow their firms despite severe resource scarcity. This gap in mainstream organizational theories, spanning an issue that is critical to understanding what entrepreneurship contributes to organizational processes, may also help to explain the continued lack of integration between mainstream organization studies and entrepreneurship research. More broadly, this represents a general gap in our understanding of how

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some organizations survive and sometimes prosper in the commonplace circumstance of persistent resource scarcity.

Penrose's (1959) classic discussion of the nature of firms' resource environments provides a different and perhaps more useful basis for understanding how entrepreneurs may create value in depleted and penurious environments. Penrose argued that firms possessing very similar material and human resource inputs may offer substantially different sets of services to the market because of differences in their ability to grasp possible uses and combinations of those inputs. Although she suggested that firms may find heterogeneous value in ostensibly identical resources, her work did not provide a process model of how they accomplish this. Work in the resource-based view of firm strategy has extended some of the themes that Penrose introduced, but as several scholars have recently emphasized, this work too has seldom examined the processes of idiosyncratic resource combination that are argued to underlie value creation by firms (Mosakowski, 2002; Denrell, Fang, and Winter, 2003; Ahuja and Katila, 2004).

In the study of entrepreneurial persistence in depleted and constrained environments reported in this paper, we found that Lévi-Strauss's (1967) concept of "bricolage," often described as making do with "whatever is at hand" (Lévi-Strauss, 1967: 17; Miner, Bassoff, and Moorman, 2001; Weick, 1993a), helped to explain regularities we observed among 29 firms embracing new challenges under conditions of tight resource constraints. We also found the construct useful in interpreting our field data in a way that allowed us to integrate a wide variety of concepts useful for understanding how some entrepreneurs create something out of nothing in resource-constrained environments. The model of entrepreneurial bricolage we develop here also helps to shed light on the processes by which firms generate heterogeneous value from ostensibly identical resources.

RESOURCE CONSTRUCTION THROUGH BRICOLAGE

For at least three decades, open-systems models (Boulding, 1956) have dominated organization theory (Katz and Kahn, 1978; Scott, 1998), providing explanations of how variations in resource environments and constraints shape firm outcomes. These theories have generally been predicated on the insight that organizations are "dependent on continuing exchanges with—and constituted by—the environments in which they operate" (Scott, 1998: 28) and that it is therefore useful to focus scholarship more on an organization's context "and the pressures and constraints" that arise from that context (Pfeffer, 2003: xi). By combining this environmental perspective with an emphasis on variations in resource constraints, open-systems theories have deepened our understanding of organizational dynamics well beyond what was possible with traditional internally focused administrative models (Perrow, 1986).

These theories have typically construed resource scarcity in macro terms as a dimension of the environment (Emery and Trist, 1965; Hannan and Freeman, 1977) that has a variety of

direct effects on important organizational behaviors and outcomes. For example, in population ecology (Hannan and Freeman, 1984), factors associated with environmental munificence—largely unmediated by variations in firms' ability to respond—strongly affect organizational births and deaths. Across evolutionary perspectives more generally (Campbell, 1969), patterns of resource scarcity create selection environments that determine patterns of firm survival. In neo-institutional approaches, an environment of objectified normative rules (Berger and Luckmann, 1967) and taken-for-granted beliefs strongly constrains organizations (Hirsch and Lounsbury, 1997) by structuring the terms on which scarce resources are made available. Resource dependence studies suggest that the patterned scarcity of critical resources shapes subunit, organization, and even industry power outcomes, as well as patterns of mergers and board interlocks (Burt, 1983, 1992; Pfeffer and Salancik, 2003).

These perspectives share an underlying assumption that the nature of resources is largely given and unproblematic. Resource environments have a stubborn facticity, either in the sense of an objective ecology of distributed resources or in the sense of appearing objective and being taken for granted by participants (Parsons and Smelser, 1965; Meyer and Rowan, 1977; Aldrich, 1999). Though theorists have recognized the possibility of error when organizations "construct perceptions of reality" (Pfeffer and Salancik, 2003: 13) regarding their environments, the same theorists have emphasized that the objective environment affects an organization's outcomes even when it doesn't affect the organization's behavior. Resources remain objective and definable independent of the specific organizations embedded in a resource environment. Resources are what they are, and organizations either have the resources they need or they do not.

Under these assumptions, it is hard to imagine entrepreneurs creating something from nothing. Although the resource-constrained entrepreneurial firm might act on the mistaken assumption that it has adequate resources, its outcomes would still be objectively bound by resource constraints. Such firms would then face two choices. They could engage in resource-seeking attempts to ease constraints, as many entrepreneurial firms do, for example, by attempting to generate debt or equity inflows for their firms (Berger and Udell, 1994; Lerner, 1995; Pollock, Porac, and Wade, 2004). Or they could engage in some sort of avoidance or escape—albeit a painful escape—from the need to accomplish challenging tasks with the limited resources at hand. Such responses might include disbanding (Sutton, 1987, 1990; Whetten, 1987; Miner et al., 1999), downsizing (Barker and Mone, 1994; Cameron, 1994), or ignoring new opportunities (Lee, Lim, and Tan, 1999). Firms acting as if they were not resource constrained would simply appear foolish from this perspective. More generally, theories built on the image of a powerful environment of objective resource constraints provide an inadequate basis for explaining the survival and occasional success of entrepreneurs who embrace new chal-

lenges while employing the constrained set of resources they have at hand.

In contrast, Penrose (1959: 42) portrayed the resource environment as idiosyncratic to the uses firms make of it. She did not reject the objective nature of resources but suggested that the resource environment is neither as powerful nor as constraining as it might appear and that "there is a wide scope for judgment." Her argument rests on the distinction between resources and services. Resources include physical objects and people, while services are "the contributions these resources can make to the productive operations of the firm. A resource, then, can be viewed as a bundle of possible services" (1959: 67). The distinction allowed Penrose to argue that the various ways that each of a firm's resources can be used and the myriad possible useful combinations are such that "no firm ever perceives the complete range of services available from any resource" (1959: 86). This leads to three characterizations that are useful for understanding how entrepreneurs may construct resources from nothing.

First, her argument implies that each firm is unique in its idiosyncratic relation to its resource environment: "Not only can the personnel of a firm render a heterogeneous variety of unique services, but also the material resources of the firm can be used in different ways, which means they can provide different kinds of services" (Penrose, 1959: 75; also see Mishina, Pollock, and Porac, 2004). This highlights the limitations of understanding a resource environment as independent of the activities of firms embedded in it. Second, the argument leads us to expect substantial differences among firms in their ability to survive or prosper given ostensibly similar resource constraints. Different firms will discover and elicit different services and combinations of services from similar objective resources. Third, at the extreme, her argument suggests the possibility that the same resource may be worthless (even treated as waste products) to one firm but valuable to another, especially to the extent that the latter firm can combine what was heretofore valueless with its own unique set of other resources and services. Together, these three characterizations of the firm's resource environment provide a promising basis for understanding how entrepreneurs might wrest valuable resource combinations from what appear to be highly constrained environments. Yet Penrose's focus was on the continuing growth of established successful manufacturing firms, and she did not provide a plausible model of how firms come to construct their unique and idiosyncratic resource environments. Similarly, work from the resource-based view also emphasizes the centrality of unique input resource combinations (Conner, 1991) but downplays the role of discretion and choice (Barney, 1986; Mosakowski, 2002). More promising for understanding how entrepreneurial firms sometimes persist or even thrive in apparently constrained environments is Lévi-Strauss's (1967) concept of bricolage, which a small amount of prior work has begun to apply in studies of entrepreneurial processes (Harper, 1987; Narduzzo, Rocco, and Warglien, 2000; Baker, Miner, and Eesley, 2003; Garud and Karnoe, 2003).

Bricolage

Lévi-Strauss (1967) offered no specific definition of bricolage, and scholars have applied his insights to a vast range of phenomena, also without converging on a concise or consistent definition. During our study, we read broadly across this multidisciplinary literature to supplement the scanty prior use of bricolage in organization studies and developed an integrative definition of bricolage as making do by applying combinations of the resources at hand to new problems and opportunities. Though this definition is informed by our own observations, it also incorporates many of the insights of prior work, summarized in table 1, where we also provide illustrations of the positive, neutral, and negative results of the use of bricolage. Here we briefly explicate the three elements of our definition

Table 1

Examples of the Characteristics of Bricolage from Various Literatures

Characteristic from Lévi-Strauss (1967)	Illustrative examples
Resources at hand	Existing organizational mechanisms, forms and "junk routines" used as resources to construct the platform organization and its constituent structures (Ciborra, 1996).
	Social myths and fragments of myths as materials at hand for construction of new ideologies (Chao, 1999).
	The "models, analogies, conventions, concepts" (Campbell, 1997: 22) of existing institutional principles as the materials of economic and political bricolage (Stark, 1996; Lanzara, 1998).
	Available materials "such as wood and lorry gears," other "modest resources" and miscellaneous "embedded" individuals providing inputs for development of Danish wind turbines (Garud and Karnoe, 2003).
	Existing social network contacts as resources for building technology businesses (Baker, Miner, and Eesley, 2003).
	Constitutional and legal fragments used to construct new laws and constitutions (Hull, 1991; Tushnet, 1999).
	Previously learned skills and coping mechanisms as pragmatic and limited repertoire for dealing with challenging students and situations (Hatton, 1989, 1995).
	Elements of prior musical recordings as materials for creating hip-hop music and elements of current African American and Latino urban culture for creating Indian youth subculture in New York (Maira, 1999).
	A longstanding and common complement of genes and gene components as the basic biological building materials through which evolutionary processes create new functions and species (Jacob, 1977; Duboule and Wilkins, 1998).
	Prior and existing institutions and elements of failed institutions as the building materials for new institutions (Lanzara, 1998: 28, quoting Stark, 1996: 995); institutions built "not on the ruins but with the ruins" of the old regime.
	Information system fragments, components, results of small experiments used as elements of complex and multilayered systems; systems built "on the ruins and with the ruins of old systems" (Lanzara, 1999: 346).
Recombination of resources for new purposes	Information system designers "paste together a few components into 'something,' see how it looks like, play with it, check if it works, evaluate, modify or reject. This bricolage activity is not directed to any specific solution or configuration in particular . . . because neither of them knows in advance what the final configuration is going to be" (Lanzara, 1999: 337).
	The "ingenious reconciliation of existing organizational mechanisms and forms, picked by management according to subjective plans and interpretations ('bricolage')" (Ciborra, 1996: 104).
	For the development of the Danish wind turbine industry, many different resources were reused, combined, and deployed by constellations of different players, with the entire bricolage process supporting and demonstrating "distributed agency" (Garud and Karnoe, 2003), rather than "heroic" individually driven entrepreneurship.
	Biological evolution "makes a wing from a leg or a part of an ear from a piece of jaw." . . . "It is always a matter of using the same elements, of adjusting them, of altering here or there, of arranging various combinations to produce new objects of increasing complexity. It is always a matter of tinkering" (Jacob, 1977: 1164–1165).

