

**MICROFOUNDATIONS OF ROUTINES AND CAPABILITIES:
INDIVIDUALS, PROCESSES, AND STRUCTURE**

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January 5, 2012

Acknowledgments: A special thanks to participants of the 2009 Rotterdam Conference, as well as the participants and co-organizer Juha-Antti Lamberg for the 2010 Helsinki Conference on “Micro-origins of organizational routines and capabilities.” Thanks to James Carlson for research assistance.

Keywords: Routines, Capabilities, Micro-foundations.

JEL Codes: B52, D21, L21, M1.

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Abstract

We discuss the microfoundations of routines and capabilities, including why a microfoundations view is needed and how it may inform work on organizational and competitive heterogeneity. Building on extant research, we identify three primary categories of micro-level components underlying routines and capabilities: individuals, social processes, and structure and design. We discuss how these components, and their interactions, may affect routines and capabilities. In doing so, we outline a research agenda for advancing the field's understanding of the microfoundations of routines and capabilities.

Key Words: Microfoundations, routines and capabilities, aggregation, micro-macro links

INTRODUCTION

Routines and capabilities have emerged as central constructs in a host of fields in management research. For example, routines and capabilities have played a prominent role in the analysis of organizational and competitive heterogeneity. Routines and capabilities have also been closely linked to the broad “knowledge-based” emphasis in the field of management. While much progress has been made in understanding routines, capabilities and knowledge, the underlying microfoundations or micro-level origins of these constructs have not received adequate attention. For example, Argote and Ingram noted that to the extent that there has been progress in studying knowledge as the basis of competitive advantage, “... it has been at the level of identifying consistencies in organizations’ knowledge development paths and *almost never at the level of human interactions that are the primary source of knowledge and knowledge transfer*” (2000: 156, emphasis added). Although research has made progress on this issue since Argote and Ingram’s statement, numerous questions remain regarding the micro-level origins of routines and capabilities and how these origins give rise to routines and capabilities (Abell, Felin and Foss, 2008; Felin and Foss, 2005, 2011; Gavetti, 2005; Salvato and Rerup, 2012 Teece, 2007).

A microfoundations approach identifies a set of collective phenomena in need of explanation, specifically the origins, creation and development, reproduction, and management of collective constructs such as routines and capabilities. It also proffers that an explanation of these collective phenomena requires consideration of lower-level entities, such as individuals or processes in organizations, and their interactions.¹ In general, there are many different kinds of arguments for such an approach, including philosophical theoretical, methodological, as well as pragmatic arguments that focus on adding explanatory power. Notably, a strong motivation for unpacking routines and capabilities in microfoundational terms is that doing so will advance our understanding of what drives

1. However, a microfoundations argument does not imply that collective level constructs cannot be part of the relevant explanation.

differences in the behavior and performance of firms in at least two ways. First, we will gain a better understanding of what routines and capabilities really “are” in terms of their different constituent components. Second, exploring how the constituent components interact, within or across categories, will shed light on how differences in routines and capabilities arise. Clarifying these sources of heterogeneity will, in turn, assist us in understanding how microfoundations contribute to heterogeneity among firms. This explanatory task has relevance beyond the confines of strategic management, as routines and capabilities are key constructs in a number of management fields, notably international management, technology strategy and management, and organization theory and studies. Of course, understanding how routines and capabilities are built and how they can be maintained, extended, leveraged, adapted, phased out, and so on in terms of their constituent microfoundations has general managerial relevance.

The notion of “microfoundations” certainly is not new. It is traditionally allied with notions of “reduction” or “decomposition” in science and with “methodological individualism” in the philosophy of social science. Although the notion’s pedigree harks back more than a century, the notion itself emerged in the 1960s, when economists began discussing how to link micro- and macro-economics (e.g., Leijonhufvud, 1968; see a review in Janssen, 1993). A micro emphasis also was central to Austrian conceptions of the economy and economic activity, in reaction to more collective-level and historicist theorizing of the time (Hayek, 1948). The notion of microfoundations is also informed by a long tradition of debate in philosophy and sociology regarding whether individuals or collectives should have explanatory primacy in social theory (e.g., Coleman, 1964; Lazarsfeld and Menzel, 1970; Popper, 1957; for an overview, see Udehn, 2001). Micro-level phenomena, specifically, individuals, processes, and (organizational) structures, played a central role in the origins of management theory. For example, Barnard (1968: 139) argued that “the individual is always the basic strategic factor of organization.”

And early work on the behavioral theory of the firm (Cyert and March, 1992; March and Simon, 1958) explored several microfoundational explanations of organizational heterogeneity (for a historical overview, see Felin and Foss, 2009).

In management research, a large body of contemporary work indeed points to micro-level phenomena or mechanisms, such as individuals, processes, and structures, and/or their interactions, as important causes of the emergence, function and dynamics of routines and capabilities (e.g., Burgelman, 1994; Cohen and Bacdayan, 1994; Cyert and March, 1992; Hoopes and Madsen, 2008; Knott, 2003; March and Simon, 1958; Murmann, 2003; Narduzzo et al., 2000; Pentland and Reuter, 1994, Selznick, 1984; Zbaracki and Bergen, 2010).² Although this research does not always ally itself with a microfoundations argument, it is nevertheless highly relevant to our inquiry. A complementary line of work in strategy explores the general origins of capabilities or dynamic capabilities (e.g., Helfat and Lieberman, 2002; Klepper, 2002; Pisano, 2000; Zollo and Winter, 2002). Building on this work, several recent theoretical and empirical studies devote explicit attention to the micro-level origins of routines and capabilities (Becker and Lazaric, 2003; Becker et al., 2005; D'Addiero, 2009; Gavetti, 2005; Heimeriks, Schijven, and Gates, *in press*; Helfat and Peteraf, 2010; Salvato, 2009; Rerup and Feldman, 2011; Feldman and Pentland, 2003, Pentland and Feldman 2008; Teece, 2007). Thus, situated at the nexus of this extant and emerging work, the goal of this paper (and the associated Special Issue) is to clarify, and expand on, the microfoundations lens and define a research agenda for further work on the microfoundations of routines and capabilities.

The article proceeds as follows. We begin with a working definition of microfoundations. Next, we provide an underlying rationale for a microfoundations analysis – more generally, why scientific decomposition might lead to progress and, more specifically, why the study of routines and capabilities

2. Scholars also might suggest that the roots extend to Barnard, (1938(68)), Chandler (1992), Leonard-Barton (1995), March and Simon (1958), Weick, (1969(79)). While informative, prior work however, was not initiated with the intent of understanding the microfoundations of routines and capabilities.

warrants an understanding of micro-level origins. Thereafter, we expand on our definition, with special attention to how different types of microfoundations, 1) individuals, 2) processes and interactions, and 3) (organizational) structure and design, affect routines or capabilities. Framed, in part, by the extant work, our primary focus lies with explicating the microfoundations of routines and capabilities and specifying a research agenda for this line of inquiry.

THE WHAT AND WHY OF MICROFOUNDATIONS

A Definition

We define microfoundations as a theoretical explanation, supported by empirical examination, of a phenomenon located at analytical level N at time t (N_t). In the simplest sense, a baseline microfoundation for level N_t lies at level $N-1$ at time $t-1$, where the time dimension reflects a temporal ordering of relationships with phenomena at level $N-1$ predating phenomena at level N .³ Constituent actors, processes, and/or structures, at level $N-1_{t-1}$ may interact, or operate alone, to influence phenomena at level N_t . Moreover, actors, processes, and/or structures at level $N-1_{t-1}$ also may *moderate* or *mediate* influences of phenomena located at level N_t or at higher levels (e.g., $N+1_{t+1}$ to $N+n_{t+n}$).

