JOURNAL OF MANAGEMENT STUDIES

Journal of Management Studies 49:8 December 2012
doi: 10.1111/j.1467-6486.2012.01052.x

Microfoundations of Routines and Capabilities: Individuals, Processes, and Structure

Teppo Felin, Nicolai J. Foss, Koen H. Heimeriks and Tammy L. Madsen

Brigham Young University; Copenhagen Business School and Norwegian School of Economics; Erasmus University; Santa Clara University

ABSTRACT This article introduces the Special Issue and discusses 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. 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.

Keywords: aggregation, microfoundations, micro-macro links, routines and capabilities

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. They 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 and capabilities, the underlying microfoundations or micro-level origins of these constructs have not received adequate attention. For example, Argote and Ingram note 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, p. 156; emphasis added). Although research has made progress on this issue since Argote and Ingram's statement, numerous questions remain regarding

Address for reprints: Koen H. Heimeriks, Department of Strategic Management and Business Environment, Rotterdam School of Management, Erasmus University, Burg. Oudlaan 50, 3062 PA Rotterdam, The Netherlands (kheimeriks@rsm.nl).

the micro-level origins of routines and capabilities (Abell et al., 2008; Argote and Ren, 2012; Felin and Foss, 2005; Gavetti, 2005; Salvato and Rerup, 2011; Teece, 2007).

A microfoundations approach focuses on collective phenomena that need explanation, specifically the creation and development, and the 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. A microfoundational approach, however, does not imply that collective level constructs cannot be part of the relevant explanation. Notably, a strong motivation for unpacking routines and capabilities in microfoundational terms is that this will advance our understanding of what drives differences in the behaviour and performance of firms. First, with microfoundations we can enhance our understanding of the primary components underlying routines and capabilities. Second, exploring how the 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 studies. Of course, understanding how routines and capabilities are built, maintained, extended, leveraged, adapted, and phased out in terms of their constituent microfoundations also 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 (see a review in Janssen, 1993). A micro emphasis was also central to Austrian conceptions of the economy and economic activity (e.g. Hayek, 1948). The notion of microfoundations is also informed by a long 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). Micro-level phenomena, specifically, individuals, processes, and structures, played a central role in the origins of management theory. For example, Barnard (1968, p. 139) argued that 'the individual is always the basic strategic factor of organization', whereas early work on the behavioural theory of the firm explored several microfoundational explanations of organizational heterogeneity (Cyert and March, 1963; March and Simon, 1958; for an overview, see Felin and Foss, 2009).

More recently, 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. Cohen and Bacdayan, 1994; Feldman and Pentland, 2003; Hoopes and Madsen, 2008; Miller et al., 2012; Salvato, 2003). 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 et al., 2007; 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, 2004; Gavetti, 2005; Heimeriks et al., 2012; Helfat and Peteraf, 2010; Rerup and Feldman, 2011; Salvato, 2009; Teece, 2007). Thus, situated at the nexus of the extant and emerging work, the goal of the Special Issue and this article 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 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) structure – 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 micro-foundation 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.[1] 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 organizational routine or capability as the focal level N, the focal level N in a microfoundations inquiry may represent any collective level.[2]

Similar to a genealogical hierarchy, each analytical level is influenced by lower level mechanisms or entities in time. For example, a (set of) microfoundation(s), may serve as causal explanations for the creation of a routine or capability (i.e. 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 (Garud et al., 2010; Vergne and Durand, 2010). It follows that some microfoundations may be temporally prior to others. As a result, an analysis of microfoundations considers both initial conditions and evolutionary processes.

In sum, for our purposes, the microfoundations of organizational routines and capabilities include constituent components (i.e. main effects) – individuals, processes, and structure; *and* interactions within and across components (i.e. interaction effects) – the interactions of individuals, processes, and structures that contribute to the aggregation and emergence of the collective constructs.

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. For example, population ecologists initially assumed uniformity among firms or members of populations (e.g. Hannan and Freeman, 1977). In studies of institutionalism, sociologists often portrayed individuals as 'cultural dopes' (Garfinkel, 1967, pp. 68–75; see also Coleman, 1990). Historically, economists have also suppressed micro-level variation by using assumptions of 'representative agents' (Kirman, 1992).

As fields progress, evidence suggests that assumptions about micro-level uniformity prove unsustainable and inaccurate. For instance, several studies on firm level experience or learning have unearthed micro explanations for variance in organizational behaviour or performance (such as individual experience, team experience, processes underlying practices, or interactions between individuals and technology) (e.g. Edmondson et al., 2001; Tyre and Von Hippel, 1997). Indeed, micro-level phenomena are often more idiosyncratic in nature than not (McKelvey, 1998). For example, there is vast heterogeneity in individual-level skills and abilities (Felin and Hesterly, 2007), and this variance contributes to differences in behaviour and performance among firms (e.g. Coff, 1997, 1999; Johnson and Hoopes, 2003). As a result, attention to micro-level sources of heterogeneity has contributed to theoretical debate and advancement in multiple fields or subfields, such as behavioural economics' critiques of conventional economics; (e.g. Camerer et al., 2005; Kahneman and Tversky, 1979) or institutional theory's call for more attention to the processes of micro-institutionalization or institutional work (Jennings and Greenwood, 2003; Lawrence et al., 2009; Powell and Colyvas, 2008). Advancing the understanding of particular phenomena and, in turn, a field, thus may require expanding theoretical and empirical work to encompass multi-level effects, including micro-level effects (e.g. Hitt et al., 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).

As a result, the call for understanding microfoundations is viewed in the context of scientific reduction and associated progress. Elster (1989, p. 74) indeed argues that 'reduction is at the heart of progress in science'. 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.

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 reasonably unified microfoundations exploration. Note that it is not our intent to apply a 'greedy' reductionist approach to understanding routines and capabilities (cf. Hodgson, 2012): we do not assume that understanding lower-level phenomena

will necessarily always improve our understanding of a higher-level phenomenon (cf. Stinchcombe, 1965). However, we propose that the pursuit of the microfoundations of routines and capabilities will usually 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 reviews, see Becker, 2004; Cohen et al., 1996; Di Stefano et al., 2010; Hoopes and Madsen, 2008).

It is widely accepted that routines are 'repetitive, recognizable patterns of interdependent actions, carried out by multiple actors' (e.g. Feldman and Pentland, 2003, p. 95). Furthermore, routines are explicitly collective rather than individual-level phenomena (e.g. Nelson and Winter, 1982, p. 107; Pentland, 2011): the emphasis is placed on the interactions rather than the individuals that are interacting (Felin and Hesterly, 2007). Routines have ostensive as well as performative aspects. 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, p. 95). The interaction of the ostensive and performative aspects of routines informs our understanding of change and collective outcomes (Feldman and Pentland, 2003).

Following Winter (2000, p. 983; 2003, p. 991), 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'. This definition casts learning, experience, resources, and routines as inputs to capabilities. 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; 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 et al., 2007, pp. 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).