(Continued on next page)

Table 1

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Characteristic from Lévi-Strauss (1967)	Illustrative examples
Making do	*Positive and neutral illustrations:* "In a broadly diffused engineering ideology bricolage is usually associated with second-best solutions, maladaptation, imperfection, inefficiency, incompleteness, slowness, but as a matter of fact in many design situations it is the only thing that we can reasonably do when we are engaged in action. The outcomes of it are hybrid, imperfect, transient artifacts, which perhaps do not look very elegant, have lots of bugs and gaps, frictions and unusable components, but they do their job and can be improved" (Lanzara, 1999: 347). The benefits of the platform organization and the mechanisms of bricolage that make it possible: "What should be appreciated, instead, is the whole sequence of forms adopted over time by the organization, and the speed and friction in shifting from one to the other" (Ciborra, 1996: 114). Participants in the Danish wind turbine industry who relied on bricolage prevailed competitively over their U.S. competitors who sought "breakthrough" solutions that did not rely on prior approaches and artifacts (Garud and Karnoe, 2003). Regarding twentieth-century American legal scholars: "None of these men developed brilliant original theories. . . . Pound and Llewellyn, jurisprudential bricoleurs were able to jim-crack their storehouse of handy ideas in a brilliant fashion to create something innovative if not inventive" (Hull, 1991: 000). "Evolutionary 'bricolage' has, it turns out, been amazingly parsimonious in its choice of basic building materials while immensely creative in the deployment of these gene products in the evolutionary diversification of animal forms" (Duboule and Wilkins, 1998: 55). Many cases in which bricolage is invoked during skillful acts of improvisation (Weick, 1993a; Miner, Bassoff, and Moorman, 2001). *Negative illustrations:* In human embryonic development, a process developed through bricolage, "about 50 percent of all conceptions are estimated to result in spontaneous abortion. . . . This reveals the imperfections of a mechanism that is at the very core of any living system and has been refined over millions of years" (Jacob, 1977: 1165). Use of bricolage by Australian primary school teachers results in lack of academic success by children (Hatton, 1989; Dent and Hatton, 1996). A shaman's attempts to use bricolage by incorporating Maoist, Chinese nationalist, and shamanic elements into a ritual to help a community deal with an insane resident resulted in failure and the community's rejection of the shaman (Chao, 1999).

and show their relationship to some prior applications of Lévi-Strauss's ideas.

Making do. Lévi-Strauss (1967:17) described the "rules" of the bricoleur's "game" as "always to make do with 'whatever is at hand.'" Making do has taken on a variety of meanings, as shown in table 1. In common across these meanings, making do implies a bias toward action and active engagement with problems or opportunities rather than lingering over questions of whether a workable outcome can be created from what is at hand. This does not imply that bricolage always produces only mundane and highly imperfect solutions. Lévi-Strauss (1967: 17) suggested that bricolage can sometimes "reach brilliant unforeseen results." The examples in table 1 suggest a wide range of outcomes associated with bricolage.

A refusal to enact limitations. Our fieldwork took us beyond the conceptualizations of making do in the existing literature on bricolage to bring a more constructivist perspective to the idea. We consistently observed a conscious and frequently willful tendency for firms in our sample to disregard the limitations of commonly accepted definitions of material inputs, practices, and definitions and standards, insisting instead on trying out solutions, observing, and dealing with the results.

In subsequent readings of Weick's (1979) work on enactment, we were struck by his observation that environments are frequently enacted at least in part when actors refuse to test the limitations defined by institutional or cultural settings. The converse seemed to be true in our observations of bricolage: actors consciously and consistently tested conventional limitations. For our purposes, then, "making do" includes a bias for testing received limitations. This enhancement of the definition of bricolage has at least two important theoretical implications. First, it suggests that the social construction of resource environments can be as influential as the objective limitations of environments in determining behaviors. Second, it begins to open a black box that Penrose created when she noted that firms vary tremendously in their ability to extract services from physical inputs. A consistent behavior in firms that generate services with physical inputs that others reject is that they test institutionalized definitions of orthodox practice.

Combination of resources for new purposes. Another central theme running through many studies invoking bricolage is the combination and reuse of resources for different applications than those for which they were originally intended or used. Lévi-Strauss (1967) showed in detail how Neolithic tribes adopted the symbols of neighboring and earlier tribes but combined them in new ways to represent new meanings, and Garud and Karnoe (2003) provided a rich description of how Danish engineers and entrepreneurs combined the resources at hand to solve a variety of problems and exploit new opportunities in the Danish wind turbine industry. Authors have emphasized this aspect of bricolage to suggest that historical, institutional, or technological change often follows a logic that may be creative (Amabile, 1983) while defying assumptions of linear rationality and unbridled agency found in some design literatures. The process of combining resources for new purposes sometimes serves as a mechanism driving the discovery of innovations in the form of new "services" from existing resources. For example, Ciborra and Lanzara (1990; Lanzara, 1999; Ciborra, 2002) used the concept of bricolage to argue that the development of useful strategic information systems often follows an improvised (Miner, Bassoff, and Moorman, 2001), meandering, and path-dependent trajectory dominated not by clear vision and careful a priori planning but by serendipitous combinations of existing programs, pasted-up solutions, and failed components put to unexpected uses.

Our fieldwork both substantiated the importance of the combination of preexisting resources for new purposes in understanding bricolage and extended existing thought in important ways. Firms that made do with what was at hand tended to favor recombining existing elements rather than fabricating them from scratch, but we observed patterned variation in our firms in terms of their generation of useful combinations and noted that these patterns seemed to have some identifiable organizational antecedents and important consequences in terms of organizational growth. Although much of the literature on entrepreneurship and economic development has long assigned the recombination of existing

elements a prominent role in economic growth and innovation (Schumpeter, 1934; Hirschman, 1958; Stark, 1996), most of it, including Penrose's work, says little about how these recombinations actually come about.

The resources at hand. Lévi-Strauss (1967: 18) noted that the bricoleur (someone engaged in bricolage) possesses a set of "odds and ends," which may be physical artifacts, skills, or ideas that are accumulated "on the principle that 'they may always come in handy,'" rather than—as in the engineering model sometimes contrasted with bricolage (Lanzara, 1998, 1999)—acquired in response to the well-defined demands of a current project. A number of studies have emphasized such reliance on the preexisting elements at hand. Hargadon and Sutton (1997) examined the role of organizational memory in how a design firm brought to hand and combined problems and solutions generated while working with a diverse network of clients. Rao (1998) noted that by effecting different combinations of preexisting ideological appeals, consumer organizations experienced different development trajectories. Reliance on the resources at hand captures the role of external resource constraints and echoes but is also broader than Penrose's (1959: 5) notion of the "crucial role" of the "inherited" internal resources of the firm in determining its short-term possibilities for growth.

In defining the resources at hand, we included resources that are available very cheaply or for free, often because others judge them to be useless or substandard. In doing so, we follow the lead of Penrose and of Garud and Karnoe (2003), who observed bricolage in the Danish wind turbine industry when engineers with a practical interest in wind energy but few financial resources scoured scrap dealers for materials. This contrasted with American engineers, who purchased or fabricated new components designed specifically for their competing wind turbines. As was the case with the combination of existing resources for new purposes, our fieldwork led us to believe that firms varied significantly in their capacity to make use of inputs that were at hand, according to our definition, suggesting again the socially constructed nature of idiosyncratic firm resource environments and pointing to specific social and organizational mechanisms facilitating the entrepreneurial creation of something from nothing.

METHODS

Data

Because of the resource constraints, opportunities, and threats to survival and growth small firms face (Aldrich, 1999), they provide a particularly good context in which to explore bricolage. We used data from two groups of small, resource-constrained firms facing a variety of opportunities and threats. Our first data source grew out of a study of the persistence of independent local firms operating in an economically depressed region based on a declining mining economy. We began by approaching community leaders and long-time local residents for help in identifying local enterprises within a radius of 50 miles that had remained in business while others of the same kind had closed or been supplanted by franchises or nonlocal corporations. Our search ultimately

led to visits to and notes on over 40 independent local businesses and several hundred hours of fieldwork.

Following the typical pattern of grounded theory research, our data collection strategy evolved to match our changing theoretical understanding (Glaser and Strauss, 1967). As fieldwork progressed, it became apparent that a subset of these firms was able to carry on operations with even fewer resources than their hard-pressed peers, and we began to focus our attention on firms that were particularly good at getting by with less than other firms. We serendipitously discovered Lévi-Strauss's concept of bricolage as a good characterization of the behaviors we observed in many of these firms and again reoriented our efforts to focus on bricolage in independent local businesses facing resource scarcities. Moving between the field, the literature on bricolage, and our developing analyses, we located 16 firms that engaged in activities that fit our emerging definition of bricolage and dedicated special attention to them over a period of two years, five months of which was occupied by a full-time sabbatical dedicated to fieldwork. As our understanding of bricolage deepened, we decided to increase our knowledge of similar local firms that did not engage in substantial bricolage, and we chose for deeper study nine of the 40 firms in our initial sample that did not appear to engage in bricolage but were otherwise similar to the bricolage firms in size, capital intensity, and industry.

Our second data source consists of case studies that were initiated in 1998 during the design phase of a study of employment practices in young knowledge-intensive firms. We relied on a snowball sample, beginning with firms known from prior professional contact, and developed the case studies from interviews with entrepreneurs and managers and employees in their firms and, in some cases, customers, suppliers, and competitors. The case studies included descriptions of episodes in which employees in four firms had succeeded in solving substantial problems for their firms without being provided with any new resources for the new tasks. During 2000–2001, we conducted additional interviews with entrepreneurs, managers, and employees from these firms, as well as with several customers and consultants who had knowledge about particular events. Although by the end of the study none of the four firms continued as an independent entity (three were sold to other firms and one was disbanded), we remained in contact with several key informants during this period. We included these four cases because of their involvement in technology-intensive industries, which we did not encounter in our larger sample. Especially given prior claims that bricolage is important to the development of technological innovations (e.g., Ciborra, 2002), we felt that including these firms would provide additional cross-case variation useful for theory building (Ragin, 1987). Table 2 provides brief descriptions of the size and main products of each firm, indicates our data collection efforts, and lists the names of any individuals mentioned in the text. We have altered individual names and a few inconsequential details to maintain confidentiality.