In addition, while our theory focuses on the organization as the focal level N , the focal level N in a microfoundations inquiry may represent any collective level. For example, explaining industry dynamics (level N_t) in terms of the behaviors and interactions of incumbent firms and potential entrants (level $N-1_{t-1}$) is tantamount to providing microfoundations for such dynamics (e.g., Rumelt, 1991). In turn the behaviors and interactions of incumbent firms and potential entrants may influence other phenomena, at higher analytical levels ($N + 1 \dots n$) and over time ($t + 1 \dots n$), such as the institutional rules governing an industry (e.g., Chung and Luo, 2008; Madsen and Walker, 2007).

3. This approach however, is not intended to preclude the chance for non-causal associations between microfoundations (level $N-1$) at t and aggregate phenomena (level N) at t . For instance, phenomena at $N-1_{t-1}$ may have a causal relationship with a resource or capability at N_t ; in addition, phenomenon at $N-1_t$ might be positively or negatively associated with a routine or capability at N_t .

Similar to a genealogical hierarchy, each analytical level is influenced by lower level mechanisms or entities in time (e.g., Baum and Singh, 1994). For example, a microfoundation, or a set of microfoundations, may serve as causal explanations for the creation of a routine or capability; in other words, serve as the origin of a routine or capability. Alternatively, a microfoundation might only affect the development, operation, maintenance, and/or change of a routine or capability but not necessarily contribute to its creation. It follows then that some microfoundations may be temporally prior to others. As a result, an analysis of microfoundations is both a history-friendly and offers an analytic undertaking that considers both initial conditions and evolutionary processes.

In sum, for our purposes, the microfoundations of organizational routines and capabilities include two sources: 1) constituent components (i.e., main effects) - individuals, processes, and structure and design; and 2) interactions within and across components – the interactions of individuals, processes, and/or structures and design that contribute to the aggregation and emergence of the collective constructs. After expanding on the definitions and “why” microfoundations matter, we discuss how these sources inform our understanding of routines and capabilities.

Why Focus on Microfoundations?

Most sciences or subfields, in their early stages of development, begin at some aggregate level of analysis (N_t) and thus implicitly assume that micro-level ($N-1_{t-1}$) phenomena have relatively uniform effects on aggregate level phenomena, and/or that variation at the micro-level does not inform variation of aggregate level phenomena. That is, everything at the $N-1_{t-1}$ analytical level largely has a homogenous effect on an aggregate construct or event at the N_t analytical level.⁴ For example, population ecologists initially assumed uniformity among firms or members of populations (e.g., Hannan and Freeman, 1989). In studies of institutionalism, sociologists often portrayed individuals as

4. This focus on a given level, N , of course, can be a pragmatic solution to the lack of information (e.g., data) about lower levels of analysis, $N-1$.

“cultural dopes” (Garfinkel, 1967; 68-75; also see Coleman, 1990; Powell and Colyvas, 2008; Selznick, 1996). Historically, economists also have suppressed micro-level variation by using assumptions of “representative agents” (Kirman, 1992).

As fields progress, evidence suggests that assumptions about micro homogeneity or uniformity prove unsustainable and inaccurate. For instance, several studies on firm level experience or learning have unearthed micro explanations for variance in organizational behavior or performance (such as individual experience, team experience, processes underlying practices, or interactions between individuals and technology) (e.g., Reagans, Argote and Brooks, 2005; Darr, Argote and Epple, 1995; Edmondson, Bohmer and Pisano, 2001; Tyre and Von Hippel, 1997). Indeed, micro-level phenomena are often more idiosyncratic and stochastic in nature than not (McKelvey, 1998). For example, there is vast heterogeneity in individual-level skills and abilities (Felin and Hesterly, 2007; Zenger, 1992), and this variance contributes to differences in behavior and performance among firms (e.g., Coff, 1997, 1999; Collins and Clark, 2003; Johnson and Hoopes, 2003; Hitt et al, 2001; Mackey, 2005; Tsai and Ghoshal, 1998). As a result, attention to micro-level sources of heterogeneity has contributed to theoretical debate and advancement in multiple fields or subfields. For example, conventional economic perspectives are increasingly informed by behavioral economics; the latter challenges many assumptions in neo-classical economics by focusing on how social, cognitive, and emotional elements can inform the economic decisions of individuals and institutions (e.g., Camerer, Loewenstein and Prelec, 2005; Fehr et. al., 2005; Fehr and Rockenbach, 2003; Henrich et al. 2001; Kahneman and Tversky, 1979; Shefrin and Statman, 1985).

To provide an example from another literature, institutional theory has historically called for more explicit attention to the area’s microfoundations (e.g., Selznick, 1997). Recent work in organization theory makes some progress in this area, emphasizing that studying processes of micro-

institutionalization and entrepreneurship, or “institutional work,” provides for a fuller understanding of institutionalization (Lawrence et. al. 2009; also see Jennings and Greenwood, 2003; Johnson, 2007; Lounsbury and Crumley, 2007; Powell and Colyvas, 2008). Work on the microfoundations of social relations also has shifted attention to how individuals, as the nodes of networks, create and shape networks, as compared to extant work that emphasizes the reverse, the effects of networks on individuals (Coleman, 1990; see Cook [2000] for a review). For instance, in their study of relationships among 170 employees of a Dutch radiology department, Sasovova, Mehra, Borgatti, and Schippers (2010) found that self-monitoring among individuals critically shapes a person’s network. It follows then that advancing the understanding of particular phenomena and, in turn, a field, may require expanding theoretical and empirical work to encompass multi-level effects, including micro-level effects (e.g., Hitt, Beamish, Jackson and Mathiu, 2007). Such an inquiry also requires consideration of temporal dimensions. In sum, in the history of scientific development, micro-level phenomena have formed an important lower bound of inquiry (Schwab, 1960).

The call for microfoundations then can be seen in the context of scientific reduction and associated progress. Elster indeed argues that “reduction is at the heart of progress in science” (1989: 74; cf. Oppenheimer and Putnam, 1958; Schaffer, 2003). Scientific reduction is a call for explaining collective phenomena and structures in terms of what are seen as more fundamental, nested components (Kincaid, 1997) and the search for, and explication of, the constituent components that underlie aggregate and collective phenomena. In the study of the microfoundations of routines and capabilities, the fundamental questions are what are the constituent components, how do the components operate to affect and constitute routines and capabilities, and how do the interactions within and among components contribute to the aggregation and emergence of the collective constructs.

The above observations and trends motivate our inquiry. In addition, the extant, albeit

fragmented, empirical work on routines and capabilities suggests that the area is ripe for a microfoundations exploration. Nonetheless, it is *not* our intent to apply a “greedy” reductionist approach to understanding routines and capabilities (see Dennett, 1996). That is, we do not assume that understanding lower-level phenomena will necessarily always improve our understanding of a higher-level phenomenon (Stinchcombe, 1991)—but more simply that the decomposition of collective constructs can yield important insights. Furthermore, we believe that the pursuit of the microfoundations of routines and capabilities will bear fruit if the research agenda is rigorously defined. Importantly, this includes specifying the underlying components, or parts, of routines and capabilities, and their interactions, the mechanisms connecting the parts to the collective constructs in time and space, and the boundary conditions for this line of inquiry.