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 important starting point is identifying the phenomena underlying routines and capabilities and exploring how these phenomena contribute to routines and capabilities.

Discussions of hierarchies of routines and capabilities lend understanding to one source of these differences. Nelson and Winter (1982) distinguish routines from search routines where the latter are routines that serve to change lower-level routines (a precursor of the notion of dynamic capabilities). Scholars suggest that it makes logical sense to speak, in general, of a hierarchy with N layers of capabilities (N possibly larger than 2) (Collis, 1994; Winter, 2000, 2003). Some capabilities are 'zero-level' capabilities in the sense that they underlie daily 'routine' operations whereas others are 'first order' or higher-order capabilities, notably 'dynamic capabilities' (Collis, 1994; Helfat et al., 2007; Teece et al., 1997; Winter, 2003, p. 992). For instance, studying the way in which serial acquirers customize routines in a specific acquisition, Heimeriks et al. (2012) 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 (cf. Schreyögg and Kliesch-Eberl, 2007), which often depends 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 or specified, 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. Even though such forms of capabilities 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 (cf. Teece, 2012). Conversely, some types of routines are purposively more flexible than rigid, allowing for substantial managerial discretion in their execution (Feldman and Pentland, 2003). These differences warrant study given that 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. First, the higher-order routine (or collection of routines) characteristic of a dynamic 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 operational or zero-order routine has both performative and ostensive aspects (Feldman and Pentland, 2003). Second, 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 behaviours that are consistent with routine performance; cf. Postrel and Rumelt, 1992).

In sum, the different manifestations and aspects of routines and (dynamic) capabilities are likely to have implications for their respective microfoundations. Such variation

underscores the complexity in explaining routines and capabilities, and in turn, emphasizes the need for partial approaches, that is, explaining a well-defined aspect of a routine in a clear and transparent manner, drawing on insights from extant literature (for examples, see Cohen and Bacdayan, 1994; Egidi and Narduzzo, 1997; Postrel and Rumelt, 1992). 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.

BUILDING 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 routines and capabilities and this variation may have explanatory consequences. For example, does explaining basic operational capabilities require the same microfoundations as explaining dynamic capabilities? Second, 'microfoundations for routines and capabilities' can refer to a number of conceptually different processes, such as the emergence, maintenance/reproduction, change, and/or displacement of routines and capabilities. 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 explanans or phenomena to be explained are so diverse.

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. As noted above, these categories are embedded in a nested and 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 explaining firm-level heterogeneity and outcomes (e.g. Coff, 1997, 1999; Felin and Hesterly, 2007; Madsen et al., 2003; Mehra et al., 2001). Drawing on the behavioural theory of the firm and psychology, other work shows that managerial (individual) cognition contributes to differences in managerial and/or firm behaviour (e.g. Felin and Zenger, 2009; Gavetti, 2005; Johnson and Hoopes, 2003; Laureiro-Martínez et al., 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 et al., 1996; Cyert and March, 1963; Feldman and Pentland, 2003), whereas the complementary 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, 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 et al., 1995; Klepper and Simons, 2000; Nelson and Winter, 1982; Pisano, 2000). In addition, some work on the knowledge-based theory of the firm (e.g. Grant, 1996) underscores the role of individuals, processes, and interactions in the development of organizational level constructs. Last, other research 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).

Overall, much work in strategy, organization theory, and organizational behaviour 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 article. Instead, we highlight examples of work that informs our understanding of the microfoundations of routines and capabilities, 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.

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 $N + 1$). 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 (2012) 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 (Felin and Hesterly, 2007). A simplistic way to think about organizations is as an aggregation of the individuals that compose them. Work shows that individuals – for example, in their capacities as managers or 'star analysts or scientists' – greatly affect the behaviour, evolution, and performance of organizations (e.g. Groysberg and Lee, 2009; Zucker and Darby, 1996). 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, behavioural theory emphasizes that

individuals make choices that are more or less informed and rational. In addition, individuals may have different beliefs, goals, and interests that inform and affect their choices. Second, individuals bring different human capital (skills, knowledge, experience, cognitive capacities) 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.

Behavioural and psychological foundations. Work on the behavioural 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' (Simon, 1985, p. 303; emphasis added). Even though the behavioural theory of the firm focused on individual-level considerations, the intervening decades have seen less emphasis on these factors. Gavetti et al. (2007, p. 524) indeed note that research has been 'considerably less focused on linking individuals' interests and cognitions to organizations' actions and decisions'. However, there are exceptions: for example, Cohen's (2012) essay points to recent work in physiology (on procedural memory and action-specialized perceptual capability) that identifies some psychological foundations of routines. Nonetheless, individual-level considerations merit further attention. For example, a central question is: What are the origins of individual-level factors such as beliefs and expectations and how are these factors aggregated to a collective level? In other words, if organizations are composed of 'individuals and groups whose preferences, information, interest, or knowledge differ' (March and Simon, 1993, p. 2), a need exists to specify these differences and their origins and organizational ramifications. The following briefly explores each question.

The notion of bounded rationality serves as one starting point for the analysis of individual-level factors. As noted by Argote and Greve (2007, p. 337), 'rationality is a lot like ancient Rome – all roads lead to it'. In other words, a proper understanding and specification of rationality is central to the study of organizations. Behavioural theories have focused on the experiential and learning-related aspects of rationality. As individuals and actors take actions informed, in part, by their beliefs, they gain feedback and experience and, in turn, learn about the environment. This learning is bounded by the cognitive limitations of actors and by their experiential data. Such experiential learning is a central facet of routines (given the emphasis on repetition) and one input to capability development.

While the boundedness of rationality is important, factors outside of experience also influence individual and organizational behaviour. For instance, during problem-solving, actors rely on their forward-looking capacities by imagining novel options and theorizing about the future (Felin and Zenger, 2009; Gavetti and Levinthal, 2000). These activities affect the formation of beliefs. In addition, experience informs individuals' forward-looking capacities as they may leverage their histories while building new knowledge. Gavetti and Levinthal (2000) contrast these forward-looking, cognitive aspects with backward-looking, experiential facets associated with the behaviour of firms. Thus actors not only rely on experiential data, which may lead to myopia, but 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 (Felin and Zenger, 2009), as is the case with de novo start-up organizations or major industry transformations.

Consequently, cognition represents an important stream of research related to bounded rationality and strategy. This stream of research cuts across multiple levels of analysis and covers a breathtaking range of concepts (for a recent overview, see Barr et al., 1992; Fahey and Narayanan, 1989; Kaplan, 2011; Siggelkow, 2011; Walsh, 1995). Scholars have examined how individual firms perceive themselves within industries (Porac et al., 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. Markóczy, 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), and in turn, how this process affects routines and capabilities (for an exception, see Laamanen and Wallin, 2009).