Table 2

Firm Characteristics and Data Collection

Firm	Employees	Names mentioned in text	Firm's principal activities	No. of interviews	No. of persons interviewed	No. of site visits	Approximate hours of fieldwork
1	Several occasional helpers	Terry Starr	Earthmoving, demolition, firewood, welding, mine maintenance, used equipment sales	9	4	30+	45
2	4 full-time, 2 occasional helpers	George Love	Construction, real estate brokerage, moving, rehabilitiation and demolition of old buildings	13	4	20+	24
3	3 full-time	Denny Green	Purchase, sale, and repair of used vehicles	13	3	20+	35
4	20 full-time	Biggs Dig	Environmental restoration, fuel production and sales, trucking, earthmoving, farming, fisheries	2	2	3	7
5	4 full-time (fluctuated)	None	Automotive and agricultural machinery repair, occasional sales	4	2	7	4
6	2 occasional helpers	None	Landlord, sales of used electronic gear and building materials	3	3	1	3
7	8 full-time	Tim Grayson	Electricity generation, methane sales, hydroponic and traditional farming, fish farming	2	2	1	4
8	1 full-time, 3 seasonal	None	Real estate sales, manufacture and sale of artists' easels, used tool sales, remodeling and restoration	2	2	3	27
9	2 occasional helpers	Roger Barnfield	Rehabilitation, rental and sales of distressed properties	10	3	20+	42
10	3 occasional partners	Jim Roscoe	Electronic equipment manufacture and repair; residential and commercial construction, remodeling, and rentals	5	3	20+	85
11	5 full-time	Homer Smith	Landscaping, real estate development, commercial real estate rentals	3	1	0	5
12	None	None	Building repair and restoration, occasional sales of used construction materials	9	2	30+	28
13	4 full-time	Paul Hatchett	Automotive repair	4	3	12	12
14	8 full-time	None	Real estate sales and management	2	2	4	20
15	2 partners, 1 occasional helper	None	Sales, repair and upgrade of computers	2	2	7	6
16	8 full-time	None	Decorating, furniture sales, real estate rentals, sales, and remodeling	2	1	1	2
17	16 full-time	None	Sales and service of travel trailers and recreational vehicles	1	1	1	16
18	6 full-time	None	Construction and building repair	4	4	14	36
19	6 part-time	None	Lounge and dance barn	2	2	9	36
20	6 full-time	None	Breeding and raising fish for human consumption	2	2	1	14
21	4 full-time, 3 part-time	Rege Cano	Janitorial services	4	3	6	46
22	2 full-time	Dave Compton	Mobile home park, sales and rentals; laundromat	5	4	30+	100
23	4 full-time	None	Nightly and longer-term lodging	2	2	1	6
24	7 full-time	Russ Taylor	Automotive repair	4	2	4	6
25	4 full-time	Jim Jarvis	Motorcycle repair	12	6	30+	55
26	109 full-time, 26 contract employees	Tim Reno & Bobby Crane	Information technology services	18	6	8	32
27	3 full-time, 6 part-time	None	Software training services	5	3	2	7
28	36 full-time, 12 part-time	Jason Bond	Wireless communication services	14	6	5	26
29	4 full-time, 5 part-time	None	Diagnostic medical device development	9	7	6	28
Total				167	87	297+	757

Much of what we learned came from being on site, and we spent most of our field time observing real-time activities. For many of the firms, the number of hours spent in the field is therefore disproportionate to the number of formal interviews performed (a total of 757 hours in the field and 167 interviews). For the four technology-intensive firms, we relied more heavily on long interviews. Throughout the study, we documented our observations and interviews in field notes, research diaries, and summary reports totaling hundreds of handwritten and typed pages. With one exception, however, our conversations were not taped. When we quote respondents in this paper, the source is our written notes made during conversations with them, rather than direct transcription.

Analytic Strategy

We structured our methodology according to established procedures for theory-building inductive research (Glaser, 1978; Miles and Huberman, 1994; Denzin and Lincoln, 1998), working recursively between our multiple cases (Yin, 1984; Eisenhardt, 1989) and the theory we were developing. We analyzed field notes at two levels. We focused first on building detailed descriptions of particular new problems or opportunities the firms faced without benefit of new resources, treating each such challenge as an individual case. We then examined these cases comparatively, developing a series of matrices in which we coded the cases according to a variety of simple typologies that emerged during the process (Miles and Huberman, 1994). An important set of codings involved the various domains in which firms engaged in bricolage, supported by codings of firms' engagement in what we labeled "testing limitations" (Weick, 1979). We then organized the individual cases by firm, following the same process of experimental coding, theoretical interpretation, and refinement at this higher level, comparing and contrasting overall firm-level differences in the use and consequences of bricolage and gradually developing overall firm-level narratives (Denzin and Lincoln, 2000).

As we documented patterns in the data and constructed tentative theoretical explanations, we continued to use our data to challenge and extend our theory (Strauss and Corbin, 1998). We wrote several working papers that attempted to identify and explain regularities in our data (Strauss and Corbin, 1990; Denzin and Lincoln, 1998). We circulated and presented these papers to colleagues and students and received several rounds of critical feedback. During the repeated process of interrogating the data, revising the theory, and returning to the data, the themes we report in this paper eventually emerged. In our presentation of the results, we make use of a combination of illustrative examples and tables describing the data from which we drew our inferences (Miles and Huberman, 1994). When we introduce examples, we use the name or titles of the primary individuals involved, indexed by the number of the firm as identified in table 2.

USING BRICOLAGE TO CREATE SOMETHING FROM NOTHING

As we cycled from the field to our field notes, to the literature, then back to the field and again to the literature, our definition of bricolage evolved and became more precise, and we found that nine of the 25 firms we originally studied exhibited no discernable evidence of bricolage under any of the working definitions we developed. Paul Hatchett's Auto Tech (#13) and Rege Cano's Acqua Clean (#21) were typical. Paul Hatchett, who said he'd been "turning wrenches for a living" for more than twenty years, modeled his business on the G.M. dealerships where he worked for much of his career and through which he received extensive formal training. Hatchett and the people who worked for him did not "make do." He was adamant that his shop would not estimate or undertake a repair unless they were confident of being able to do it "the right way," as defined by standard procedures documented in shop manuals. These procedures typically call for changing out rather than attempting to repair or modify faulty parts and subassemblies. Hatchett frequently declined business from customers who were looking for a cheap workaround, and he would not allow his shop to undertake work for which it was not fully qualified and equipped. Rege Cano's cleaning business did not face the liability issues that make adherence to industry practice attractive for auto repair, but he similarly relied on standard equipment and methods with no hint of making do with what was at hand. In hours of shadowing Aqua Clean personnel on site at different client facilities, we found nothing but standard methods and equipment. Services provided were governed by detailed service contracts specifying exactly what was to be done, how often, and with what equipment and materials. Rege described his approach this way:

> We specify exactly what we will do both verbally and in writing and stick to what we've agreed. There are very few surprises, good or bad. We won't sweep dirt under the rug, but we don't clean underneath the rug unless you specify it in the contract. If the customer specifies he wants the floor stripped and waxed monthly, that's what he gets whether the floor needs it or not. If he doesn't include stripping in the contract, it doesn't get stripped, no matter how much wax is built up. We use standard cleaning compounds at standard dilutions—no less, no more.

In the remaining 20 firms, we frequently observed each of the elements of bricolage, especially reliance on the resources at hand, separately and typically with mundane outcomes. Bricolage, combining all three elements, occurred much less frequently but with more interesting results. Below, we provide examples of such instances of bricolage that illustrate the range of settings in which we found bricolage, the range of services created, the underlying similarities that characterized the bricolage solutions we observed, and how the three elements of bricolage interacted to create unique services.

After the market for his electronics repair service went soft, Jim Roscoe (#10) found himself with a miscellany of testing equipment, power transformers, and various components scavenged from TVs and other electronic devices. Aware that

coal mines have miles of high-voltage underground power lines that become damaged from movement through a very harsh subterranean environment, he developed a rough idea for a design that would allow him to combine old components into a useful tool for the technicians who needed to troubleshoot the underground cables. He teamed up with a friend and ex-tenant who had welding skills that Roscoe lacked. Together, they combined several electronic components from Roscoe's collection to create a simple and rugged tool that permitted technicians to test the underground cables, with the great advantage of not having to move or disconnect them. Roscoe sold a few of these devices to local firms and then moved on to unrelated projects. This instance of bricolage provided a temporary source of income but did not alter his overall business activities in any substantial way.

Jason Bond (#28) worked as the billing manager for a startup wireless telecommunications company serving about 20,000 customers. The firm relied on outmoded wire line telephone company software to bill its customers. Unfortunately, the old software wasn't able to process the myriad and complex "billing plans" the company marketed to compete in the consumer market. Instead, clerks would intercede in the billing process, manually adjusting computer billing and accounting files for customers who had purchased services with special temporary pricing deals or with particularly complex billing plans, and then send the files on for printing and mailing.

Jason's boss, the vice president of operations and one of the firm's founders, asked him to "do whatever he could" to get the billing system to work in a way that would require less manual work and therefore fewer billing clerks. He explained that the company needed to save money in back-office operations in order to focus expenditures on sales and marketing initiatives. Jason responded to this request by combining his firm's software with a "homegrown" spreadsheet-based accounts-receivable system used by a small import-export firm where he used to work. Using self-taught programming skills that were not part of his formal job responsibilities, and a great deal of trial and error, Jason constructed complex chains of rudimentary code that integrated the two systems and automated much of the manual adjustment work that had previously been done by billing clerks. Jason's bricolage allowed his firm to avoid investing any money in its billing system for almost two years while saving many thousands of dollars on billing clerks' salaries. By allowing the billing system to handle increased complexity, it also permitted the firm to offer increasingly sophisticated pricing "deals" and temporary specials.

We found another strikingly creative instance of bricolage in Grayson Hill Farms (#7). Tim Grayson was a farmer whose land was crisscrossed by abandoned coal mines. He knew that the tunnels—a nuisance to farmers because of their tendency to collapse, causing mammoth sinkholes in fields—also contained large quantities of methane. Methane is another nuisance, a toxic greenhouse gas that poisons miners and persists in abandoned mines for generations. Grayson and a partner drilled a hole from Grayson's property to an abandoned mine shaft, then acquired a used diesel

generator from a local factory and crudely retrofitted it to burn methane. During the conversion process, Grayson was repeatedly blown off his feet when the odorless, colorless gas exploded. His bricolage produced electricity, most of which he sold to the local utility, using scavenged switchgear. Because Grayson's generator also produced considerable waste heat, he built a greenhouse for hydroponic tomatoes, which he heated with water from the generator's cooling system. He also used electricity generated during off-peak hours to power special lamps to speed plant growth. With the availability of a greenhouse full of trenches of nutrient-rich water, heated "for free," Grayson realized he might be able to raise tilapia, a tropical delicacy increasingly popular in the U.S. He introduced the fish to the waters that bathed the tomato roots and used the fish waste as fertilizer. Finally, with abundant methane still at hand, Tim began selling excess methane to a natural gas company.