THE MICROFOUNDATIONS OF ROUTINES AND CAPABILITIES

Routines and Capabilities: Some Definitions

Before proceeding with our discussion of the microfoundations of routines and capabilities, we highlight the basic definitions of these constructs. Our purpose is to anchor and build on the more common definitions rather than to provide an exhaustive review (for recent work that offers thorough reviews of definitions see Barreto, 2010; Becker, 2005; Cohen et al., 1996; Hoopes and Madsen, 2008; Leiblein, 2011; Di Stefano et al., 2010).

It is widely accepted that routines are “repetitive, recognizable patterns of interdependent actions, carried out by multiple actors” (e.g., Feldman and Pentland, 2003: 95; Nelson and Winter, 1982).⁵ Furthermore, routines are explicitly collective rather than individual-level phenomena (e.g., Nelson and Winter, 1982: 107; Pentland, 2011). The emphasis is placed on the interactions rather than the components interacting (for a review, see Felin and Hesterly, 2007). Routines also include two

5. Habits are associated with an individual’s behavior patterns (e.g., Dosi, Nelson and Winter, 2000; Becker, 2005).

critical aspects: ostensive and performative. The ostensive aspect captures the traditional view of routines as structure or the “abstract idea of the routine” whereas the performative involves the enactment of a routine in time and space (e.g., Feldman and Pentland, 2003: 95). The interaction of the ostensive and performative aspects of routines informs our understanding of change and collective outcomes (see Feldman and Pentland [2003] for a review).

Following Winter, an organizational capability is “a high level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization’s management a set of decision options for producing significant outputs of a particular type” (2000: 983; 2003: 991). This definition casts learning, experience, resources, and routines as inputs to capabilities (Zollo and Winter, 2002). For example, routines can also be capabilities whereas inputs such as experience and resources may contribute to capabilities. Capabilities themselves are associated with putting resources (and other inputs) into action (Dosi et al., 2000; Eisenhardt and Martin, 2000; Makadok, 2001; Winter, 2003).

One form of capability, dynamic capability, involves the “capacity of an organization to purposefully create, extend or modify” a firm’s product or service offerings, processes for generating and/or delivering a product or service, or customer markets (Helfat, 2007: 1, 4; Winter, 2003). The logic that dynamic capabilities operate on other capabilities indicates that capabilities evolve within a hierarchy (Collis, 1994; Winter, 2000, 2003). Following Winter (2003: 992), the hierarchy begins with zero-order, or operational, routines and capabilities. These zero-order routines are associated with “how we earn a living now”-type activities. The next level in the hierarchy then involves first- or higher-order change or dynamic capabilities. This hierarchical conception of dynamic capabilities requires two components, a rigid and flexible one, to separate the replication effect from the dynamization effect inherent in this construct (Schreyogg and Kliesch-Eberl, 2007).

Routines and (Dynamic) Capabilities Are Separate Constructs, Yet Linked

While routines and capabilities are theoretically linked, these constructs vary in multiple ways. For instance, routines and capabilities come in different manifestations and focus on different phenomena. One implication of this heterogeneity is that many aspects of routines and capabilities require further explanation. An explanation is, obviously, an explanation of *something*. Research on the explanation of routines and capabilities may benefit from a clearer identification of such explanandum phenomena.

Discussions of hierarchies of routines and capabilities lend understanding to one source of these differences (Nelson and Winter, 1982; Winter, 2003). Nelson and Winter (1982) distinguish routines from dynamic routines where the latter are routines that serve to change lower-level routines (a precursor of the notion of dynamic capabilities). Winter (2003) suggests that it makes logical sense to speak, in general, of a hierarchy with N layers of capabilities (N possibly larger than 2). Some capabilities are “zero-level” capabilities in the sense that they underpin daily “routine” operations whereas others are “first order” or higher-order capabilities, notably “dynamic capabilities” (Helfat and Peteraf, 2003; Teece, Pisano and Shuen, 1997; Winter, 2003: 992). For instance, studying the way in which serial acquirers customize routines in a specific acquisition, Heimeriks et al. (forthcoming) find that successful acquirers adjust their (zero-order) codified routines using higher-order routines in the form of risk management and tacit knowledge transfer practices.

Differences in routines and capabilities also are associated with the extent to which they are more rigid or more flexible; such manifestations often depend on context. Rigid routines consist of sequences of actions where each and every action must be carried out in a specific manner. These types of routines draw on previously accumulated knowledge and may be viewed as fully-designed, maximizing solutions to coordination tasks or problems. For example, organizations that must execute activities in a highly reliable manner (nuclear power stations, chemical plants, hospitals, etc.) or that require efficient

replication of specific processes across multiple units (franchises in fast food or casual dining restaurants) often leverage such rigid routines (often referenced as standard operating procedures (SOPs)). In contrast, even though some forms of capabilities, such as zero-order, may involve standard ways of operating, their deployment may allow for managerial discretion. As a result, managerial actions may contribute to variance in the nature of a capability over time. Some types of routines also are more flexible than rigid, allowing for managerial discretion in their execution (Feldman and Pentland, 2003). In sum, the different manifestations of routines and capabilities may be associated with, or stem from, different microfoundations. These differences warrant study given the bundle of routines and capabilities held by organizations, on average, represent a mix of these heterogeneous constructs.

The different dynamic aspects of routines and capabilities also merit further explanation. The question of how routines and capabilities emerge from their microfoundations is conceptually separate from the question of how they are changed (e.g., by managerial intervention, employee turnover, incremental learning, etc.), or maintained (e.g., incentives and monitoring may be necessary to call forth behaviors that are consistent with routine performance; cf. Postrel and Rumelt, 1992). Very different microfoundations may underlie these different processes. An additional source of heterogeneity is that the high-level routine (or collection of routines) characteristic of a capability suggests that the construct may primarily involve a performative aspect (an organization putting knowledge or resources into action at a place in time), whereas a basic or low-level routine has both performative and ostensive aspects (Feldman and Pentland, 2003).

Taken together, differences in routines and capabilities are likely to have implications for their respective microfoundations. It is readily seen that the explanatory tasks ahead are almost forbiddingly complex. The sheer complexity of “explaining routines and capabilities” surely warrants partial

approaches, that is, explaining a well-defined aspect of a routine (properly defined) in a clear and transparent manner, drawing on select insights from extant literature. We know of rather few such exercises (for some examples, see Rumelt and Postrel, 1992; Cohen and Bacdayan, 1994; Egidio and Narduzzo, 1997; Feldman and Pentland, 2003; Danneels, 2011). It also calls for explorative, small-N research, in addition to formal model-building. In the following we seek to build a roadmap for such work by mapping the microfoundations of routines and capabilities in terms of three important constituent components.

BUILDINGS BLOCKS: INDIVIDUALS, PROCESSES, AND STRUCTURE

What, then, are the microfoundations of routines and capabilities? Strictly speaking, the question is not well specified. First, as noted above, there is considerable variation in what we seek to explain—and such variation may have explanatory consequences. For example, does explaining basic operational capabilities require the same microfoundations as explaining dynamic capabilities? Such variations in routines and capabilities also suggest that different microfoundations are relevant. Second, “microfoundations for routines and capabilities” can refer to a number of conceptually different processes, namely the emergence of routines and capabilities, but also their maintenance/reproduction, change, and possible displacement. Understanding these different processes may require different microfoundations. It is therefore reasonable to expect substantial variation in the constituent components comprising adequate microfoundations simply because the explanandum phenomena are so diverse.