Overall, extant empirical work in management research says less about how the internal states of individuals, and in particular, their various psychological processes (such as subconscious routines or habits, procedural memory), affect their choices, and in turn, an organization's routines and capabilities (see, however, March and Simon's (1958) thoughtful discussion of the internal states of human actors). Huy's (2011) single-case study is a recent exception, showing how individual, middle manager's emotions, caused by organization-level actions, have a direct bearing on implementation success. Another exception lies with emerging work leveraging functional magnetic resonance imaging technologies to explore individuals' neural activity in the context of choice and decision-making (Laureiro-Martínez et al., 2010). Hence, individuals may invoke various psychological processes when carrying out their parts in the development, modification, or enactment of organizational routines or capabilities. In addition, individuals' internal states adapt and evolve over time. It follows that examining whether and how individuals' psychological processes affect organizational routines and capabilities is important to a microfoundations inquiry. In addition, understanding how individuals in groups and organizations collectively encode, store, and retrieve beliefs, information, or knowledge can facilitate the integration and renovation of an organization's knowledge assets, and in turn may affect capability creation and development (Argote and Ren, 2012).

The microfoundations inquiry might also benefit from recent advances in psychology, where unconscious thought, or 'deliberation without attention', is crucial to optimize outcomes in complex decisions (e.g. Dijksterhuis et al., 2006). In various 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 in different complex tasks, as compared to conscious thinkers who place inappropriate weight on elements less important to a decision's outcome. For a field generally assuming bounded rationality, these insights also 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, enable, 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. Early behavioural 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' (March, 1962, p. 672). The question of aggregation is difficult given that many 'emergent' and interactional effects are hard to predict based on knowledge of the individual components (cf. Dansereau et al., 1999). Scholars have, however, looked at 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.

Characteristics and abilities. It is widely accepted that the heterogeneity of individuals matters (e.g. Mowday and Sutton, 1993; O'Reilly et al., 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; Zenger, 1992). In short, the human capital of individuals can vary significantly. Another level of heterogeneity lies with differences in individuals' skills or abilities, some that are 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 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 artefacts (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.

While work on individual-level characteristics, abilities, and human capital has received increasing attention in the strategy and organizations literature (e.g. Hatch and Dyer, 2004; Ployhart and Moliterno, 2011), more work is needed to explicitly tease out how individual-specific stocks and characteristics affect routines and capabilities and which factors matter most for the building and operating of routines and capabilities. As an example, many opportunities exist for linking strategy research with rigorous research in organizational behaviour and applied psychology (cf. Lindenberg and Foss, 2011). 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). The study of big five personality characteristics has a long history in organizational behaviour; opportunities exist for bridging this work with work on aggregate, interactional, and emergent organizational behaviour. Routines and capabilities, in other words, might crucially depend on the characteristics of the individuals involved. This topic has also begun to interest strategy scholars whose work focuses on the role of human capital in value creation and appropriation (Coff, 1999; Coff and Kryscynski, 2011; Foss, 2011).

Work on routines and capabilities provides varying room for individuals. Some literature on organizational knowledge seems to suggest that individual-level elements matter

less than other factors in the study of routines and capabilities (Kogut and Zander, 1992; Spender, 1996). Other scholars, however, 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: How are an organization's routines or capabilities affected when individuals leave or enter the organization? Evidence suggests that employee mobility has significant and varying effects on organizations (e.g. Madsen et al., 2003; Rao and Drazin, 2002; Rosenkopf and Almeida, 2003), leading some scholars to pinpoint individuals as the fundamental locus of knowledge in organizations (Corredoira and Rosenkopf, 2010; Felin and Hesterly, 2007). External factors, such as mergers and acquisitions, may also impact the productivity of key individuals (Paruchuri and Eisenman, 2012).

In all, individual-level elements, such as choices, agency, 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 (2012), 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 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. Heimeriks and Duysters, 2007; Maritan and Brush, 2003; Pentland and Rueter, 1994; Salvato, 2009).

Different types of process-based routines exist. First, as noted earlier, 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 within and among firms (e.g. Hoopes and Madsen, 2008). Trial and error learning represents another type of process-based routine where variations or trials unfold in a stochastic or blind manner (Miner, 1994; Nelson and Winter, 1982; Pentland et al., 2012). In this case, the core components of the process, and their relationships, are defined but the stochastic element may yield variance in outcomes (Miner, 1994; Nelson and Winter, 1982). Last, a fourth type involves *ad hoc* problem solving, which diverges from the traditional 'highly-patterned' or 'repetitious' conception of routines (Winter, 2003, p. 991).

Work has explored these different types of process-based routines using a range of methods (see Becker, 2005). For instance, following 1300 auto-manufacturing employees over four months using a large-scale, single firm approach, Arthur and Huntley (2005) illustrate how a deliberately designed improvement programme lowered production costs through the use of employee suggestions. Using a lab experiment, Cohen and Bacdayan (1994) show that individuals often store routines as procedural memories; this procedural memory may have negative implications for an organization when routines are changed. 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), and emphasizes that routines have a strong coordinative dimension (who should take which actions at which point of time?) (cf. Crawford and Haller, 1990).

Methods of coordination and integration. The 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 (cf. Becker, 2004). A host of studies have analysed a variety of formal coordination processes both within (e.g. Argote, 1982; March et al., 2000) and across organizational boundaries (e.g. Ariño and Reuer, 2004; Mayer and Salomon, 2006). 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. Henderson and Clark, 1990; Hoopes and Postrel, 1999). Such integrating mechanisms facilitate cooperation and coordination among members of an organization (Lawrence and Lorsch, 1967) and in turn, shape the collective constructs of interest. Additional work explores the more informal aspects of coordination at multiple levels of analysis. For example, work examines how experiential learning (e.g. Lounamaa and March, 1987), trust (e.g. Szulanski et al., 2004), and culture (e.g. Wilkins and Ouchi, 1983) affect coordination, whereas other studies explore how institutional processes and norms influence coordination and, in turn, capability development (Fauchart and Von Hippel, 2008; Jacobides and Billinger, 2006).

While formal and informal coordination mechanisms may constrain or enable individual action, they raise important questions regarding the role of microfoundations. For instance: How can stability and flexibility in recurring action patterns be nurtured through deliberate collective level rules (e.g. Pentland and Rueter, 1994)? To what extent do routines and capabilities benefit from being rigid versus flexible? 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. Technology and (the use of) process or routine-based templates feature prominently in the 'copy-exactly'-approach as posited

by Szulanski and colleagues (e.g. Szulanski and Jensen, 2006; Winter and Szulanski, 2001). A related stream of research examines the role of technologies in shaping organizational outcomes. For instance, work finds that the use of specific technologies structures social interaction among medical specialists (Barley, 1986) and positively influences learning rates in financial services firms (e.g. Ashworth et al., 2006). Relatedly, the implementation of new technologies critically depends on the team learning process as Edmondson et al. (2001) illustrate 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. Such items could involve physical workspace and serve to reveal information and enable or reinforce behaviour. For instance, a recent study by Pentland and Feldman (2008) shows the limitations of material artefacts in designing organizational routines. Similarly, analysing the effect of colours in material objects, Rafaeli and Vilnai-Yavetz (2004) 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 artefacts, Cacciatori (2012) demonstrates how an emerging system of artefacts shapes patterns of action in a British engineering consulting firm (see also Bapuji et al., 2012). Yet, given that technologies and artefacts themselves are easily imitable, how can firms shape the process between individuals, technology, and ecology to optimize routines and capabilities?