The impact of the bricolage we observed varied from very little to the generation of major new business activities. But in each of these examples, as in the other cases in which all three elements of bricolage were present, we witnessed the creation of some novel service in a way that is not described or explained by the contemporary entrepreneurship literature or by open-systems views of organizations. It was the presence of all three elements simultaneously that allowed these firms to enact idiosyncratic resource environments and rendered them unique. For example, if Grayson's energy source had not been at hand—that is, if he had purchased natural gas and electricity from a utility—his greenhouse would have looked much like a number of others in his area. If he had not combined existing inputs, raising tilapia in a pond rather than in hydroponic tomato beds, his fish farm would have looked much like a number of others. Most importantly, had he accepted the prevailing definitions of abandoned mines as a "dangerous nuisance" and hydroponic growth media as an "environment for growing plants, not animals," without taking any action to test the limitations of these definitions, none of the unique services described above would have come to be. The three elements together create a powerful mechanism for generating novel services from common inputs.

Testing and Rejecting Institutional Constraints and Definitions

Making do by testing socially constructed constraints is fundamental to the process by which bricolage creates something from nothing. The social construction of the resource environment involved reframing or outright rejection of prevailing definitions of resources. Bricolage typically appeared to involve a general awareness of existing practices and norms and a conscious willingness to abrogate them. We illustrate this below in an extended example of a sequence of behaviors we observed, in one variation or another, repeatedly.

One day while Jim Jarvis, owner of a motorcycle repair shop (#25), was busy mounting a tire, his partner told him that a customer with a front wheel problem was outside. Jim went

outside and greeted the customer by name, then had him stand and steady the bike while Jim sat down on the sidewalk and asked about the behavior of the wheel at different speeds and road conditions. He noted the customer's responses and then said "First we need to know if we have to amputate," as he spun the wheel. He then adjusted the axle as he looked for irregular wear on the tire. Proclaiming, "The wheel looks a little out of true, but you might be able to keep it, at least for awhile," Jim disappeared inside for spoke wrenches and a screwdriver. He returned and commented, "I don't have any used gold wheels like this, and I'm not sure if they even make them anymore." He then spun the wheel while holding a screwdriver on the fender to check for bends and trued the wheel as best he could by adjusting the tension of the spokes in an effort to pull out the deformity. He noted, "I used to have a tool I made out of a clamp to check true on the bike without taking off the wheel, but I lost it in the move." After about twenty minutes of tinkering, he dismissed the customer with instructions to check the bike's handling under specific conditions. He presented no bill and collected no money at that time. The adjustments improved the bike's handling, but the customer eventually returned and paid Jim to remount the tire on a scrap rim from storage.

When later asked to analyze how a dealer would have handled this particular encounter, Jim spent approximately a half hour describing how his approach to the customer differed from standard practice. From his description, we identified at least ten major deviations, from the choice not to remove the tire or use a standard "truing stand" for the adjustment to the choice to attend to the customer immediately and not charge him because of this customer's possession of a rare "sand-cast engine block" that Jim wanted for a potentially lucrative restoration. Most of these deviations involved rejecting industry practice in order to offer the customer a service unavailable elsewhere, for terms unavailable elsewhere, using a nonstandard technique or tool produced from scrap materials, so that Jim could later realize value from a scrap part to be combined with other materials at hand to produce an expensive and unique show bike. Although Jim was aware of each standard practice and market prices and although (unlike many cases we observed) he was capable of implementing each practice, he chose to ignore all except a few very basic safety precautions in deciding the particular mix of services to provide to this customer. Such knowledge and use of conventional definitions of resources and prevailing practices as a foil against which to generate unique services was common in the firms we studied.

Parallel and Selective Bricolage

The instances of bricolage we observed were consistent in terms of generating unique services from nonstandard or discarded inputs. They were also consistent in their reliance on construals of the resource environment that rejected common institutional definitions and practices. There was substantial variation among firms in the organizational context from which instances of bricolage arose, however, and this variation helped to explain the frequency and the scope of the bricolage we observed, as well as whether a firm experi-

enced growth. Among the 20 firms in which we identified substantial instances of bricolage, we found nine that exhibited very similar organizational features and behavioral patterns and did not grow during our research. The remaining 11 were much more diverse organizationally, and they accounted for eight out of ten cases of firm growth in our sample. The first pattern we observed we call "parallel bricolage," because it is marked by multiple ongoing projects relying on bricolage. We refer to the second pattern as "selective bricolage." Because parallel bricolage is the most complex pattern we observed and because selective bricolage is more meaningful when seen as a deviation from parallel bricolage, we devote a large portion of our description of results to parallel bricolage and its organizational context.

Parallel bricolage. In addition to the presence of several projects undertaken at the same time, firms engaging in parallel bricolage were characterized by regularities in the collection and storage of physical inputs, origin and breadth of the skills used by personnel, nonconformity to craft standards, industry practices, and legal regulations, and the nature of their social networks. These regularities reinforced one another to embed these firms in a community of practice and create an organizational identity that both perpetuated the parallel bricolage pattern and limited growth.

Physical inputs: Diverse resource trove. The firms engaged in parallel bricolage each did a great deal of scavenging, defined as acquiring and extracting "usage from goods that others eschew or do not intend to use" (Starr and MacMillan, 1990: 84). This resulted in collections of tools, materials, and other odds and ends that were very diverse when compared with the equipment and inventory of firms doing little bricolage. The repair shops run by Denny Green (#3) and Paul Hatchett (#13), each doing about the same amount of business, provide a good contrast. Hatchett, who engaged in little or no bricolage, had a small, well-ordered inventory of new tires, shocks, belts, hoses, and other consumables like motor oil, coolant, and grease. Green, in contrast, drew most of what he needed from a diverse trove of mostly scavenged materials. His storage area required at least double the square footage of his workspace. His three pole barns full of used parts joined more than twenty junked vehicles scattered around his property. In addition to the "parts cars," his "inventory" included used engines, tires, suspension and body parts, various subassemblies, carburetors, fuel pumps, transmissions, lawn tractors, four-wheelers, and a pile of windshields.

Perhaps the most extreme case of a diverse resource trove supported Terry Starr's business (#1), with the storage area dominating the workshop area by at least four to one. His inventory included everything from heavy construction equipment (backhoe, loader, dump truck, bulldozer) to firewood and cookware. He had a tractor, woodstoves, many chain saws and parts, hydraulic jacks and lifts, torch and electric welders, sets of mechanic and metal-working tools, pumps, tanks, gauges, a tractor trailer, hoses, pipes, valves, and many other items. Firms varied greatly in the extent to which their troves were well organized, maintained, and catalogued,

but in every case, knowledge of the content of the troves was a primary factor in how the entrepreneurs and their employees approached new projects.

Labor inputs: Broad self-taught skills. Neither the proprietors of the firms engaged in parallel bricolage nor many of their employees had formal education in any of the trades or professions they practiced. Instead, most had informally picked up a variety of skills, which they applied with little regard to craft or professional boundaries. Jim Roscoe (#10) provides a simple example. When he was not repairing TVs or other electrical equipment, he was often doing carpentry, plumbing, sheetrock, roofing, heating or cooling installation, electrical work, or occasional backhoe or auto repair projects. None of these skills was obtained through formal training. His electrical repair career began when he took a broken TV to a friend and stayed on to watch. He learned auto repair by watching shade-tree mechanics as a youth and later graduated to full-time work in a garage. He also learned some carpentry skills on the job while working for a local cabinetmaker.

The array of projects that Roscoe and various partners took on provided plentiful opportunities to apply their broad amateurish skills. For example, once when we tried to reach him, we were given the number of a club where his band frequently played. Upon contacting the club, we were informed that "he can't talk right now, because he's knee deep in s**t, in the basement, fixing a broken sewer line." On other occasions, he installed a new electrical panel and rewired most of the branch circuits and installed and maintained an illegal cable descrambler for the same club. By counteracting institutional limitations on what constitutes skills and craft knowledge, firms engaged in parallel bricolage were able to apply broad sets of rudimentary skills to combine and extract new services from their resource troves.

Institutional/regulatory environment. Firms engaged in parallel bricolage repeatedly deviated from and tested the limits of local codes as well as craft and professional norms and standards. Engaging in activities that other firms, including some in our study, would reject as impermissible, firms engaged in parallel bricolage explored the extent to which external rules and standards represented real constraints for them. In so doing, they developed deep knowledge of what they could get away with and which apparent constraints they could ignore and even disdain. Jim Roscoe (#10) frequently disregarded credentials, codes, and intellectual property law. Roger Barnfield (#9) boasted that he could "burn anything except water" in his makeshift furnace. He tried burning paper soaked with freely available discarded motor oil and, as he described it, almost anything else he could "fit through the furnace door." He asked around about emission standards and the possible hazards of burning different materials, but he wasn't able to learn much, so he established "a rule of thumb that if I can see through the stack gases, I'm probably OK."

Denny Green's firm (#3) provides another good example, particularly in regard to environmental regulations. When one

customer brought in a car because of sluggish performance, Green—without prompting or discussion—substituted a length of exhaust pipe for a fouled catalytic converter, saving the customer several hundred dollars while increasing air pollution and creating the risk of heavy fines. Another customer commented that his van "ran much better after Denny disconnected the emission controls." Denny did not own an expensive freon recovery unit but performed complete air conditioning repairs, venting freon into the atmosphere with abandon (also illegal). This contrasts sharply with the repair shops run by Paul Hatchett (#13) and Russ Taylor (#24), which refused even to recharge a system if the smallest freon leak could be detected. This disdain for codes and standards was neither universal in parallel bricolage nor completely absent in the other firms but seemed much more commonplace and taken for granted by proprietors, employees, and even customers of firms engaged in parallel bricolage. By refusing to enact limitations reflecting external rules and standards, bricolage created space for these firms to "get away with" solutions that would otherwise seem impermissible.