Nevertheless, as a starting point, we suggest that the microfoundations of routines and capabilities can be clustered into three core or overarching categories: (1) individuals, (2) processes and interactions, and (3) structure and design. As noted above, these categories are embedded in a temporal (and even causal) hierarchy. In addition, while we suggest that each category may have main effects on routines and capabilities, each category does not operate in a vacuum. Instead, they are enmeshed in

different interactions within an organization (individuals and individuals; individuals and processes; etc.). As a result, interactions within and among categories form a second set of effects that contribute to the collective phenomena of routines and capabilities. Detailing the interaction effects explicitly within and across each category however introduces an additional layer of complexity. To the extent that enacting processes within organizations requires individual action and that this action occurs within the social structure of an organization, we devote more attention to the role of interaction effects when discussing how processes may affect routines and capabilities.

Our focus on the above three categories is informed by multiple, distinct, streams of work in strategy and organization theory. First, theoretical and empirical work highlights the importance of individuals and their interactions in explanations of firm-level heterogeneity and outcomes (e.g., Coff, 1999, 1997; Collins and Clark, 2003; Mackey, 2005; Madsen, et. al., 2003; Mehra, Kilduff and Brass, 2001; Tsai and Ghoshal, 1998). Drawing on the behavioral theory of the firm (e.g., Cyert and March, 1963) and psychology (e.g., Tversky and Khaneman, 1974), other work shows that managerial (individual) cognition contributes to differences in managerial and/or firm behavior (e.g., Gavetti, 2005; Helfat and Peteraf, 2010; Johnson and Hoopes, 2003; Laureiro-Martinez, Brusoni and Zollo, 2010; Tripsas and Gavetti, 2000). Second, other research considers the processes underlying routines and capabilities. Several studies in this area highlight the different aspects of routines (such as cognitive, structural and performative) (e.g., Cohen, 1991; Cyert and March, 1963; Feldman and Pentland, 2003; Pentland and Feldman, 2008) whereas the related work on capabilities explores how processes and event sequences contribute to capabilities and their development (e.g., Maritan and Peteraf, 2007; Salvato, 2009; Zollo and Winter, 2002). Related research, applying an evolutionary lens, also shows that knowledge, experience, learning processes, and a firm's history underlie a firm's capabilities and practices (e.g., Argote and Darr, 2000; Darr, Argote and Epple, 1995; Klepper, 2002; Klepper and

Simons, 2000; Nelson and Winter, 1982; Pisano, 2000; Rerup and Feldman, 2011; Winter, 2000). In addition, some work on the knowledge-based theory of the firm (e.g., Grant, 1996; Argote, 1999) underscores the role of *individuals, processes, and interactions* in the development of organizational level constructs. Last, additional work emphasizes the importance of structural aspects of organizations, such as integration and coordination mechanisms, in the emergence of capabilities (e.g., Clark and Fujimoto, 1991; Fujimoto, 1989).

Thus work in strategy, organization theory and organizational behavior spans, and is informed by, multiple theoretical areas related to the three primary microfoundations identified above. As such, a comprehensive review of the extant empirical literature at each level of analysis and for each microfoundations category is beyond the scope of this brief essay. Instead, we highlight examples of work that informs our understanding of the microfoundations of routines and capabilities (see Table 2). As a result, and for the sake of brevity, we may leave out work that is complementary but speaks less directly to the development of routines and capabilities.⁶

Furthermore, given our multi-level focus, we recognize that studying micro-level phenomena benefits from both aggregating microfoundational components as well as disaggregating routines and capabilities over time within an organization. As a consequence, studying microfoundations may benefit from these two paths of analysis—aggregating from microfoundational components to collective (organization) level constructs and disaggregating collective (organization) level constructs into their constituent microfoundations. In addition, organization or collective-level phenomena may be affected by the context, or macro social structure, in which an organization is embedded (or phenomena at level

6. For instance, work in domains such as organizational behavior, psychology, social psychology, sociology, and organizational anthropology may complement a micro-origins view, albeit from different angles. Classic works in organization theory also may provide additional insights into each category of micro-origins (such as, March and Simon, 1958; Cohen, March and Olsen, 1972; Thompson, 2003; Cyert and March, 1963; Simon, 1947, 1991). Future work might: 1) take a deeper dive in explicating the conditions under which the streams of work in these domains inform the collective constructs of routines and capabilities and 2) provide a detailed mapping of the classic works to micro-origins.

N+1). Consistent with our micro-level focus, however, the formal boundaries of an organization condition our line of inquiry.

The Role of Individuals

Consistent with Teece's (this issue) call for studying 'entrepreneurial management' to understand how sensing and seizing opportunities arise, the role of the individuals is crucial to understand routines and capabilities. A simplistic way to think about organizations is as an aggregation of the individuals that compose them. Certainly, individuals—for example, in their capacities as managers or "star scientists"—may matter greatly to the behavior and evolution of organizations (e.g., Felin and Hesterly, 2007; Miller and Sardais, 2011; Hess and Rothaermel, 2011). From this perspective individuals in organizations serve as microfoundations of routines and capabilities in various ways. Individual-level components, such as choices and agency, characteristics, abilities, or cognition are one of many important building blocks for understanding collective phenomena such as routines and capabilities. First, behavioral theory emphasizes that individuals make choices that are more or less informed, and more or less rational. In addition, individuals, as agents in organizations, may have divergent goals and interests that influence their choices. These choices are informed by the cognition and beliefs of agents. Second, individuals bring different human capital (skills, knowledge, experience), and characteristics to an organization. Variation in these dimensions may influence the routines and capabilities that arise from organizational members and their interactions. We consider these points in turn.

Behavioral and psychological foundations. Work on the behavioral theory of the firm directs attention to the role of individuals in explaining organizational outcomes. In fact, Herbert Simon argued that "*nothing* is more fundamental in setting our research agenda and informing our research methods than our view of the nature of the human beings whose behavior we are studying" (1985: 303, emphasis

added). But while the behavioral theory of the firm focused on individual-level considerations (for an overview, see Felin and Foss, 2009), the intervening decades have seen less emphasis on these factors. As recently noted by Gavetti et al., research has been “considerably less focused on linking individuals’ interests and cognitions to organizations’ actions and decisions” (2007: 524). A central question, then, is the origins of individual-level factors such as beliefs and expectations and how these in turn are aggregated to the collective level. In other words, if organizations are composed of “individuals and groups whose preferences, information, interest, or knowledge differ” (March and Simon, 1993: 2), then there is a need to first specify these differences, their origins, and then to discuss the underlying factors through which heterogeneous beliefs are aggregated toward organization-level activity (cf. Simon, 1962). We address each question in turn.

Perhaps there is no better place to start the analysis of individual-level factors than with the notion of “bounded rationality.” However, as noted by Argote and Greve, “rationality is a lot like ancient Rome – all roads lead to it” (2007: 337). In other words, a proper understanding and specification of rationality is central to any inquiry related to organizations. On this front, behavioral theories have focused on the experiential and learning-related aspects of rationality. Individuals and actors take local actions and, over time, learn about the nature of the environment as they gain feedback and experience. This learning is bounded by the cognitive limitations of actors and by their experiential data. This experiential learning is a central facet of routines (given the emphasis on repetition) and even the basis of developing a capability.

However, while the experiential boundedness of rationality is important to recognize (particularly as a contrast to models that feature omniscience), nonetheless there are also factors outside experience that play a central role in individual and organizational behavior (for an overview, see Felin and Foss, 2011; also see Grandori, 2010). For instance, actors have creative, forward-looking capacities

in generating novel solutions to problems, by imagining novel options, theorizing the future and so forth (cf. Amabile and Gryskiewicz 1987; Sternberg, 1999). There also are forward-looking aspects to the formation of beliefs. These forward-looking capacities are to a large extent enabled by experience; thus, individuals may leverage their histories while building new knowledge based on forward looking activity.