Structure

Work also relates different forms of organizational structure to the microfoundations of routines and capabilities. Structures, whether at the organizational level or within an organization, specify the conditions that enable and constrain individual and collective action and establish the context for interactions within an organization. While structures may constrain behaviour, they also enable efficient information processing, knowledge development and sharing, coordination and integration, and more generally, collective action. We highlight three areas of work that build connections between structure and the microfoundations of routines and capabilities.

The structure or design of decision-making activities within organizations may affect routines and capabilities. For instance, members of organizations often make choices in the face of organizational and institutional constraints (see Ingram and Clay, 2000). In addition, firms typically establish heuristics or rules that guide decision making; as executives gain experience, they may change the heuristics, or the structure of the heuristics, to enhance decision making (e.g. Bingham and Eisenhardt, 2011) or to align with changing conditions. For example, some firms might allow for more flexibility in structures and rule systems by combining improvisation with rules (Davis et al., 2009), whereas others may develop complex rule structures to govern activities. The efficacy of these different approaches may affect how routines and capabilities are created and evolve in organizations.

A vast body of work considers how differences in the design of organizational structures may affect routines and capabilities. It is widely recognized that the degree of complexity of an organizational structure or form (e.g. tall vs. flat; matrix, virtual matrix, network form) impacts the nature, rate, and diffusion of different activities within an organization, such as information processing, knowledge sharing, routine replication, and capability development. For instance, flat structures allow for autonomy and maximize the information held by members of an organization, but also create problems for effective coordination (Foss, 2003). At the same time, an organization's design might give rise to gaps in shared knowledge across parts of the organization and, in turn, compromise coordination and integration (Hoopes and Postrel, 1999).

Last, the resource and environmental conditions present at a firm's founding affect its subsequent development, including its routines and capabilities. More specifically, work finds that a founder's logic for organizational design has a persistent effect on a start-up's development (Baron et al., 1999). For instance, founders with a bureaucratic logic tend to build more rigid administrative structures and processes over time as compared to founders with different organizing logics. These organizing logics also affect a firm's resource and capability investment policies over time and, in turn, a firm's rate of development (Baron et al., 1996). Similarly, a study of US commercial banking (1978–2001) shows that founding conditions and institutional change influenced banks' capability development efforts and their organizational structures (Marquis and Huang, 2010).

In sum, while substantial work may inform the relationships between structure and the microfoundations of routines and capabilities, many areas warrant additional attention. For example, what types of capabilities may benefit more from a structured (unstructured) approach in their creation and development? Under what conditions will an 'invisible hand' like approach to organizational design lead to efficacious capabilities and routines? What types of structures and heuristics might assist firms in managing the life cycles of 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 article 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 have highlighted 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 also 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. Egidi and 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 Bingham and Eisenhardt, 2011; Feldman and

Pentland, 2003). It is seems clear that no methods or approaches can claim any primacy, and the study of the microfoundations of routines and capabilities calls for a healthy methodological pluralism. Nonetheless, the theoretical and empirical variety is not a call for labelling 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

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

Individuals: Actions

Focusing specific attention on individual actions and their repetition over time, Pentland et al. (2012) 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 (2012) 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 (2012) show how individuals' experiences influence routine performance in a novel context – 4378 garbage collection route sequences spanning seven months 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 respond to contextual change than less experienced individuals. A third study focuses on the role of agency and human capital. Wang and Wong (2012) 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.

Teece's essay (2012) is also broadly within the domain of human capital and capabilities. Specifically, he emphasizes the necessity to dig into the characteristics of top managers and entrepreneurs and the processes they initiate to shape a firm's dynamic capabilities. Advancing the term 'entrepreneurial managerial capitalism', he proposes shifting attention from studying start-up activities and the role of the entrepreneur to analysing non-routine activities and leadership skills which are often context- or even enterprise-specific.

Individuals, Interactions, and Artefacts

Two articles explicitly consider how the interactions between individuals and between individuals and artefacts affect the design and performance of routines. For instance, Bapuji et al. (2012) examine a specific type of routine, 'towel changing' in hotels. They show how artefacts, different individuals' intentions (hotel staff, customers), and the interactions between different individuals and artefacts shape the efficacy and evolution of a routine. Their paper features a novel combination of field and survey work, thus offering a window into how routines are constituted by artefacts, heterogeneous actors, and their interactions and intentions. Second, using a longitudinal case study at a British engineering consulting firm, Cacciatori (2012) examines how artefacts may affect the evolution of new routines. Studying the evolution of an Excel worksheet within a firm, her work reveals how the bundling of artefacts led the firm to develop new patterns of action among the agents involved. Her research design also provides insights into different types of artefacts 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' artefacts (i.e. physical materials that embody knowledge, e.g. furniture), and suggests that work should consider the influence of *systems* of artefacts rather than of single artefacts in isolation.

Individuals and Organizational Structure

Shifting attention to capabilities, Mäkelä et al. (2012) 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.

Processes and Individuals

The paper by Miller et al. (2012) builds on Feldman and Pentland's (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 literature has not yet systematically examined the general absence in organizations of a 'shared holistic ostensive routine'. Given the absence of such a routine, they use the notion that individuals store 'know-how' in procedural memory, 'know-what' in declarative memory, and 'know-who' in transactive memory (see Argote and Ren, 2012) to frame their analysis of routine dynamics. Examining memory formation during collaborative problem-solving helps the authors clarify the ostensive nature of organizational routines and its connection to the performative aspect. Using an agent-based modelling approach to simulate routines, they model not only the formation of new routines, but also the changes in established organizational routines resulting from loss of personnel (due to downsizing) and changes in environmental demands. The essay by Argote and Ren (2012) also discusses 'transactive memory systems' – knowing who knows what within the organization – and these systems shape 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 (2012) and Geoffrey Hodgson (2012) – offer provocative critiques of the microfoundations programme. 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. Hodgson offers some historical perspective on the microfoundations programme and argues that the programme failed in economics, and raises additional concerns related to agency and multiple levels of analysis.

CONCLUSION

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 is relevant to decomposing routines and capabilities. This article identifies opportunities for explaining the origins of routines and capabilities by analytically focusing on three primary microfoundations: (1) individuals, (2) processes and interactions, and (3) structure. 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.

ACKNOWLEDGMENTS

We extend 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 are also due to James Carlson for research assistance.

NOTES

[1] 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, phenomena at $N - 1_t$ might be positively or negatively associated with a routine or capability at N_t.