Customers and labor: Multiplex ties. Perhaps most importantly, the network ties that helped to sustain parallel bricolage differed from those we saw in other businesses, especially in the prevalence of particular sorts of embedded multiplex ties (Portes and Sensenbrenner, 1993; Uzzi, 1997). During the early months of studying firms engaged in parallel bricolage, our notes reflected some confusion over who played what roles in these businesses from week to week. Many customers began as or became friends. Friends and customers would frequently contribute labor or expertise to projects. They also located scavenging opportunities and sometimes brokered the acquisition of physical inputs. Suppliers frequently also became customers and vice versa. The same processes that allowed firms to make use of scavenged resources and self-taught skills allowed them to make use of the inputs provided by network members. These multiplex relations contrasted with the policies favoring arm's-length transactions in some of the other firms. For example, Mike Mathews (#24) told a variety of "horror stories" from the early days when he tried to befriend and mentor his mechanics, concluding, "After a number of bail bond payments and defaulted loans I decided to take a 'strictly business' attitude toward my employees." Similarly, Homer Smith (#11) had tried entering partnerships with or employing relatives and close friends and swore he would never do so again.

In addition, the multiplex ties between parallel bricolage firms and members of their networks sustained the exchange of inexpensive non-standard products and services by creating obligations on the part of firms to provide ongoing fixes and repairs and matching obligations on the part of customers to moderate their expectations about reliability. George Love (#2) told us that about half of the houses he had acquired, rehabilitated and sold would otherwise have been torn down. In many cases, his rehabilitations were incomplete. He sold old and frequently substandard houses inexpensively to people who would otherwise simply not have been part of the

housing market in his area. Oftentimes, he already knew the people to whom he sold such houses. He also extended credit to buyers and provided inexpensive fixes for the inevitable problems, using parts from his resource trove and labor inputs from the homeowners. He generally created relationships in which he and the homeowners could work out problems themselves. By Love's estimate, many of the people to whom he had sold houses would otherwise still be renting or living with relatives. Denny Green's (#3) relationship with people who bought his used cars followed the same pattern closely, with similar results. More generally, by moderating customers' demands and creating mutual obligations on the part of buyers and sellers, firms engaged in parallel bricolage "created" customers from people who otherwise would not be part of the market.

Mutually reinforcing pattern. A mutually reinforcing pattern appeared to characterize several elements of parallel bricolage. Scavenging led to diverse resource troves, which, combined with flexibility in standards and practices and permissive multiplex network ties, encouraged the firms engaged in parallel bricolage to undertake broad sets of challenges. Engaging in new challenges allowed members of firms to increase the range of their self-taught skills, and this, in turn, further broadened the range of problems and opportunities that the firms were willing to tackle through bricolage. The broadened range of skills and potential challenges increased the variety of tools and materials that might come in handy and that were therefore scavenged and accumulated.

Several characteristics of these mutually reinforcing processes appeared to make it unlikely that firms engaged in parallel bricolage would grow. The firms engaged in parallel bricolage often flitted from project to project as parts became available and interest waxed and waned, and a project's priority depended in part on the strength of ties and the urgency displayed by particular customers. This pattern helped to support a constant flow of work for the firms but, due in part to continued reliance on a bounded local network, provided no focus on discovery or exploitation of opportunities for growth. In addition, engaging in multiple novel projects consumed large amounts of time and attention for the processes of learning, experimentation, and fabrication that bricolage often involves and also for the extended period of "coaxing"—the ongoing attempts to get additional service out of worn, failing, or obsolete resources—that typically accompanies bricolage. The work done by George Love's firm to maintain the substandard houses he sold is an example of coaxing. Other coaxing was directed at tools and equipment, rather than end products, and sometimes required considerable creativity and an intimate understanding of the principles underlying the operation of a piece of equipment and of its limits. Terry Starr was able to finesse the use of his aging backhoe—for example, knowing how high he could raise the bucket without damaging the hydraulic system—in a way that another operator could not. Coaxing was not only time consuming but was also anathema to the establishment of reliable impersonal routines.

In some cases, the relationally embedded ties that emerged from the intertwined processes of creating something from

nothing across input, regulatory, and customer domains appeared to have evolved to a community of practice (Brown and Duguid, 1991) in which suppliers, customers, employees, family members, and assorted hangers-on all understood and participated in how business was done by the firms engaged in parallel bricolage, their suppliers, and their customers. In such cases, the permissive environment in which few limitations were enacted was no longer simply an ongoing, active, effortful achievement but was, rather, a socially constructed fact (Berger and Luckmann, 1967; Meyer and Rowan, 1977) that strongly shaped the environment in which these firms did business.

Having used bricolage to escape the constraints of a penurious resource environment, these firms appeared to have created a set of interlocking behaviors and expectations that kept them on the path of parallel bricolage. Bricolage, in the process of countering the social psychological processes of enactment (Weick, 1979), had created an objectified and constraining social structure (Porac, Thomas, and Baden-Fuller, 1989; Aldrich, 1999) that was taken for granted by most participants. In addition, for most of these firms, bricolage appeared to emerge as a constraining firm "identity" (Albert and Whetten, 1985). Firms embraced parallel bricolage as a positive identity (Gioia, Schultz, and Corley, 2000; Rao, Davis, and Ward, 2000), in which members frequently expressed some pride, in the form of disdain for other firms unable to make do with the resources at hand. The clearest instantiation of this identity building process was found at Jim Jarvis's Cycle Tech (#25), where two to three hours before official closing time and usually for some time after, members of the firm's multiplex network would converge on the shop, beer in hand. Work continued, albeit more slowly, jokes, gossip, and information were exchanged, customers would help the mechanics with unfinished work they needed in a hurry, bikes were bought and sold, spare parts located, disputes mediated, and informal rides planned. Jim said that during this "beer time, the place turns into a bar without stools." This process of frequent interaction blurred the distinction between customer, owner, employee, and supplier, as well as work and leisure, and reinforced a set of understandings about how Cycle Tech—not as a company but as a cultural entity—worked. Denny Green (#3) funded noisy monthly parties—complete with live bands—that appeared to fulfill a similar function for the community of practice in which his firm was embedded.

Selective bricolage. Parallel bricolage is associated with a very distinctive and robust organizational form. Moreover, it is impressive in how it allows firms to survive and function with a bare minimum of conventional resources. Parallel bricolage is used to create something from nothing in almost every aspect of a firm's operation. In reviewing the different ways that parallel bricolage renders services from physical inputs and persons that conventional approaches reject, we identified five domains in which something can be created from nothing: physical inputs, labor, skills, customers, and the institutional environment. Table 3 characterizes each of these dimensions. In all of the firms practicing parallel bricolage we

Table 3

Environmental Domains in Which Bricolage Was Used to Create Something from Nothing

Domain	Description
Inputs	
Physical	By imbuing forgotten, discarded, worn or presumed "single-application" materials with new use value, bricolage turns valueless or even negatively valued resources into valuable materials.
Labor	By involving customers, suppliers, and hangers-on in providing work on projects, bricolage sometimes creates labor inputs.
Skills	By permitting and encouraging the use of amateur and self-taught skills (electronics repair, soldering, road work, etc.) that would otherwise go unapplied, bricolage creates useful services.
Customer/markets	By providing products or services that would otherwise be unavailable (housing, cars, billing system, etc.) to customers (because of poverty, thriftiness, or lack of availability), bricolage creates products and markets where none existed.
Institutional and regulatory environment	By refusing to enact limitations with regard to many "standards" and regulations, and by actively trying things in a variety of areas in which entrepreneurs either do not know the rules or do not see them as constraining, bricolage creates space to "get away with" solutions that would otherwise seem impermissible.

found evidence of creating something from nothing in four if not all five domains. They created new services from physical inputs that other firms rejected. They extracted labor from unpaid customers or bystanders. They extracted expertise from skill bases that would be considered unqualified in other firms. They created customers from people whose resources or choices kept them from buying from conventional firms, and they produced services in the shadows and lacunae of institutionalized practice. Unfortunately, precisely this ability to call forth resources out of thin air created an organizational form and identity that isolated parallel bricolage firms from richer markets and impeded the development of organizational focus and routines that might support growth and profitability. As a result, none of the firms that engaged in parallel bricolage during our study grew.

In contrast, a form of bricolage that we labeled "selective" appeared to support or even to drive firm growth. Unlike the parallel bricolage firms, these selective bricolage firms varied considerably on all of the dimensions in which the parallel bricolage firms were homogenous—there was no single organizational or operational pattern. These firms also used bricolage to create something from nothing, but instead of doing so consistently and repeatedly across multiple domains, they appeared able to use it selectively. Most of these firms later rejected bricolage in some or even all domains and thereby avoided becoming constrained by the demands of embedded ties and an organizational identity defined by bricolage.

In one pattern, businesses were started or radically changed using bricolage, but bricolage was rejected once the business was established or the transition completed. A good example of this was Compton Rentals (#22), which followed a pattern of broad but temporary bricolage after Dave Compton bought an ailing trailer park. The business had long catered to what he described as a "troublesome clientele" and was a mechanical and aesthetic "disaster," replete with trailers abandoned by prior tenants. Taking advantage of an environment in which local codes were seldom enforced on trailer

parks, Compton and his employee initially made do by practicing the same sorts of scavenging, coaxing, and bricolage favored by the prior owners, but they focused on slowly improving the park's aesthetics and clientele. They stripped some trailers for parts, used the parts to refurbish the better units, demolished the worst units, and rearranged trailers so that larger and more attractive units were clustered together and more visible. They built useful network ties by allowing some clients to occupy abandoned trailers for free if they repaired them, also letting tenants scavenge other units for parts. Once clients completed their repairs, Compton allowed them either to rent a space for a discounted fee or to remove the trailer from the park. Although he did not possess and could not convey title to the abandoned trailers, Compton found that "the sheriff doesn't ask to see the title to the trailer, only the moving permit."

As his cash position improved, Compton slowly abandoned most bricolage in favor of a business model with higher costs but with higher rents and, he claimed, higher margins. As part of this process, he enacted constraints on what his trailer park considered a bona fide customer by implementing rental contracts that were detailed and almost draconian in their terms, particularly regarding the conduct of tenants. This allowed him to sever network ties selectively and forced out the most troublesome clientele. He enacted institutional constraints by insisting that all units remain in strict compliance with both state and local regulations and imposing his own inspections on people who moved their trailers to the park. As improvements progressed, Compton developed apparent zeal toward rejecting bricolage. He opted, for example, to conduct all repairs with new parts and to hire professional service firms to do much of the work on his property, even when good used parts and cheaper labor were readily available.

The park continued to display vestiges of the old approach, and our initial field notes described it as a "patchwork." During our observation, however, the number of empty spaces and unrented units declined, as did the frequency of calls to the police to deal with disturbances. Compton's decision to reject bricolage over time led to freedom from the need to engage in a high degree of coaxing. This in turn allowed him to begin to establish some simple and impersonal routines for the day-to-day operation of the business and also allowed him to focus more attention both on trying to generate growth and on exploring related ventures, including a modular home dealership. Compton did not add employees during the study, but he did increase occupancy levels and raise rents.