Gavetti and Levinthal (2000) contrast these forward-looking, cognitive aspects with backward-looking, experiential facets associated with the behavior of firms. Thus actors do not only rely on experiential data, which may lead to myopia, but they may also engage in cognitive efforts to envision future scenarios and strategies outside their context. This is particularly likely (and important) when there is little experience to draw on, as is the case with de novo startup organizations (for an overview, see Felin & Zenger, 2009) or when a transformation in industry conditions makes experience irrelevant.

Thus cognition represents an important stream of research related to bounded rationality and strategy (e.g., Fahey and Narayanan, 1989; Jenkins and Johnson, 2003; Porac et al., 1989; Spender, 1989; Stubbart, 1989; also see Barr et al., 1992; Walsh, 1995). This stream of research is vast, cutting across multiple levels of analysis and covering a breath-taking range of concepts (for a recent overview, see Kaplan, 2011). Scholars have examined how individual firms perceive themselves within industries (Porac et al., 1989; Spender, 1989) and how various demographic characteristics of top management teams lead to different cognitive orientations (e.g., Finkelstein and Hambrick, 1990). But, direct measures of cognition are lacking (cf. Markoczy, 1997). As a consequence, few studies examine how differences in managerial cognition and in managers' beliefs and expectations about the future aggregate or reconcile in an organization (cf. Walsh and Fahey, 1986; Tripsas and Gavetti, 2000) and in turn, how this process affects routines and capabilities.

Overall, extant empirical work says less about how the internal states of individuals, and in

particular, their various psychological processes (such as subconscious routines or habits, procedural memory, and transactive memory), affect their choices and in turn, an organization's routines and capabilities (see March and Simon's (1993) thoughtful discussion of the internal states of human actors). Huy's (2011) recent single-case study is an important exception, which shows how individual, middle manager's emotions, caused by organization-level actions, have a direct bearing on the implementation success. Hence, individuals may invoke various psychological processes when carrying out their parts in the development, modification or enactment of organizational routines or capabilities (see also Cohen, this volume). In addition, individuals' internal states adapt and evolve over time. It follows then that examining whether and how individuals' psychological processes affect organizational routines and capabilities is important to a microfoundations inquiry.

The microfoundations inquiry might also benefit from recent advances in social psychology, where the unconscious thought theory has been proffered to explain that "deliberation without attention" is of crucial importance in complex decisions (e.g., Dijksterhuis, Bos, Nordgren, and Van Baaren, 2006). In a variety empirical settings, work by Dijksterhuis and colleagues shows that individuals who rely on unconscious thought (also referred to as "sleeping on it") arrive at better decisions for a variety of complex tasks relative to conscious thinkers as a result of the latter attributing inappropriate weight to elements less influential to the outcome of the decision. For a field generally assuming bounded rationality, these insights raise important questions for studying microfoundations of organizational routines and capabilities: To what extent does unconscious thinking influence managerial choices and organizational outcomes? When do emotions interfere or reinforce unconscious deliberation by decision-makers within the firm?

The second question of interest relates to how the above, cognitive and psychological factors are aggregated in social settings. Organizations are often treated as unitary actors without explicit attention

to how individual-level factors aggregate. For example, if individuals in organizations have different beliefs and expectations about the future, how are these aggregated? Early behavior theories made this aggregation a specific focus. March, for example, begins with the premise that “the composition of the firm is not given; it is negotiated. The goals of the firm are not given; they are bargained” (1962: 672).

The question of aggregation of course is difficult as there are likely to be many “emergent” and interactional effects that are hard to predict based on knowledge of the individual components (cf. Dansereau et al., 2001). Though, scholars have for example looked at, for example, top management team “negotiated beliefs structures” (Walsh and Fahey, 1986) where aggregation necessarily is dealt with. But additional work is needed on how heterogeneous individuals, with conflicting information, resolve these differences in the process of making decisions about strategy. And to the extent that the selection of routines and capabilities can be understood as a rational choice between clearly defined alternatives, scholars might also draw insights from, for example, social choice theorists (Sen, 1999).

Characteristics and abilities. It is widely accepted that the heterogeneity of individuals matters (e.g., Blumberg and Pringle, 1982; Mowday and Sutton, 1993; O’Reilly, 1991). At the most basic level, this includes variation in what individuals bring with them to an organization, such as characteristics (e.g. gender, IQ); values, preferences and beliefs (e.g., risk preferences, self-efficacy); and knowledge and experience (e.g., education level, job tenure) (Felin and Hesterly, 2007; Madsen et al., 2003; Molloy et al., 2011; Zenger, 1992). In short, the human capital of individuals can vary significantly and this has important implications for the nature of organizational routines and capabilities.⁷

Another level of heterogeneity, then, lies with differences in individuals’ skills or abilities, some that are more general in nature, and others that are more *specific* to creating, developing, modifying, and enacting routines and capabilities. The category of general skills and abilities includes elements that may

7. Work how different types of individuals (leadership, entrepreneurs) shape organizations may also inform this line of inquiry.

affect a capability or routine indirectly. For instance, since routines involve patterns of interdependent actions carried out by multiple actors, an individual's ability to engage or interact with other individuals (relational ability) or to integrate different elements such as knowledge or artifacts (integration ability) may affect the execution and outcome of a routine or capability. Alternatively, specific skills or abilities such as creating, forecasting, or sensing, may directly influence the development and modification of routines and capabilities.

Work on routines and capabilities often abstracts away from micro-level elements such as individual level abilities and skills. Indeed, the literature on collective and organizational knowledge contains many explicit statements that individual-level elements simply do not matter in our study of routines and capabilities and performance (for an overview, see Felin and Hesterly, 2007: 197-198; see Kogut and Zander, 1992; Nahapiet and Ghoshal, 1998; Nelson and Winter, 1982; Spender, 1996). On the other hand, other scholars argue that individual skills and abilities are central for understanding organization level outcomes (e.g., Abell et al., 2008; Grant, 1996; Simon, 1991). One litmus test for the importance of individual skills and abilities lies with the mobility of individuals. Are organizational routines or capabilities affected if individuals leave or enter an organization? Evidence suggests that employee mobility has significant and varying effects on organizations (Agarwal et al., 2011; Ganco and Agarwal, 2010; Corredoira and Rosenkopf, 2010; Madsen et al, 2003; Rao and Drazin, 2002; cf. Zenger, 1992; 1994), leading some scholars to pinpoint individuals as the fundamental locus of knowledge in organizations (e.g., Corrediora and Rosenkopf, 2010).

While work on individual-level characteristics, abilities, and human capital has received increasing attention in the strategy literature (e.g., Youndt et al., 1996; Hitt et al., 2001; Adner and Helfat, 2003; Madsen et al., 2003; Hatch and Dyer, 2004; Ployhart and Moliterno, 2011; Rothaermel and Hess, 2007), more work is needed to explicitly tease out how individual-specific stocks or attributes

affect routines and capabilities. For example, a focus on the individual level raises particularly sticky questions about not just the creation of value but also the appropriation of value (Coff, 1999; 2010). If organizational capabilities can be imputed to individuals (such as stars – cf. Groysberg, 2009), under what conditions would these individuals be able to appropriate the value of their skills (Henderson and Cockburn, 1994)?