[2] For example, explaining industry dynamics (level N_t) in terms of the behaviours and interactions of incumbent firms and potential entrants (level $N - 1_{t-1}$) is tantamount to providing microfoundations for such dynamics. In turn the behaviours and interactions of incumbent firms and potential entrants may influence other phenomena, at higher analytical levels (N + 1. . . n) and over time (*t* + 1. . . *n*), such as the institutional rules governing an industry (e.g. Madsen and Walker, 2007).

REFERENCES

Abell, P., Felin, T. and Foss, N. (2008). 'Building micro-foundations for the routines, capabilities, and performance links'. *Managerial and Decision Economics*, **29**, 489–502.

Argote, L. (1982). 'Input uncertainty and organizational coordination in hospital emergency units'. *Administrative Science Quarterly*, **27**, 420–34.

Argote, L. and Darr, E. (2000). 'Repositories of knowledge in franchise organizations: individual, structural and technological'. In Dosi, G., Nelson, R. R. and Winter, S. G. (Eds), *The Nature and Dynamics of Organizational Capabilities*. New York: Oxford University Press, 51–68.

Argote, L. and Greve, H. R. (2007). 'A behavioral theory of the firm – 40 years and counting: introduction and impact'. *Organization Science*, **18**, 337–49.

Argote, L. and Ren, Y. (2012). 'Transactive memory systems: a micro foundation of dynamic capabilities'. *Journal of Management Studies*, in press.

Ariño, A. and Reuer, J. J. (2004). 'Designing and renegotiating strategic alliance contracts'. *The Academy of Management Executive (1993–2005)*, **18**, 37–48.

Arthur, J. B. and Huntley, C. L. (2005). 'Ramping up the organizational learning curve: assessing the impact of deliberate learning on organizational performance under gainsharing'. *Academy of Management Journal*, **48**, 1159–70.

Ashworth, M. J., Argote, L. and Mukhopadhyay, T. (2006). 'The effect of information technology on organizational learning and knowledge retention and transfer'. Working Paper, Carnegie Mellon University.

Bapuji, H., Hora, M. and Saeed, A. M. (2012). 'Intentions, intermediaries, and interaction: examining the emergence of routines'. *Journal of Management Studies*, **49**, 1586–607.

Barley, S. R. (1986). 'Technology as an occasion for structuring: evidence from observations of CT scanners and the social order of radiology departments'. *Administrative Science Quarterly*, **31**, 78–108.

Barnard, C. I. (1968). *The Functions of the Executive*. Cambridge, MA: Harvard University Press.

Baron, J. N., Burton, M. D. and Hannan, M. T. (1996). 'The road taken: origins and evolution of employment systems in emerging companies'. *Industrial and Corporate Change*, **5**, 239–75.

Baron, J. N., Hannan, M. T. and Burton, M. D. (1999). 'Determinants of managerial intensity in the early years of organizations'. *American Sociological Review*, **64**, 527–47.

Barr, P. S., Stimpert, J. L. and Huff, A. S. (1992). 'Cognitive change, strategic action, and organizational renewal'. *Strategic Management Journal*, **13**, 15–36.

Becker, M. C. (2004). 'Organizational routines: a review of the literature'. *Industrial and Corporate Change*, **13**, 643–78.
Becker, M. C. (2005). 'The concept of routines: some clarifications'. *Cambridge Journal of Economics*, **29**, 249–62.
Bingham, C. B. and Eisenhardt, K. M. (2011). 'Rational heuristics: the 'simple rules' that strategists learn from process experience'. *Strategic Management Journal*, **32**, 1437–64.
Cacciatori, E. (2012). 'Resolving conflict in problem-solving: systems of artefacts in the development of new routines'. *Journal of Management Studies*, **49**, 1559–85.
Camerer, C., Loewenstein, G. and Prelec, D. (2005). 'Neuroeconomics: how neuroscience can inform economics'. *Journal of Economic Literature*, **43**, 9–64.
Clark, K. B. and Fujimoto, T. (1991). *Product Development Performance: Strategy, Organization, and Management in the World Auto Industry*. Boston, MA: Harvard Business School Press.
Coff, R. W. (1997). 'Human assets and management dilemmas: coping with hazards on the road to resource-based theory'. *Academy of Management Review*, **22**, 374–402.
Coff, R. W. (1999). 'When competitive advantage doesn't lead to performance: the resource-based view and stakeholder bargaining power'. *Organization Science*, **10**, 119–33.
Coff, R. W. and Kryscynski, D. (2011). 'Invited editorial: drilling for micro-foundations of human capital–based competitive advantages'. *Journal of Management*, **37**, 1429–43.
Cohen, M. D. (2012). 'Perceiving and remembering routine action: fundamental micro-level origins'. *Journal of Management Studies*, **49**, 1383–8.
Cohen, M. D. and Bacdayan, P. (1994). 'Organizational routines are stored as procedural memory: evidence from a laboratory study'. *Organization Science*, **5**, 554–68.
Cohen, M. D., Burkhart, R., Dosi, G., Egidi, M., Marengo, L., Warglien, M. and Winter, S. (1996). 'Routines and other recurring action patterns of organizations: contemporary research issues'. *Industrial and Corporate Change*, **5**, 653–98.
Coleman, J. S. (1964). 'Collective decisions'. *Sociological Inquiry*, **34**, 166–81.
Coleman, J. S. (1990). *Foundations of Social Theory*. Cambridge, MA: Belknap Press of Harvard University Press.
Collis, D. J. (1994). 'Research note: how valuable are organizational capabilities?'. *Strategic Management Journal*, **15**, 143–52.
Corredoira, R. A. and Rosenkopf, L. (2010). 'Should auld acquaintance be forgot? The reverse transfer of knowledge through mobility ties'. *Strategic Management Journal*, **31**, 159–81.
Crawford, V. P. and Haller, H. (1990). 'Learning how to cooperate: optimal play in repeated coordination games'. *Econometrica: Journal of the Econometric Society*, **58**, 571–95.
Cyert, R. M. and March, J. G. (1963). *A Behavioral Theory of the Firm*. Englewood Cliffs, NJ and Cambridge, MA: Prentice-Hall and Blackwell.
Dansereau, F., Yammarino, F. J. and Kohles, J. C. (1999). 'Multiple levels of analysis from a longitudinal perspective: some implications for theory building'. *Academy of Management Review*, **24**, 346–57.
Darr, E. D., Argote, L. and Epple, D. (1995). 'The acquisition, transfer, and depreciation of knowledge in service organizations: productivity in franchises'. *Management Science*, **41**, 1750–62.
Davis, J. P., Eisenhardt, K. M. and Bingham, C. B. (2009). 'Optimal structure, market dynamism, and the strategy of simple rules'. *Administrative Science Quarterly*, **54**, 413–52.
Dijksterhuis, A., Bos, M. W., Nordgren, L. F. and Van Baaren, R. B. (2006). 'On making the right choice: the deliberation-without-attention effect'. *Science*, **311**, 1005–7.
Di Stefano, G., Peteraf, M. and Verona, G. (2010). 'Dynamic capabilities deconstructed: a bibliographic investigation into the origins, development, and future directions of the research domain'. *Industrial and Corporate Change*, **19**, 1187–204.
Dosi, G., Nelson, R. R. and Winter, S. G. (2000). *The Nature and Dynamics of Organizational Capabilities*. New York: Oxford University Press.
Edmondson, A. C., Bohmer, R. M. and Pisano, G. P. (2001). 'Disrupted routines: team learning and new technology implementation in hospitals'. *Administrative Science Quarterly*, **46**, 685–716.
Egidi, M. and Narduzzo, A. (1997). 'The emergence of path-dependent behaviors in cooperative contexts'. *International Journal of Industrial Organization*, **15**, 677–709.
Eisenhardt, K. M. and Martin, J. A. (2000). 'Dynamic capabilities: what are they?'. *Strategic Management Journal*, **21**, Special Issue, 1105–21.
Elster, J. (1989). *Nuts and Bolts for the Social Sciences*. Cambridge and New York: Cambridge University Press.
Fahey, L. and Narayanan, V. (1989). 'Linking changes in revealed causal maps and environmental change: an empirical study'. *Journal of Management Studies*, **26**, 361–78.