In four cases, we also observed a narrower temporary use of bricolage, limited to particular departments or functions within a firm. In each of these cases, supervisors requested that one or more employees take on new challenges or solve substantial problems without spending any money, to allow the firm to concentrate limited resources elsewhere. All of the supervisors involved agreed that in addition to their requests, they were—implicitly or explicitly—providing what we labeled "permissions." That is, the supervisors intended

to remove assumed limitations and send the message that the firm was willing to live with some shortcuts and problems in exchange for getting the basic task accomplished without the need for additional resources. Jason Bond's billing system (#28) described earlier was typical.

In three out of the four cases of bricolage in a department or function of an otherwise traditional firm, narrow selective bricolage helped the firms to grow by allowing resources to go to areas that senior managers viewed as strategic. Unlike the mutually reinforcing dynamics of parallel bricolage, or the explicit decisions to end broad temporary bricolage, however, this form of bricolage appeared to be self-arresting. Employers' requests and permissions were generally quite narrow. In addition, in two of the cases we observed, the solutions created through requests and permissions required so much coaxing that maintaining the solutions came to dominate the jobs of the employees involved. For example, because Jason Bond continually had to tweak the billing system he created, his job as supervisor of the billing department changed over time to the much narrower position of billing system supervisor. Similarly, Tim Reno (#26), who, along with Bobby Crane, created an *almost* fault-tolerant information technology system architecture through bricolage, eventually quit his job, in large part, he said, "because I was tired of trying to make that half-a**ed system run and then trying to explain why it couldn't do everything the real [fault-tolerant] systems can do."

In some cases, firms used selective bricolage in an exploratory way, successively investigating and developing innovations and growth opportunities through bricolage. Although these companies were characterized by multiple instances of bricolage, they seemed to have been able to limit bricolage, often to just one or two domains, thus avoiding the self-reinforcing cycles of parallel bricolage. One example is Grayson Hill Farms (#7), which used bricolage serially but was not limited by it. Grayson Hill started its bricolage by using methane at hand for electrical cogeneration, later adding hydroponic tomatoes, then tilapia, and finally the sale of mine methane to natural gas companies. Despite successive cycles of bricolage, Grayson Hill never became locked into a pattern of parallel bricolage, because it always limited its simultaneous attempts to create something from nothing to one or two domains. Tim Grayson and his partners combined used capital equipment and physical inputs to generate new services but serviced customers using arm's length transactions. Relations with the utility, owners of subsoil rights, and supermarkets were all impersonal and single function. Grayson also bought *new* equipment for subsequent generating stations, once he had "figured out we could make money from mine methane."

A similar case of the generation of new services through successive but not self-reinforcing instances of bricolage was found in a company started by Biggs Dig. Dig (#4) was employed with a subcontractor doing mine maintenance for many years. As local coal mines began to close, he learned how to do some of the cleanup required by environmental regulations and founded his own firm. He learned that stan-

dards in mine cleanup and reclamation were inconsistently enforced and that old mining properties with unresolved environmental problems could be acquired very cheaply. The slackening mining economy also made available a large supply of used trucks and mining equipment no longer valuable to the mine owners and for which there was little demand. Biggs acquired the title to an abandoned strip mine essentially for free because no one else wanted to cope with the environmental liabilities involved. He also purchased, as he described it, "for a song," a variety of used mining equipment. He experimented on this first property and developed a number of unconventional approaches to cleanup that allowed him to accomplish—combining the materials and equipment cheaply and readily at hand—workable solutions to a problem that mining companies and regulators alike considered a daunting and expensive task to be avoided whenever possible.

Dig's most remarkable success came when he succeeded in extracting and selling at a profit thousands of tons of carbon from a huge, toxic tailing pond, used to hold refuse water from the coal preparation process. Reclaiming the tailing pond per se was a massive undertaking, but the efficiency of the recovery process was far above that of traditional coal mining. For a two-year period Dig's company reported that it recovered 31.2 and 23.2 tons of carbon per hour of labor. The reported state average during the same years was 4.6 and 3.9 per labor hour, respectively. Instead of selling the newly restored property, Dig began to toy with the question of what it would take to clean up the site to conform to strict Environmental Protection Agency regulations for mine reclamation. One major challenge was the requirement that standing water left on a former mine site be of extremely high quality, which it was after some additional work. When Dig realized that these water-quality standards were so stringent as to make his water quality suitable for aquaculture, he proceeded to start a fish farm in his erstwhile tailing pond. The idea was so unconventional that it attracted national attention and netted Dig a high-profile environmental award. Using the visibility and the government contacts he made while attempting to comply with reclamation standards, Dig secured a contract to use his now-pristine lake to raise trout, which are very sensitive to water quality, for the state's fisheries division. He then acquired and reclaimed yet more abandoned mine lands and gradually turned to farming the reclaimed land. He had to move so much carbon and earth during these projects that he also founded a trucking company.

Biggs Dig creatively combined ravaged and largely abandoned mining properties with surplus mining equipment to generate an impressive variety of services, from reclamation to fuel sales and delivery, to aquaculture and farming. As with Grayson Hill Farms, we see a progression from one use of bricolage to the next, often arising out of consequences of the first bricolage. Again though, creating something from nothing was limited to a few domains. Dig made do with raw material and capital inputs that were at hand, and he and his employees were by and large multiskilled and self-trained. At the same time, he was cautious and scrupulous about institu-

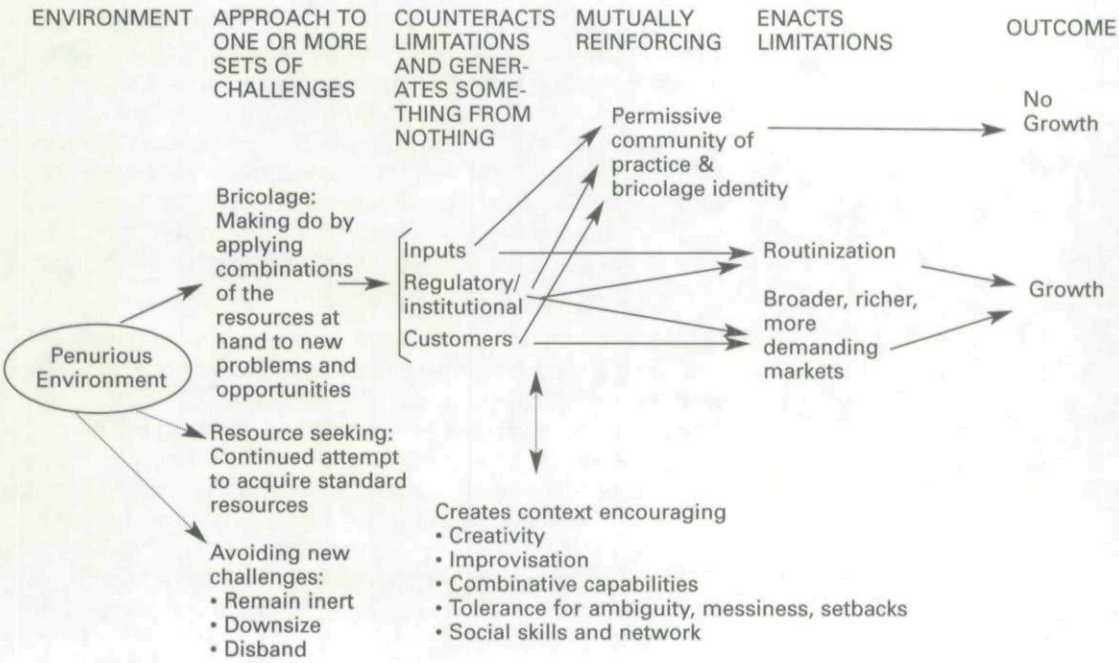
tional and legal regulations, and although he exploited his favorable public image and acquaintance with state regulations and regulators in securing deals and benefits, his social network did not exhibit the same degree of multiplexity or generate the same demands and permissiveness as those of firms engaged in parallel bricolage.

Toward a Process Model of Bricolage and Firm Growth

Figure 1 presents a simple process model that begins with a penurious environment and ends with variations in the likelihood of firm growth. Some parts of the model that we have induced here are strongly substantiated by the results we have presented, while others, as we describe in the discussion section, were suggested by our results but call for additional research. Dashed lines represent processes not explored in this paper or elements of the model for which our data are only suggestive.

Our starting point is a penurious environment. An environment is penurious from a firm's perspective if it presents new challenges, whether opportunities or problems, without providing new resources. When faced with a penurious environment, firms have at least three alternatives. First, many firms respond to environmental constraints by seeking to acquire externally the appropriate levels and types of resources that the new challenges appear to demand. Second, some firms, including many that have tried and failed in their resource-seeking activities, instead take paths that avoid the new challenges, for example, by refusing to undertake new challenges, or in more extreme cases by downsizing or disbanding. Third, firms facing penurious environments sometimes engage in bricolage, making do by applying combinations of the resources at hand to new problems and opportunities. Firms engaged in bricolage typically create

Figure 1. A process model of bricolage and growth.



something from nothing by rendering novel services that arise from their ability and willingness to refuse to enact commonly accepted limitations. The process of testing and counteracting limitations also elicits a variety of other behaviors and capacities, such as creativity, improvisation, and various social and network skills. Bricolage appears to create a context in which such behaviors are encouraged, in part because it relies heavily on trial and error and tolerance for setbacks and also because it creates situations in which out-of-the-ordinary behavior can result in visible, out-of-the-ordinary results.

We identified five domains in which firms created something from nothing by using bricolage, including three input domains (material, skills, labor), the regulatory and institutional domain, and customers. Bricolage across multiple domains generates mutually reinforcing patterns and, in some cases, a firm identity and community of practice that cements firms into the practice of parallel bricolage and stalled growth. Firms engaged in parallel bricolage exhibited an impressive ability to get by or do without resources that other firms considered essential but became so enmeshed in the communities they created that they were unable to exploit opportunities from outside their communities and were sometimes unable to realize profits inside them, a dynamic also found among highly embedded firms in the garment industry (Porac, Thomas, and Baden-Fuller, 1989; Uzzi, 1997).

In contrast, firms that engaged in selective bricolage created something from nothing in fewer domains. Evidently because they escaped the self-reinforcing dynamics of the parallel bricolage identity and organizational form, these firms often preserved the ability to leverage the unique services created through bricolage to generate growth. It appears that by selectively enacting limitations with regard to inputs, these firms were able to generate relatively efficient business routines that permitted them to focus on growth. By enacting limitations with regard to who was a potential customer, firms oriented their services toward broader markets with more demanding but more lucrative customers. Enacting commonplace institutional and regulatory limitations aided both routinization and avoidance of the extraordinarily flexible and personalistic business practices common in parallel bricolage. Overall, through selectivity in the choice and timing of which limitations were counteracted and enacted, firms engaged in selective bricolage were frequently able to grow.