A microfoundational approach then asks for scholars to more carefully study those characteristics that matter most for the operation of routines and the building of capability. Many opportunities exist for linking strategy research with rigorous research in organizational behavior and applied psychology. Indeed, scholars have begun to assess what characteristics and factors might be most relevant for this type of multi-level analysis (cf. Molloy et al., 2011). For example, the study of Big 5 personality characteristics has a long history in organizational behavior; opportunities exist for bridging this work with work on aggregate, interactional and emergent organizational behavior. Routines and capabilities, in other words, might be crucially dependent on the characteristics of individuals involved. This question has also begun to interest strategy scholars whose work focuses directly on the role of human capital and competitive advantage (Coff and Kryscynski, 2011).

In all, individual-level elements, such as choices and agency, and characteristics, cognitions and abilities, are an important building block for understanding collective phenomena such as routines and capabilities. Of course, microfoundations naturally also involve important processes of interaction and aggregation, which we discuss next.

Processes and Interaction

As noted by Winter (this issue), it is hard to tease out the “origins” of routines and capabilities without reference to the historical and contextual factors that clearly play a role in the operation of routines and development of capability. Time-dependent processes necessarily inform routines and

capabilities in two fundamental ways. In the simplest sense, a process is a sequence of interdependent events; this baseline definition maps directly to the definition concept of routines. Second, putting processes into action requires the intervention of individuals. Thus, interactions among individuals and processes within organizations may provide insights into how capabilities and routines emerge. These process-based origins of routines and capabilities are strongly evident in extant and emerging empirical work (e.g., Becker, 2004; Maritan and Brush, 2003; Pentland and Rueter, 1994; Heimeriks and Duysters, 2007; Salvato, 2009).

The following expands on the different types of process-based routines. We begin by identifying the baseline categories and their potential effects on routines and capabilities. Next, we clarify how processes and interactions may affect routines and capabilities by discussing a firm's methods for coordination and integration and the role of technology and artifacts in organizational activities.

Different types of process-based routines exist. First, as noted in the routine definition section, routines may be more or less designed but vary in their deployment -- some require strict adherence to the underlying process whereas others involve processes that allow for flexibility or adaptation. Each approach has different implications for routines and capabilities. Routines that arise from rigidly designed processes may result in limited variation at the organizational level. In contrast, routines that allow for managerial discretion in execution (or modification by those who carry out activities "in" the routine) may result in variation in the focal routine over time and thus, heterogeneity among firms (e.g., Hoopes and Madsen, 2008). A third type of process-based routine unfolds in a stochastic or blind manner, such as trial and error learning. In this case, the core components of the process, and their relationships, are defined but the stochastic nature of the process may yield variance in outcomes (Miner, 1994; Nelson and Winter, 1982). A fourth category of processes involves *ad hoc* problem solving. However, such processes are not "highly-patterned" or "repetitious" and therefore, typically do

not fall within traditional conceptions of routines (Winter, 2003: 991).

Work has explored these different types of process-based routines using a range of methods (see Becker, 2005). For instance, following 1,300 auto-manufacturing employees over four months using a large-scale, single firm approach, Arthur and Huntley (2005) showed how a deliberately designed improvement program lowered production costs through the use of employee suggestions. Using a lab experiment, Cohen and Bacdayan (1994) illustrate how changes in elements associated with a process-based routine negatively impact team-level efficiency. One conclusion from this study is that individuals may store routines as procedural memories; thus, changes to a routine may not necessarily yield the expected outcome. In a field study exploring adaptive or flexible learning processes, Miner, Bassoff and Moorman (2001) found that creative outcomes emerged via repeated, sequenced behaviors that were recombined over time. Other recent work provides inspiration for understanding how individuals may shape such processes and in turn, affect heterogeneity in performance among firms (e.g., Johnson and Hoopes, 2003; Gary and Wood, 2010). In addition, other work uses an agent-based simulation approach to study the formation of traffic conventions (which side of the road to drive on) when agents follow habits (Hodgson and Knudsen, 2004). Such work emphasizes that, like traffic conventions, routines have a strong coordination aspect (who should take which actions at which point of time?). This work suggests that iterative coordination games, with explicit assumptions about agents' behaviors, represent one promising way of studying routine emergence. Such an approach allows for agents that are fully rational, but have difficulties coordinating on two (or more) equilibria with identical payoffs (Crawford and Haller, 1990). Thus, different modeling approaches exist that can supplement existing, more descriptive approaches to routine emergence and change (such as Feldman and Pentland, 2003). Because of the sheer diversity of routines and capabilities, their multiple dynamic aspects (emergence, maintenance, decay, etc.) and the many different models of choice and agency, the application of many

different analytical approaches is clearly warranted.

Methods of coordination and integration. The formal, or informal, interactions between individuals and processes within a firm shape its routines and capabilities in critical ways. Various studies find that both formal (e.g., rules, standard operating procedures) and informal forms of coordination (e.g., experience, norms, values) influence sequences of interdependent events or actions (e.g., Becker, 2004). A host of studies have analyzed a variety of formal coordination processes both within (e.g., Argote, 1982; March, Schultz and Zhou, 2000; Reynaud, 2005) and across organizational boundaries (e.g., Ariño and Reuer, 2004; Mayer and Salomon, 2006; Hoetker and Mellewig, 2009). For example, in a study of 126 offshored processes, Srikanth and Puranam (2010) find that modularization, ongoing communication, and tacit mechanisms are three distinct coordination processes that have critical performance consequences. Other work illustrates how formal processes support the integration of different organizational elements such as individuals, teams, departments, or cross-functional knowledge resources (e.g., Fujimoto, 1989; Henderson and Clark, 1990; Hoopes and Postrel, 1999; Iansiti and Clark, 1994). Such integrating mechanisms facilitate cooperation and coordination among members of an organization (Lawrence and Lorsch, 1967). In this way, these mechanisms play a critical role in shaping the collective constructs of interest (see Hoopes and Madsen, 2008, for a review).

Beyond these formal types of coordination methods, other work explores the more informal aspects of coordination at multiple levels of analysis. For example, within organizations, work has examined how experiential learning (e.g., Lounamaa and March, 1987), trust (e.g., Szulanski, Cappetta and Jensen, 2004), and culture (e.g., Wilkins and Ouchi, 1983) affect coordination. At the supra-organizational level, a recent study found institutional antecedents critically influence firm capabilities (see e.g., Suddaby, Elsbach, Greenwood, Meyer and Zilber, 2010). Two related studies show how institutional processes and processes fostering transitional identities impact respectively acquisitive

behavior (Marquis and Huang, 2010) and interaction between merged entities (Clark, Gioia, Ketchen, and Thomas, 2010). Indeed, both conceptual (e.g., Dunning and Lundan, *forthcoming*) and empirical studies have shown that institutional norms matter to capability development (Jacobides and Billinger, 2006; Fauchart and Von Hippel, 2008).

While formal and informal coordination mechanisms may constrain or enable individual action, they raise important questions regarding the role of microfoundations. For instance, to what extent can stability and flexibility in recurring action patterns be nurtured through deliberate collective level rules (e.g., Pentland and Rueter, 1994)? And to what extent do routines and capabilities benefit from being rigid versus flexible? And, what is the role of particular individuals within these routines? Does, for example, mobility impact the execution and stability of informal and formal processes?