Fauchart, E. and Von Hippel, E. (2008). 'Norms-based intellectual property systems: the case of French chefs'. *Organization Science*, **19**, 187–201.
Feldman, M. S. and Pentland, B. T. (2003). 'Reconceptualizing organizational routines as a source of flexibility and change'. *Administrative Science Quarterly*, **48**, 94–118.
Felin, T. and Foss, N. J. (2005). 'Strategic organization: a field in search of micro-foundations'. *Strategic Organization*, **3**, 441–55.
Felin, T. and Foss, N. J. (2009). 'Organizational routines and capabilities: historical drift and a course-correction toward microfoundations'. *Scandinavian Journal of Management*, **25**, 157–67.
Felin, T. and Hesterly, W. S. (2007). 'The knowledge-based view, nested heterogeneity, and new value creation: philosophical considerations on the locus of knowledge'. *Academy of Management Review*, **32**, 195–218.
Felin, T. and Zenger, T. R. (2009). 'Entrepreneurs as theorists: on the origins of collective beliefs and novel strategies'. *Strategic Entrepreneurship Journal*, **3**, 127–46.
Finkelstein, S. and Hambrick, D. C. (1990). 'Top-management-team tenure and organizational outcomes: the moderating role of managerial discretion'. *Administrative Science Quarterly*, **35**, 484–503.
Foss, N. J. (2003). 'Selective intervention and internal hybrids: interpreting and learning from the rise and decline of oticon spaghtetti organization'. *Organization Science*, **14**, 331–449.
Foss, N. J. (2011). 'Micro-foundations for resource-based theory'. *Journal of Management*, **37**, 1413–28.
Garfinkel, H. (1967). 'Common sense knowledge of social structures: the documentary method of interpretation in lay and professional fact finding'. In Scher, J. M. (Ed.), *Theories of the Mind*. New York: The Free Press of Glencoe, 689–712.
Garud, R., Kumaraswamy, A. and Karnoe, P. (2010). 'Path dependence or path creation?'. *Journal of Management Studies*, **47**, 760–74.
Gavetti, G. (2005). 'Cognition and hierarchy: rethinking the microfoundations of capabilities' development'. *Organization Science*, **16**, 599–617.
Gavetti, G. and Levinthal, D. (2000). 'Looking forward and looking backward: cognitive and experiential search'. *Administrative Science Quarterly*, **45**, 113–37.
Gavetti, G., Levinthal, D. A. and Ocasio, W. (2007). 'Neo-Carnegie: the Carnegie School's past, present, and reconstructing for the future'. *Organization Science*, **18**, 523–36.
Grant, R. M. (1996). 'Toward a knowledge-based theory of the firm'. *Strategic Management Journal*, **17**, 109–22.
Groysberg, B. and Lee, L. E. (2009). 'Hiring stars and their colleagues: exploration and exploitation in professional service firms'. *Organization Science*, **20**, 740–58.
Hannan, M. and Freeman J. (1977). 'The population ecology of organizations'. *American Journal of Sociology*, **82**, 929–64.
Hatch, N. W. and Dyer, J. H. (2004). 'Human capital and learning as a source of sustainable competitive advantage'. *Strategic Management Journal*, **25**, 1155–78.
Hayek, F. A. (1948). *Individualism and Economic Order*. Chicago, IL: University of Chicago Press.
Heimeriks, K. H. and Duysters, G. (2007). 'Alliance capability as mediator between experience and alliance performance: an empirical investigation into the alliance capability development process'. *Journal of Management Studies*, **44**, 25–49.
Heimeriks, K. H., Schijven, M. and Gates, S. (2012). 'Manifestations of higher-order routines: the underlying mechanisms of deliberate learning in the context of post-acquisition integration'. *Academy of Management Journal*, **55** (in press).
Helfat, C. and Peteraf, M. (2010). 'Understanding dynamic capabilities: progress along a developmental path'. *Strategic Organization*, **7**, 91–102.
Helfat, C., Finkelstein, S., Mitchell, W., Peteraf, M. A., Singh, H., Teece, D. J. and Winter, S. G. (2007). *Dynamic Capabilities. Understanding Strategic Change in Organizations*. Blackwell: Cambridge, MA.
Henderson, R. M. and Clark, K. B. (1990). 'Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms'. *Administrative Science Quarterly*, **35**, 9–30.
Hitt, M. A., Beamish, P. W., Jackson, S. E. and Mathieu, J. E. (2007). 'Building theoretical and empirical bridges across levels: multilevel research in management'. *Academy of Management Journal*, **50**, 1385–99.
Hodgson, G. (2012). 'The mirage of microfoundations'. *Journal of Management Studies*, **49**, 1389–94.
Hodgson, G. M. and Knudsen, T. (2004). 'The firm as an interactor: firms as vehicles for habits and routines'. *Journal of Evolutionary Economics*, **14**, 281–307.
Hoopes, D. G. and Madsen, T. L. (2008). 'A capability-based view of competitive heterogeneity'. *Industrial and Corporate Change*, **17**, 393–426.
Hoopes, D. G. and Postrel, S. (1999). 'Shared knowledge, "glitches", and product development performance'. *Strategic Management Journal*, **20**, 837–65.