Table 4 summarizes some of our codings for each firm we studied in a way that compactly illustrates and substantiates our thinking. The table classifies firms according to whether we observed evidence of parallel, selective, or no bricolage, shows the domains in which we observed firms creating something from nothing, and indicates the primary characteristics we saw that were closely associated with parallel bricolage. A "Y" indicates that our field notes contained strong evidence for the presence of a behavior or characteristic, an "N" that our evidence suggested strongly that a firm did not display that characteristic or behavior, and a question mark that the data left us in question.

Table 4

Patterns of Bricolage*

		Domains of Bricolage				Elements of Parallel Bricolage					
Firm	Bricolage type	Physical inputs	Labor	Customers	Skills	Instit./ Reg.	Diverse trove	Broad self-taught skills	Violates norms	Multiplex network	Mutually reinforcing
1	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	P	Y	?	Y	Y	Y	Y	Y	Y	Y	Y
3	P	Y	Y	?	Y	Y	Y	Y	Y	Y	Y
6	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	P	Y	?	Y	Y	Y	Y	Y	Y	Y	Y
9	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
10	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
12	P	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
25	P	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
4	S	Y	N	N	Y	N	N	Y	N	N	N
5	S	Y	Y	N	Y	Y	Y	N	N	N	N
7	S	Y	N	N	N	N	N	N	N	N	N
11	S	N	N	Y	Y	Y	Y	Y	Y	Y	Y
16	S	?	N	N	Y	N	?	N	N	N	N
20	S	Y	N	?	N	N	N	N	N	N	N
22	S	Y	Y	N	Y	N	N	Y	N	N	N
26	S	Y	N	N	Y	Y	N	Y	Y	Y	N
27	S	Y	N	N	Y	N	N	Y	N	N	N
28	S	Y	N	Y	Y	N	N	N	Y	N	N
29	S	Y	N	N	N	N	Y	N	N	N	N
13	N	N	N	N	N	N	N	N	N	N	N
14	N	N	N	N	N	N	N	N	N	N	N
15	N	N	N	N	N	N	N	N	N	N	N
17	N	N	N	N	N	N	N	N	N	N	N
18	N	N	N	N	N	N	N	N	N	N	N
19	N	N	N	N	N	N	N	N	N	N	N
21	N	N	N	N	N	N	N	N	N	N	N
23	N	Y	N	N	N	N	N	N	N	N	N
24	N	N	N	N	N	N	N	N	N	N	N

* P = parallel; S = selective; N = no bricolage; Y = yes; N no; ? = data ambiguous.

Table 4 illustrates the striking homogeneity we encountered in firms engaged in parallel bricolage and the consistency with which these firms created something from nothing across multiple domains. For parallel bricolage firms, only five out of 90 cells did not contain a "Y." It also illustrates the striking differences between firms engaged in parallel bricolage and those engaging in little or no bricolage, for which only one of 90 cells contained a "Y." In the category of selective bricolage, the table suggests an interesting pattern among the otherwise quite heterogeneous firms. In particular, these firms typically created something from nothing in the physical input domain (9 of 11) without accumulating a diverse resource trove (only 3 of 11) and without multiplex ties (only 2 of 11). The apparent contradiction of producing something from nothing in the physical input domain without accumulating a diverse physical trove is intriguing, as is the lack of multiplex ties. We suspect the absence of a diverse trove suggests that the selective bricolage firms, for example, Biggs Dig, made use of neglected but plentiful undifferentiated physical inputs that did not require or benefit from storage and organization as a trove. We similarly suspect that the dearth of multiplex ties helped selective bricoleurs avoid

the social entanglements that constricted margins, required special deals, and prevented migration from poorer to richer client bases. Together, these factors may have facilitated the development of routinization and movement to broader markets that permitted growth.

DISCUSSION

The results of this study show emphatically that firms engaged in entrepreneurial bricolage often create something from nothing and that such bricolage is an engine driving the enactment of resource environments that are idiosyncratic to the firm. Our work is broadly consistent with scholarship building on Penrose's (1959) insights, including prior claims that resource constraints may be an important precursor to the enactment of idiosyncratic resource environments (Denrell, Fang, and Winter, 2003: 986). In contrast to prior work, however, we propose a process model of entrepreneurial bricolage to understand how firms enact the idiosyncratic resource environments described by Penrose (1959) and the idiosyncratic resource combinations central to resource-based views. Taken as a whole, the results strongly substantiate our claim that a constructivist view of resource environments is critical to understanding what entrepreneurship contributes to organizational processes, and they open up new areas for research.

We relied on Weick's (1979: 149) description of a process that he called "the enactment of limitations." In Weick's analysis, limitations and constraints on behavior arise from the "failure to act" based on "avoidance of testing" whether something can be accomplished. These presumed limitations then appear to be environmental constraints that limit action. Bricolage is an important means of counteracting the organizational tendency to enact limitations without testing them. In some ways, however, our results suggest that Weick's depiction is misleading, because bricolage is not simply a matter of firms passively not enacting limitations but, rather, requires substantial activity and effort. At the broadest level, our answer to the question "How do you create something from nothing?" is by refusing to treat (and therefore see) the resources at hand as nothing. This refusal calls upon and provides a context in which firms actively exercise their creative and combinatorial capabilities, their tolerance for ambiguity and messiness and setbacks, and their ability to improvise and take advantage of emerging resources and opportunities. Through this process, bricolage is used to create something from nothing.

Our finding that the patterns of enacting or testing and counteracting limitations shape the relationship between bricolage and firm growth represents an important theoretical contribution to our understanding of entrepreneurship under resource constraints. The refusal to enact environmental limitations helps firms use bricolage to create something from nothing. We found, however, that when this is taken to an extreme—as when the firms engaged in parallel bricolage repeatedly attempted to create something from nothing across multiple domains—identities and communities of practice that are constructed create a new set of limitations that suppress

growth. In contrast, when firms use bricolage more narrowly or temporarily, first rejecting and then enacting environmental resource limitations, they appear to be more likely to grow. This also suggests that firms may differ systematically in their ability to apply bricolage skillfully, which we might label their "bricolage capabilities."

A theory of entrepreneurial bricolage that accounts for differences in bricolage capabilities would be useful beyond the sorts of penurious environments that we have studied. What we labeled creating something from nothing was appropriate to the tightly resource-constrained environments we targeted for our study. But something from nothing is in many ways simply an extreme version of more from less. We expect that a theory of entrepreneurial bricolage can help to explain differential firm behavior and outcomes under less extreme resource conditions than those faced by the firms in our study. Research on bricolage in less tightly constrained environments can also provide an important complement to contemporary research exploring the importance of issues of timing in whether slack resources contribute to or detract from a variety of firm outcomes (Mishina, Pollock, and Porac, 2004; George, 2005).

Moving beyond our data, we can speculate about some general advantages that high levels of bricolage capabilities might provide. We expect, for example, that bricolage capabilities will provide survival advantages during the periods of low resource stocks experienced by most new firms, even in generally munificent environments. Similar advantages may accrue to firms in very poor resource environments, such as those that are common in the earliest days of the emergence of most new industries (Aldrich and Fiol, 1994). Moreover, in very crowded and competitive markets, a decline in available resources might have a positive overall effect on firms with strong bricolage capabilities, as competitors that only know how to operate with exactly the right levels and types of resources disband, forgo opportunities, or otherwise exit the market. As our results suggest, bricolage capabilities may help firms explore and exploit new opportunities that might appear too expensive to pursue through other means.

The process of requests and permissions and how it extended the resources at hand and the solutions available to firms is particularly intriguing to us. It has long been noted that employees bring with them a variety of skills and resources, along with the willingness and desire to make use of a greater range of their capabilities than their jobs require. Miner (1987), for example, showed that the evolution of jobs toward employees' interests and capabilities, in ways that sometimes meet changing organizational needs, is common, although relatively slow even in very large and formally bureaucratic organizations. Moreover, her research suggested that such job evolution could have important consequences for organizational adaptation (Miner, 1990). Our observations suggest a quicker route to such job evolution and to accessing a broader range of employee capabilities. Supervisors issued requests and permissions for employees to take on challenging new tasks with no additional resources, employees responded by engaging in bricolage, and their jobs

evolved accordingly. Bricolage capabilities may be a particularly potent mechanism for permitting employees to make use of a variety of amateur skills and resources at hand to them and for generating solutions that their jobs would otherwise be unlikely to elicit from them. This represents a theoretically and practically important case of refusing to enact limitations and creating something from nothing in the specific domain of available skills. Development of a fuller theory of entrepreneurial bricolage requires detailed investigation of the creation of something from nothing in this and other domains, such as labor inputs, material resources, the institutional and regulatory environment, customers, and perhaps others.

Bricolage and Entrepreneurship Research

Strands of the entrepreneurship literature emphasize the distinction between opportunities and the resources required to exploit them. For example, in a series of influential statements on what makes entrepreneurial management distinctive, Stevenson and his colleagues (Stevenson and Jarillo, 1990; Stevenson et al., 1999) have distinguished between an entrepreneurial focus on pursuit of opportunity, without regard to the resources a firm currently controls, versus a non-entrepreneurial administrative or trustee focus on carefully protecting resources. Recent research building on Austrian economics (Eckhardt and Shane, 2003), particularly on the work of Kirzner (Jacobson, 1992; Kirzner, 1997, 2000), has even more strongly emphasized the fundamental role of opportunities in driving entrepreneurial activity. This work suggests a temporal ordering in which opportunities are preexisting objective phenomena that may be discovered and evaluated, with those that are favorably evaluated subsequently eliciting attempts at resource mobilization (Shane and Venkataraman, 2000). Such an ordered process undoubtedly characterizes some entrepreneurship, including some cases in which opportunities are discovered through superior alertness (Kirzner, 1973) or through the serendipity popular in entrepreneurial folklore (Merton and Barber, 2003). But recent empirical research (Reynolds and White, 1997; Baker, Miner, and Eesley, 2003; Ruef, Aldrich, and Carter, 2003) strongly suggests that such orderly sequential processes may be the exception in entrepreneurship. Moreover, just as our results challenge the usefulness of objectivist characterizations of resource environments, they similarly challenge the objectivist characterizations of opportunities that hold sway in much contemporary entrepreneurship research (Baker, Gedajlovic, and Lubatkin, 2005).