Technology and ecology. Another type of interaction that occurs between individuals and processes involves a firm's technology and ecology. The role of technology and (the use of) templates feature prominently in the "copy-exactly"-approach as posited by Szulanski and colleagues (e.g., Winter and Szulanski, 2001; Szulanski and Jensen, 2006). A related stream of research examines the role of technologies in shaping organizational outcomes. For instance, the use of specific technologies has been found to structure social interaction among medical specialists (Barley, 1986) and positively influence learning rates in financial services firms (e.g., Ashworth, Mukhopadhyay and Argote, 2004). Relatedly, the implementation of new technologies critically hinges on the team learning process as Edmondson, Bohmer and Pisano (2001) illustrated in their study of 16 hospitals. Other research stresses the role of "situated learning," suggesting that problem-solving hinges on individual interactions with technology in context (Tyre and Von Hippel, 1997).

Regarding ecology, a multitude of material items that individuals interact with inside an organization influence organizational routines and capabilities (cf. Gagliardi, 1992). Such items could

involve physical workspace and serve to reveal information and reinforce behavior. For instance, a recent study by Pentland and Feldman (2008) shows the limitations of material artifacts in designing organizational routines. Similarly, analyzing the effect of colors in material objects, Rafaeli and Vilnai-Yavetz (2007) illustrate how the painting of a public transportation company was influenced by employee emotion.

Though more insight has been generated over the past years into the role technology and ecology play in shaping routines and capabilities, this area remains important and promising. Interestingly, proposing a two-dimensional typology of artifacts, Cacciatori (this issue) demonstrates how an emerging system of artefacts shapes patterns of action in a British engineering consulting firm. Yet, given that technologies and artifacts themselves are easily imitable, how can firms shape the process between individuals, technology, and ecology to optimize routines and capabilities?

Structure and Design

Structure and design also pertain to the microfoundations of routines and capabilities. Structures specify constraints within which action, choice and agency occur and also, the forms of interaction that may, or may not, occur within organizations. Organizational structure and design naturally also *enable* the efficient processing of information, the utilization and exchange of knowledge and ideas, and the development of expertise.

The role of structure in studying microfoundations of routines and capabilities is not confined to the level of the organization but also relates to individual-level heuristics (e.g., Tripsas and Gavetti, 2000; Gavetti, Levinthal and Rivkin, 2005). Related emerging work addresses the role of “structure” as shaping the microfoundations of routines and capabilities. In a recent multiple case study, Bingham and Eisenhardt (2011) show that as firms gain task experience, executives involved changed the structure of heuristics, thereby simplifying the decision rules underlying internationalizing decisions. Similarly,

albeit at an alternative level of analysis, a broadly conceived institutional theory (with links to both economics and sociology) examines the role of “choice-within-constraints” in disparate regulatory and societal contexts (Ingram and Clay, 2000). In the organizational literature Marquis and Huang (2010) demonstrate, studying the U.S. commercial banking industry over the period 1978-2001, how founding conditions and institutional changes influenced banks’ not only their capability development but also the likelihood to engage in acquisitions which critically affected the structure of individual banks. Still other recent work points to managerial roles in understanding the need for flexible versus rigid structures in uncertain environments. For instance, using a simulation design, Davis, Eisenhardt and Bingham (2009) suggest that leveraging ‘simple rules’, which combine improvisation with rules, is especially critical for established, relative to entrepreneurial, organizations.

Consistent with this finding, a related stream of research considers the “structure” in decision processes. For instance, the degree to which component elements of prior experience are similar or dissimilar critically influences performance in acquisitions (Haleblian and Finkelstein, 1999; Zollo, 2009). Interestingly, the role of individuals in acquisition decisions has been found to constrain such outcomes through managerial hubris (Hayward and Hambrick, 1997; Haleblian and Finkelstein, 1999) and outside advisor experience has been shown to critically reduce the firm’s likelihood to overpay for acquisitions (Kim, Haleblian & Finkelstein, 2011).

Other studies explicitly link hierarchical structure to organizational routines and processes (e.g., Grandori, 2010). The role of hierarchy and its relationship to operational routines also is well established in the literature (e.g., Knott, 2001; Gavetti, 2005). Formal organizational structures are also reflected in an organization’s design (e.g., Pugh, Hickson, Hinings, Turner, 1968; Galbraith, 1979; Mintzberg, 1983). Recent studies show that organizational design critically influences a firm’s internal decision-making processes (Knudsen and Levinthal, 2007) as well as a firm’s ability to adjust to its environment

(e.g., Siggelkow and Rivkin, 2005).

Overall, while emerging work suggests that more *and* less structure may be crucial to capabilities supporting heterogeneous tasks (e.g., Davis *et al.*, 2009), the role of structure in shaping microfoundations of organizational routines and capabilities is an important area for research. Diving into the antecedents that cause firms to “overstructure” can help reveal how to both constrain and nurture the components which advance organizational routines and capabilities.

Summary

The preceding sections identify and discuss three categories of microfoundations relevant to organizational routines and capabilities – individuals, processes, and structure –, as well as some important unanswered questions and areas for exploration. Undoubtedly, we have not identified *all* relevant research questions. However, by specifying categories for inquiry, we view this essay and issue as a first step in defining a research agenda for work on the microfoundations of routines and capabilities.

In defining the agenda, we highlight theory and empirical work that, although not directly addressing the microfoundations of routines and capabilities, may nevertheless inform the exploration of each foundation. It is clear that multiple, disparate lenses can be applied to the study of microfoundations associated with routines and capabilities. The same variety obtains with respect to the research designs and methods. These range from analytical methods (Abell *et al.*, 2008), simulations (e.g., Narduzzo, 1997; Hodgson and Knudsen, 2004) and experiments (Cohen and Bacdayan, 1994) to various quantitative and qualitative empirical approaches, such as process methodologies or more descriptive anthropological techniques (see Feldman and Pentland, 2003; Eisenhardt, Furr and Bingham, 2010). Given the fragmented and scant nature of knowledge on the microfoundations of routines and capabilities, the sheer diversity of routines and capabilities, the many aspects of routines and capabilities

that can be studied (emergence, maintenance, decay, etc.), and the many candidate microfoundations, it is seems clear that no methods or approaches can claim any primacy. The study of the microfoundations of routines and capabilities thus would indeed seem to privilege a healthy methodological anarchism or pluralism. Nonetheless, the theoretical and empirical variety is not a call for labeling any component a microfoundation of a routine or capability. Instead, we offer three categories of microfoundations and their interactions as a starting point for defining the scope of an initial research agenda. Importantly, ensuring that future work is more accretive than fragmented requires considering, and building on, the extant and emerging work in this area of inquiry. It is in this spirit that we now briefly discuss what we see as the main issues in the study of the microfoundations of routines and capabilities, and do so in the light of the papers in this Special Issue.

OPENING THE BLACK BOXES OF ROUTINES AND CAPABILITIES:

THE ARTICLES IN THIS SPECIAL ISSUE

Opening Up the Black Boxes

Our plea for robust research on the microfoundations of organizational routines and capabilities is motivated by fundamental explanatory, predictive and managerial concerns. Despite decades of work on routines and capabilities, several black boxes underlying these constructs remain ripe for exploration. Undeniably, a plethora of work in various disciplines and management fields (organizational behavior and theory, strategy, technology management and so on) is relevant to opening up these black boxes. However, the relevant insights have not yet been systematically applied to the building of microfoundations for routines and capabilities. Arguably, this is the case, because the recognition that there may be a distinct need for building such foundations is a very recent one (Felin and Foss, 2005; Gavetti, 2005).