Huy, Q. N. (2011). 'How middle managers' group-focus emotions and social identities influence strategy implementation'. *Strategic Management Journal*, **32**, 1387–410.
Ingram, P. and Clay, K. (2000). 'The choice-within-constraints new institutionalism and implications for sociology'. *Annual Review of Sociology*, **26**, 525–46.
Jacobides, M. G. and Billinger, S. (2006). 'Designing the boundaries of the firm: from "make, buy, or ally" to the dynamic benefits of vertical architecture'. *Organization Science*, **17**, 249–61.
Janssen, M. C. W. (1993). *Microfoundations: A Critical Inquiry*. London: Routledge.
Jennings, P. D. and Greenwood, R. (2003). 'Constructing the iron cage: institutional theory and enactment'. In Westwood, R. and Clegg, S. (Eds), *Debating Organization: Point-Counterpoint in Organization Studies*. Malden, MA: Blackwell, 195–207.
Johnson, D. R. and Hoopes, D. G. (2003). 'Managerial cognition, sunk costs, and the evolution of industry structure'. *Strategic Management Journal*, **24**, 1057–68.
Kahneman, D. and Tversky, A. (1979). 'Prospect theory: an analysis of decision under risk'. *Econometrica: Journal of the Econometric Society*, **47**, 263–91.
Kaplan, S. (2011). 'Research in cognition and strategy: reflections on two decades of progress and a look to the future'. *Journal of Management Studies*, **48**, 665–95.
Kincaid, H. (1997). *Individualism and the Unity of Science: Essays on Reduction, Explanation, and the Special Sciences*. New York: Rowman and Littlefield.
Kirman, A. P. (1992). 'Whom or what does the representative individual represent?'. *Journal of Economic Perspectives*, **6**, 117–36.
Klepper, S. and Simons, K. L. (2000). 'The making of an oligopoly: firm survival and technological change in the evolution of the US tire industry'. *Journal of Political Economy*, **108**, 728–60.
Kogut, B. and Zander, U. (1992). 'Knowledge of the firm, combinative capabilities, and the replication of technology'. *Organization Science*, **3**, 383–97.
Laamanen, T. and Wallin, J. (2009). 'Cognitive dynamics of capability development paths'. *Journal of Management Studies*, **46**, 950–81.
Laureiro-Martínez, D., Brusoni, S. and Zollo, M. (2010). 'The neuroscientific foundations of the exploration–exploitation dilemma'. *Journal of Neuroscience, Psychology, and Economics*, **3**, 95–115.
Lawrence, P. R. and Lorsch, J. W. (1967). *Organization and Environment: Managing Differentiation and Integration*. Boston, MA: Harvard University Press.
Lawrence, T. B., Suddaby, R. and Leca, B. (2009). *Institutional Work: Actors and Agency in Institutional Studies of Organizations*. Cambridge: Cambridge University Press.
Lazarsfeld, P. F. and Menzel, H. (1970). 'On the relation between individual and collective properties'. In Etzioni, A. (Ed.), *A Sociological Reader on Complex Organizations*. London: Holt, Rinehart and Winston, 422–40.
Lindenberg, S. and Foss, N. J. (2011). 'Managing motivation for joint production: the role of goal framing and governance mechanisms'. *Academy of Management Review*, **36**, 500–25.
Lounamaa, P. H. and March, J. G. (1987). 'Adaptive coordination of a learning team'. *Management Science*, **33**, 107–23.
Madsen, T. L. and Walker, G. (2007). 'Incumbent and entrant rivalry in a deregulated industry'. *Organization Science*, **18**, 667–87.
Madsen, T. L., Mosakowski, E. and Zaheer, S. (2003). 'Knowledge retention and personnel mobility: the nondisruptive effects of inflows of experience'. *Organization Science*, **14**, 173–91.
Mäkelä, K., Höglund, M., Sumelius, J. and Ahlvik, C. (2012). 'Determinants of strategic HR capabilities in MNC subsidiaries'. *Journal of Management Studies*, **49**, 1459–83.
March, J. G. (1962). 'The business firm as a political coalition'. *Journal of Politics*, **24**, 662–78.
March, J. G. and Simon, H. A. (1958). *Organizations*. New York: Wiley.
March, J. G. and Simon, H. A. (1993). *Organization*, 2nd edition. Oxford: Blackwell.
March, J. G., Schulz, M. and Zhou, X. (2000). *The Dynamics of Rules: Change in Written Organizational Codes*. Stanford, CA: Stanford University Press.
Maritan, C. A. and Brush, T. H. (2003). 'Heterogeneity and transferring practices: implementing flow manufacturing in multiple plants'. *Strategic Management Journal*, **24**, 945–59.
Maritan, C. and Peteraf, M. (2007). 'Dynamic capabilities and organizational processes'. In Helfat, C., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D. and Winter, S. (Eds), *Dynamic Capabilities: Understanding Strategic Change in Organizations*. Malden, MA: Blackwell, 30–45.
Markóczy, L. (1997). 'Measuring beliefs: accept no substitutes'. *Academy of Management Journal*, **40**, 1228–42.
Marquis, C. and Huang, Z. (2010). 'Acquisitions as exaptation: the legacy of founding institutions in the US commercial banking industry'. *Academy of Management Journal*, **53**, 1441–73.