Stevenson and Jarillo (1990: 23) nicely defined an opportunity as a "future situation which is deemed desirable and feasible." For the firms we observed, bricolage shaped both what seemed desirable and what seemed feasible. The bricoleurs in our study did not view opportunities as objective and external to the resources and activities of the firm. Rather, the processes of discovering opportunities and enacting resources were often one and the same, with both the resource environment and the opportunity environment idiosyncratic to the specific firm and constructed through processes of bricolage. Many of the opportunities exploited

by the firms we studied existed for the firms involved only because of the unique resource environments they had enacted. While a great deal of research builds on the notion that opportunities are objective and waiting to be discovered by alert individuals (Kirzner, 1973) or by the limited number of people whose idiosyncratic life experience and knowledge enable them to see specific opportunities (Hayek, 1948; Shane, 2000), our results are more consistent with the claim that many or most entrepreneurial opportunities are more enacted than they are discovered (Gartner, Bird, and Starr, 1992; Gartner, Carter, and Hills, 2003). Entrepreneurial bricolage might well be characterized as the pursuit of opportunity through close regard to the resources at hand.

In addition, from the perspective of a theory of entrepreneurial bricolage, in those cases in which resources and opportunities are separable, alertness to resources is as important as alertness to opportunities. In many of the cases we observed, the opportunity—e.g., the problem of dealing with the detritus of a failing mining economy or the opportunity Jason Bond's firm faced to get customized bills out the door effectively—was obvious to many people and firms. But Jason was alert to the existence of a spreadsheet-based accounts-receivable system that he could combine with his company's billing system. This finding echoes Shane's (2000) study of the eight people who recognized eight distinct uses for a single manufacturing technology licensed by MIT. Viewed through the lens of entrepreneurial alertness, these eight individuals were arguably alert to resources as much as they were alert to opportunities. Resources and opportunities were seemingly reciprocally defined: the availability of the technology defined the opportunities as the opportunities defined the technology as a resource. Building on Hayek's (1948) arguments about the distribution of knowledge in society, Shane argued compellingly that the eight would-be entrepreneurs discovered different opportunities because of differences in the prior knowledge that they carried when they were introduced to the new technology. In our study, such prior knowledge was instead prior knowledge about the resources at hand (Harper, 1987; Keller and Keller, 1996), combined in many cases with vigilant alertness to the availability of other inexpensive or free resources.

Knowledge of the resources at hand enabled firms engaged in bricolage to find combinations of resources that allowed them to embrace new problems and opportunities, which meant that opportunity discovery could be interactive and social, rather than a process requiring an individual epiphany. Because knowledge of the resources at hand to a firm was often distributed among different people, the process of resource combination through which both resource environments and opportunities were enacted often involved a great deal of give and take among members of the firm, as they iteratively figured out ways to combine what was at hand. For example, Tim Reno and Bobby Crane figured out that they faced an opportunity to construct an almost fault-tolerant system while attempting to deal with recurrent service interruptions, through a process of playing around with different components both together and separately and talking

intensively and repeatedly about different ways of approaching things. The possibility of generating a system that approached the performance of expensive fault-tolerant platforms emerged through this conversation. This process of opportunity enactment and discovery through interactive social processes of bricolage stands in strong contradistinction to Austrian-economics-inspired perspectives that view opportunity discovery as the domain solely of enterprising individuals (Venkataraman, 1997; Kirzner, 2000).

Eliciting Other Behaviors and Capacities

We observed throughout our study that bricolage seemed to elicit and provide opportunities for the exercise of organizational capacities and behaviors such as creativity, improvisation, and social skills. Unfortunately, while our results as a whole strongly suggest this connection, they do not provide enough evidence to develop a full understanding of the relationship between bricolage and many of the related capacities that it sometimes entrains, and this remains perhaps the weakest part of our model.

One area in which our evidence is better concerns bricolage and improvisation. With few exceptions, organization scholars have previously invoked bricolage mainly as an element or correlate of organizational improvisation (Ciborra and Lanzara, 1990; Weick, 1993a, 1993b; Garud and Karnoe, 2003), often using the two terms interchangeably. At least one paper has argued explicitly in favor of including bricolage within the definition of improvisation (Cunha, da Cunha, and Kamoche, 2001). Recently, however, careful empirical work (Moorman and Miner, 1998; Miner, Bassoff, and Moorman, 2001) has led to the formulation of a more precise definition of improvisation and clarified its relationship to bricolage. Defining improvisation as "the deliberate and substantive fusion of the design and execution of a novel production," Miner, Bassoff, and Moorman (2001: 314) argued that because improvisation permits no temporal gap between the design and execution of activities, improvisers have little opportunity to seek resources beyond those already at hand, and they therefore typically engage in bricolage. From this perspective, organizational improvisation can be an important precursor to bricolage, but bricolage can also occur as part of even carefully pre-planned processes (Miner, Bassoff, and Moorman, 2001; Baker, Miner, and Eesley, 2003).

Complementing and extending these prior findings, in our study, bricolage often appeared as the cause of improvisation. As Moran and Ghoshal (1999: 393) noted, "'the carrying out of combinations' is more usefully viewed as a discovery process than as some sequence of discrete acts of joining known resources to produce some known outcomes." Such discoveries seem particularly likely to occur when the combinations involve materials at hand rather than materials acquired specifically for a planned task. In our observations, the execution of a prior design—which was, as Lévi-Strauss (1967: 21) suggested, often "a mere sketch"—sometimes hit a snag when unexpected and idiosyncratic characteristics of the resources at hand did not behave as anticipated. Perhaps the clearest example involves Tim

Grayson getting blown off his feet while attempting to convert the diesel generator to methane, but our study uncovered many other less dramatic examples. While these surprises sometimes resulted in a return to the drawing board, they often generated improvisation instead.

This and similar examples illustrate bricolage as a discovery process and suggest an additional reason why bricolage and improvisation often appear tightly linked empirically. Not only does improvisation call forth bricolage, but bricolage also sometimes triggers improvisation. We believe that a better understanding of the dynamic interplay of organizational improvisation and bricolage can contribute to future studies of bricolage and also to the growing body of work explicating the ability of improvisation both to improve and to detract from organizational performance. Bricolage appears to create a forum in which organizational improvisation, creativity, social skills, combinative capabilities, and other characteristics are called into play and are likely to have a substantial impact on firm outcomes. While our study makes a strong contribution to understanding the role of bricolage in generating improvisation, the detailed relationship between bricolage and these other organizational characteristics requires additional empirical study.

Bricolage as Value Creation from New Combinations

The term "combination" and its variants are applied in many useful ways in contemporary organization studies, where they share in common the important insight that most of what is new in any domain generally consists of some combination of what existed previously. This general idea has an impressive legacy. In their discussion of "combinative capabilities," Kogut and Zander (1992: 392) credited Plato for "the view that knowledge can be created only as combinations of what is already known." Unsurprisingly, given the breadth of the insight they share in common, many such discussions of combinations capture ideas that are somewhat different from the notion of combinations in bricolage.

Our understanding of bricolage overlaps with yet also extends some of the extensive menu of perspectives focused on the role of new combinations in the creation of economic value. In particular, many such theories draw on Schumpeter's (1934, 1939) argument that all economic innovation and progress comes from new combinations of existing resources, but Schumpeter also emphasized that new combinations imply the withdrawal of these same resources from whatever productive application they previously fulfilled. As Moran and Ghoshal (1999: 393) described this idea, "In all new combinations the loss in realizable value is always more certain and often more immediate than is any gain in potential value." And were an organization to take some resource away from another activity to use it for bricolage, exactly the same pattern would likely prevail. In our observations, however, bricolage sometimes created economic value without withdrawing resources from any current use. In some cases, bricolage combined resources generally perceived to be worthless (or worse, a liability) and imbued them with new

use value. Both Biggs Dig (#4) and Tim Grayson (#7) drew on toxic waste products as part of a process of bricolage that created new value. In other cases, bricolage called forth hidden and seemingly unrelated resources that would otherwise not have been put to any productive application. When supervisors' requests and permissions generated bricolage by employees, the employees called on resources that were at hand to the employees, but about which the employers had no specific knowledge. Jason Bond's (#28) boss did not anticipate that Jason would call in a favor from a prior coworker to get a copy of the spreadsheet-based accounting program that became part of Jason's billing solution, nor did he expect that Jason would apply his self-taught programming skills to construct a solution.

Because bricolage often draws on degraded, fallow, and otherwise undeveloped resources to construct new combinations, it represents a form of value creation that does not depend on the Schumpeterian assumption that assets are withdrawn from one activity for application in another. A similar logic applies to bricolage as an engine of value creation through innovation. Most results of bricolage we observed were one-time solutions that created no reusable design or innovation. But on occasion, the designs that emerged from bricolage represented valuable product or service innovations. For example, the cable-testing devices constructed by Jim Roscoe (#10) were an easy-to-manufacture improvement on previously available technology. On a larger scale, Biggs Dig's incremental bricolage with respect to the cleanup of old mining properties resulted in the discovery of replicable process innovations that won him environmental awards and created the opportunity to acquire additional impaired properties for little or no money and repeat the process. Bricolage processes represent an opportunity to understand innovation as a process of imbuing previously worthless resources with value.

The resource-based view of the firm draws in part on Penrose's (1959) insights about the creation of idiosyncratic resource pools to explain how firms may sometimes gain advantages that allow them to appropriate the value they have created even in the face of other firms' attempts to make competitive inroads. Our study provides intriguing but limited evidence in this regard. Because bricolage involves idiosyncratic combinations of heterogeneous resources applicable to new problems and opportunities, it would seem a likely engine of such value-appropriation processes (Moran and Ghoshal, 1999) such as those described in the resource-based view of competitive strategy (Wernerfelt, 1984; Barney, 1991). Novel solutions constructed by combining the odds and ends at hand might be difficult for someone without the same resources or combinations of skills to replicate. Nonetheless, most of the bricolage-based innovations we observed would have been relatively easy for other firms to copy. Among the firms we studied, bricolage was much more important as a tool of value creation than as a tool of value appropriation.

The resource-constrained environments of our study were particularly appropriate for detailed observations of bricolage,

yet our work is exploratory, and we relied on intensive study of a limited, non-representative sample of firms. As is the case in all grounded theory development, additional work will be required to test the relationships we theorized and whether the concepts we have introduced, particularly the idea of constructing resources, are useful in other contexts. If organizations are frequently called upon to deal with substantial new problems and opportunities without the benefits of substantial new resources—as we believe they clearly are—then we have identified both an important theoretical gap and the beginnings of a theory of entrepreneurial bricolage with the potential to address it.

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