The concern is that work on organization and strategy that applies the routines and capabilities

constructs lack predictive and integrative theory of how individuals, processes, and structures, and their interactions, contribute to routines and capabilities. In addition, we know less about what types of microfoundations matter most for understanding routines and capabilities. We also lack an understanding of what types of microfoundations contribute to different types of routines and capabilities (see Winter and Szulanski, 2001; Szulanski and Jensen, 2006). From an empirical view, both qualitative and quantitative work is required to map microfoundations to routines and capabilities. For instance: What are the important dimensions along which the microfoundations differ? Under what conditions do specific microfoundations affect routines and capabilities? In addition, how do microfoundations relate to a hierarchy of capabilities? Do particular microfoundations dominate at one level of the capability hierarchy? Such questions may benefit from in depth field work as well as robust empirical testing. It follows that expanding theoretical and empirical analysis may enhance our understanding of the sources of competitive heterogeneity.

The Articles and Essays

The specific goal of this Special Issue is to open up the black boxes underlying routines and capabilities. The papers in this Special Issue indeed make significant progress on this goal. The subsequent section identifies the contributions of each article in the context of the microfoundations categories.

Individuals: Actions. Focusing specific attention on individual actions and their repetition over time, Pentland, Feldman, Becker and Liu (this issue) bridge micro-level actions and patterns of action to macro-level dynamics of routines. In their theory and associated simulation model, evolutionary processes of variation, selection and retention are levers that can be used by managers to shape the dynamics of routines. This approach provides insight into the processes and activities that produce sequences of actions as well as the contexts in which different sequences of actions are produced. As a

result, the model provides a novel understanding of “what” routines are and in turn, how they can be sustained or changed. The paper also contributes to the process category of microfoundations given its explicit attention to the interconnections among variation, selection and retention (VSR) as well as the processes associated with each component of the VSR process.

Individuals: Attributes, experience and agency. Four studies highlight the role of individuals as microfoundations of routines or capabilities. First, Paruchuri and Eisenman (this issue) study the role that mergers play in shaping inventor networks and productivity and in turn, how inventor networks may affect capability development. Their study suggests that the motivations and attributes of inventors and scientists are microfoundations for R&D capabilities. Shifting attention to the role of experience, Turner and Fern (this issue) show how individuals’ experiences influence routine performance in a novel context—4,378 garbage collection route sequences spanning 7-month in the City of San Diego. The study demonstrates that an individual’s experience is a source of stability and variability in routine performance. They also find that both increases and decreases in contextual constraints (e.g., respectively city street congestion and city-observed holidays) cause divergence in routine performances. Interestingly, their work stresses that experienced individuals are more likely to be responsive to contextual change than less experienced individuals. A third study focuses on the role of agency and human capital. Wang and Wong (this issue) consider employees’ incentives to make firm-specific human capital investments in the presence of risky projects. The organizational economics literature suggests that the risk that managers may shut down such projects is detrimental to employee incentives to invest in human capital. This allows Wang and Wong to provide an intriguing reinterpretation of managerial escalation of commitment; specifically, they argue it may be a result of an intentional commitment strategy for the purpose of safeguarding human capital investments rather than a value-destroying organizational phenomenon. They build a formal model that encapsulates this idea and

confirm the model's predictions using an experimental approach.

Individuals and organizational structure. Shifting attention to capabilities, Mäkelä, Höglund, Sumelius and Ahlvik (this issue) examine individual determinants of strategic HR capabilities in subsidiaries of multinational corporations. They identify three different sources of microfoundations for an organization's strategic HR capability, the experience and formal training of subsidiary HR managers, the social capital held by subsidiary HR managers, and the social capital held by corporate HR managers. As a result, a central contribution of this study is that capabilities may arise from different sources of microfoundations operating at different levels in an organization and from the interactions of individual within and across and levels in an organization.

Individuals, interactions and artifacts. Two other articles explicitly consider how the interactions between individuals and between individuals and artifacts affect the design and performance of routines. For instance, Bapuji et al. (this issue) examine a specific type of routine, "towel changing" in hotels. They show how artifacts, different individuals' intentions (hotel staff, customers), and the interaction between different individuals and artifacts shape the efficacy and evolution of the routine. A novel combination of field and survey work offers a window into how routines are constituted by artifacts, heterogeneous actors, and their interactions and intentions. Second, using a longitudinal case study at a British engineering consulting firm, Cacciatori (this issue) examines how artifacts may affect the evolution of new routines. Studying the evolution of an excel worksheet within the firm, her work reveals how the bundling of artifacts led the firm to develop new patterns of action among the agents involved. Her research design also provides insights into different types of artifacts and raises questions regarding how such heterogeneity may affect routines. More specifically, she emphasizes the need to separate 'speaking' (i.e., representation of knowledge in visual or written form, e.g., manuals) and 'silent' artifacts (i.e., physical materials that embody knowledge, e.g., furniture) and she suggests that

work should consider the influence *systems* of artefacts rather than single artefacts in isolation.

Processes and individuals. The paper by Miller, Pentland and Choi (this issue) links up with the Feldman and Pentland (2003) distinction between the ostensive and performative aspects of routines. They note that participants' understandings of routines are partial, idiosyncratic, and distributed, and that the research literature has not yet systematically examined the general absence in organizations of a "shared holistic ostensive routine." To get an analytical grip on the dynamics of routines and situated learning, given the absence of such a routine, they start from the notion that individuals store "know-how" in procedural memory, "know-what" in declarative memory, and "know-who" in transactive memory. Examining memory formation during collaborative problem-solving help the authors clarify the nature of the ostensive aspect of organizational routines and its connection to the performative aspect. Using an agent-based modeling approach to simulate routine, they not only model the formation of new routines, but also and changes in established organizational routines resulting from loss of personnel (due to downsizing) and changes in environmental demands. The essay by Argote and Ren (this issue) also discusses "transactive memory systems" —knowing who knows what within the organization—shapes organizational learning and the development of organizational capabilities.

Our goal with this special issue was also to engage in some direct debate on whether microfoundations and a focus on individual-level factors indeed was central for understanding routines and capabilities. On this front, two essays—by Sidney Winter (this issue) and Geoffrey Hodgson (this issue)—offer a welcome critique of the microfoundations program. Winter places a specific emphasis on the temporal dynamics associated with capability development, and he thus questions whether we should focus on individuals and aggregation or more simply on historical patterns and evolution. Geoffrey Hodgson offers some historical perspective on the microfoundations program and argues that it failed in economics, and raises additional concerns related agency and multiple levels of analysis.

Alternatively, David Teece (this issue) emphasizes the necessity to dig into the characteristics of the top manager and entrepreneur and the processes they initiate to shape the firm's dynamic capabilities.

Advancing the term 'entrepreneurial managerial capitalism', he proposes to go beyond studying start-up activities and role of the entrepreneur and focus on analyzing non-routine activities and leadership skills which are often context- or even enterprise-specific.

CONCLUSION

Our goal with this Special Issue has been to open up the black boxes underlying routines and capabilities. Having laid out the importance of the microfoundations project, we have argued that there are particular opportunities to explain the microfoundations of routines and capabilities by analytically focusing on three primary categories, (1) individuals, (2) processes, (3) structure, and (4) the interactions within and among these categories. The Special Issue is not necessarily meant as an indictment of extant work that relates to routines and capabilities, but intended to highlight opportunities in decomposing routines and capabilities in an effort to better understand their origins and evolution. We believe that the papers and essays within this Special Issue offer a unique theoretical and methodological window into how future work might proceed in understanding the microfoundations of routines and capabilities.

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