Mayer, K. J. and Salomon, R. M. (2006). 'Capabilities, contractual hazards, and governance: integrating resource-based and transaction cost perspectives'. *Academy of Management Journal*, **49**, 942–59.
McKelvey, M. (1998). 'Evolutionary innovations: learning, entrepreneurship and the dynamics of the firm'. *Journal of Evolutionary Economics*, **8**, 157–75.
Mehra, A., Kilduff, M. and Brass, D. J. (2001). 'The social networks of high and low self-monitors: implications for workplace performance'. *Administrative Science Quarterly*, **46**, 121–46.
Miller, K. D., Pentland, B. T. and Choi, S. (2012). 'Dynamics of performing and remembering organizational routines'. *Journal of Management Studies*, **49**, 1536–58.
Miner, A. S. (1994). 'Seeking adaptive advantage: evolutionary theory and managerial action'. *Evolutionary Dynamics of Organizations*, **76**, 89.
Molloy, J. C., Chadwick, C., Ployhart, R. E. and Golden, S. J. (2011). 'Making intangibles 'tangible' in tests of resource-based theory'. *Journal of Management*, **37**, 1496–518.
Mowday, R. T. and Sutton, R. I. (1993). 'Organizational behavior: linking individuals and groups to organizational contexts'. *Annual Review of Psychology*, **44**, 195–229.
Nelson, R. and Winter, S. (1982). *An Evolutionary Theory of the Firm*. Cambridge, MA: Harvard University Press.
O'Reilly, C. A., Chatman, J. and Caldwell, D. F. (1991). 'People and organizational culture: a profile comparison approach to assessing person-organization fit'. *Academy of Management Journal*, **34**, 487–516.
Paruchuri, S. and Eisenman, M. (2012). 'Microfoundations of firm R&D capabilities: a study of inventor networks in a merger'. *Journal of Management Studies*, **49**, 1509–35.
Pentland, B. T. (2011). 'The foundation is solid, if you know where to look: comment on Felin and Foss'. *Journal of Institutional Economics*, **7**, 279–93.
Pentland, B. T. and Feldman, M. S. (2008). 'Designing routines: on the folly of designing artifacts, while hoping for patterns of action'. *Information and Organization*, **18**, 235–50.
Pentland, B. T. and Rueter, H. H. (1994). 'Organizational routines as grammars of action'. *Administrative Science Quarterly*, **39**, 484–510.
Pentland, B. T., Feldman, M. S., Becker, M. C. and Liu, P. (2012). 'Dynamics of organizational routines: a generative model'. *Journal of Management Studies*, **49**, 1484–508.
Pisano, G. P. (2000). *In Search of Dynamic Capabilities: The Origins of R&D Competence in Biopharmaceuticals*. Oxford, New York: Oxford University Press.
Ployhart, R. E. and Moliterno, T. P. (2011). 'Emergence of the human capital resource: a multilevel model'. *Academy of Management Review (AMR)*, **36**, 127–50.
Popper, K. R. (1957). *The Poverty of Historicism*. London: Routledge and Kegan Paul.
Porac, J. F., Thomas, H. and Baden-Fuller, C. (1989). 'Competitive groups as cognitive communities: the case of Scottish knitwear manufacturers'. *Journal of Management Studies*, **26**, 397–416.
Postrel, S. and Rumelt, R. P. (1992). 'Incentives, routines, and self-command'. *Industrial and Corporate Change*, **1**, 397.
Powell, W. W. and Colyvas, J. A. (2008). 'Microfoundations of institutional theory'. In Greenwood, R., Oliver, C., Sahlin, K. and Suddaby, R. (Eds), *Handbook of Organizational Institutionalism*. Thousand Oaks, CA: Sage, 276–98.
Rafaeli, A. and Vilnai-Yavetz, I. (2004). 'Instrumentality, aesthetics and symbolism of physical artifacts as triggers of emotion'. *Theoretical Issues in Ergonomics Science*, **5**, 91–112.
Rao, H. and Drazin, R. (2002). 'Overcoming resource constraints on product innovation by recruiting talent from rivals: a study of the mutual fund industry, 1986–94'. *Academy of Management Journal*, **45**, 491–507.
Rerup, C. and Feldman, M. S. (2011). 'Routines as a source of change in organizational schemata: the role of trial-and-error learning'. *Academy of Management Journal*, **54**, 577–610.
Rosenkopf, L. and Almeida, P. (2003). 'Overcoming local search through alliances and mobility'. *Management Science*, **49**, 751–66.
Salvato, C. (2003). 'The role of mico-strategies in the engineering of firm evolution'. *Journal of Management Studies*, **40**, 83–108.
Salvato, C. (2009). 'Capabilities unveiled: the role of ordinary activities in the evolution of product development processes'. *Organization Science*, **20**, 384–409.
Salvato, C. and Rerup, C. (2011). 'Beyond collective entities: multilevel research on organizational routines and capabilities'. *Journal of Management*, **37**, 468.
Schreyögg, G. and Kliesch-Eberl, M. (2007). 'How dynamic can organizational capabilities be? Towards a dual-process model of capability dynamization'. *Strategic Management Journal*, **28**, 913–33.
Schwab, J. J. (1960). 'What do scientists do?'. *Behavioral Science*, **5**, 1–27.
Siggelkow, N. (2011). 'Firms as systems of interdependent choices'. *Journal of Management Studies*, **48**, 1126–40.

Simon, H. A. (1985). 'Human nature in politics: the dialogue of psychology with political science'. *American Political Science Review*, **79**, 293–304.
Simon, H. A. (1991). 'Bounded rationality and organizational learning'. *Organization Science*, **2**, 125–34.
Spender, J. C. (1996). 'Making knowledge the basis of a dynamic theory of the firm'. *Strategic Management Journal*, **17**, 45–62.
Srikanth, K. and Puranam, P. (2010). 'Integrating distributed work: comparing task design, communication, and tacit coordination mechanisms'. *Strategic Management Journal*, **32**, 849–79.
Stinchcombe, A. L. (1965). 'Social structure and organizations'. In March, J. G. (Ed.), *Handbook of Organizations*. New York: Rand McNally, 142–93.
Szulanski, G. and Jensen, R. J. (2006). 'Presumptive adaptation and the effectiveness of knowledge transfer'. *Strategic Management Journal*, **27**, 937–57.
Szulanski, G., Cappetta, R. and Jensen, R. J. (2004). 'When and how trustworthiness matters: knowledge transfer and the moderating effect of casual ambiguity'. *Organization Science*, **15**, 600–13.
Teece, D. J. (2007). 'Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance'. *Strategic Management Journal*, **28**, 1319–50.
Teece, D. J. (2012). 'Dynamic capabilities: routines versus entrepreneurial action'. *Journal of Management Studies*, **49**, 1395–401.
Teece, D. J., Pisano, G. and Shuen, A. (1997). 'Dynamic capabilities and strategic management'. *Strategic Management Journal*, **18**, 509–33.
Tripsas, M. and Gavetti, G. (2000). 'Capabilities, cognition, and inertia: evidence from digital imaging'. *Strategic Management Journal*, **21**, 1147–61.
Turner, S. F. and Fern, M. J. (2012). 'Examining the stability and variability of routine performances: the effects of experience and context change'. *Journal of Management Studies*, **49**, 1407–34.
Tyre, M. J. and Von Hippel, E. (1997). 'The situated nature of adaptive learning in organizations'. *Organization Science*, **8**, 71–83.
Vergne, J. and Durand, R. (2010). 'The missing link between the theory and empirics of path dependence: conceptual clarification, testability issue, and methodological implications'. *Journal of Management Studies*, **47**, 736–59.
Walsh, J. P. (1995). 'Managerial and organizational cognition: notes from a trip down memory lane'. *Organization Science*, **6**, 280–321.
Walsh, J. P. and Fahey, L. (1986). 'The role of negotiated belief structures in strategy making'. *Journal of Management*, **12**, 325–38.
Wang, H. C. and Wong, K. F. E. (2012). 'The effect of managerial bias on employees' specific human capital investments'. *Journal of Management Studies*, **49**, 1435–58.
Wilkins, A. L. and Ouchi, W. G. (1983). 'Efficient cultures: exploring the relationship between culture and organizational performance'. *Administrative Science Quarterly*, **28**, 468–81.
Winter, S. G. (2000). 'The satisficing principle in capability learning'. *Strategic Management Journal*, **10–11**, Special Issue 21, 981–96.
Winter, S. G. (2003). 'Understanding dynamic capabilities'. *Strategic Management Journal*, **24**, 991–5.
Winter, S. G. (2012). 'Capabilities: their origins and ancestry'. *Journal of Management Studies*, **49**, 1402–6.
Winter, S. G. and Szulanski, G. (2001). 'Replication as strategy'. *Organization Science*, **12**, 730–43.
Zenger, T. R. (1992). 'Why do employers only reward extreme performance? Examining the relationships among performance, pay, and turnover'. *Administrative Science Quarterly*, **37**, 198–219.
Zollo, M. and Winter, S. G. (2002). 'Deliberate learning and the evolution of dynamic capabilities'. *Organization Science*, **13**, 339–51.
Zucker, L. G. and Darby, M. R. (1996). 'Capturing technological opportunity via japan's star scientists: evidence from Japanese firms' biotech patents and products'. *Journal of Technology Transfer*, **26**, 37–58.