Practice-Based Learning as a Dynamic Capability: A Longitudinal Study of Public Hospitals in England

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ABSTRACT

This paper examines the antecedents, consequences and moderators of practice-based learning capabilities, understood as organizations’ ability to routinely engage in learning by doing, using and interacting. As such, this mode of learning forms a natural antithesis to science-based learning, which is fueled by novel scientific and technological insights. Conceptualized as an incremental dynamic capability, practice-based learning is expected to be a vital driver of gradual organizational adaptation processes. As dynamic capabilities consist of bundles of relatively stable routines, we propose that an organization’s level of practice-based learning capabilities will be highly persistent over time. We also argue that building and exercising practice-based learning capabilities is resource-intensive and will as such tend to rely on the availability of sufficient slack resources. Last, we suggest that practice-based learning will be positively related to organizational performance, especially when the underlying business model is labor- rather than capital-intensive. To test our theoretical ideas, we draw on unique panel data from all public non-specialist hospitals in England and find broad support for our hypotheses. (171 words)

Keywords: Organizational Learning; Dynamic Capabilities; Public Management; Hospitals.
INTRODUCTION

“[…] I see innovation in two ways. The first is very much related to biomedical research as you can’t find a new gene for instance unless you do research - one really doesn’t exist without the other. The second type of innovation is to do with more practical things which come out of patient care. It is to a lesser extent related to research because it’s by doing […] by caring for patients, by seeing the difficulties they encounter that you come up with new ideas to help them […] So, I really see a split there.”

(Interview with the R&D director of an Acute Trust in the English National Health Service, August 2007)

This statement illustrates the multifaceted nature of innovation and learning in public health care and beyond. More specifically, it highlights the practical and conceptual meaningfulness of Jensen et al.’s (2007) distinction between science- and practice-based learning.1 Science-based learning is fueled by advances in science, technology and innovation and contributes to the production of often codifiable global knowledge. Practice-based learning in turn tends to add to tacit local knowledge and thrives on doing, using and interacting as essential constitutive elements of daily work. Science- and practice-based learning can be thought of as two ideal-type modes located at opposing ends of the spectrum of organizational learning processes. Brown and Duguid (1991, p. 53) seem to concur suggesting that “innovating and learning in daily activity lie at one end of a continuum of innovating practices that stretches to radical innovation cultivated in research laboratories at the far end.”

Although extant research demonstrates the practical and theoretical relevance of both modes of learning (e.g. von Hippel, 1976; Rosenberg, 1982; Pavitt, 1984), quantitative research has

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1 Jensen et al. (2007) use alternative labels to denote both learning modes. As for practice-based learning, they employ the term “Doing, Using and Interacting Mode” (DUI), while they speak of science-based innovation as the “Science, Technology and Innovation (STI) Mode”. In the interest of simplicity, we opted for a more concise set of labels.
focused almost exclusively on science-based learning (Jensen et al., 2007). That said, an important body of conceptual or qualitative research has provided rich insights into more mundane, informal and experiential forms of practice-based learning. Among others, such studies have explored situated learning (e.g. Brown and Duguid, 1991; Lave and Wenger 1991), dispersed learning (e.g. Sole and Edmondson, 2002), incremental learning (e.g. Edmondson, 2002), learning from errors (e.g. Provera, Montefusco and Canato, 2010), or learning through experimenting (Pablo et al., 2007). Often informed by a practice perspective (Brown and Duguid, 2001), this literature has contributed much to understanding the nature of learning in work settings. In particular, it revealed that working, learning and innovating are closely interrelated and at times even inseparable (Brown and Duguid, 1991; Orr, 1996). Learning thus often occurs during actual practice, defined as the “coordinated activities of individuals and groups in doing their ‘real work’ as it is informed by a particular organizational or group context” (Cook and Brown, 1999, p. 386-387). As such, practice-based learning shapes - and is shaped by - the particular social context it is situated in (Lave and Wenger, 1991).

We believe that quantitative studies can complement this body of literature meaningfully by examining possible antecedents, consequences and moderators of practice-based learning. In doing so, quantitative research can test not least the underlying assumption of many practice-based studies that learning as an integral part of daily work is indeed beneficial (Brown and Duguid, 1991). This paper seeks to contribute to this endeavor both conceptually and empirically. Drawing on the Dynamic Capabilities View in general (e.g. Teece, Pisano and Shuen, 1997; Zahra, Sapienza and Davidsson, 2006) and the notion of incremental dynamic capabilities in particular (Ambrosini, Bowman and Collier, 2009), we conceptualize practice-based learning as a set of routines that enable organizations to gradually reconfigure their resource base in response to changing requirements. Organizations’ practice-based learning capabilities are expected to be not only highly persistent over time, but also reliant on the
availability of slack resources. Moreover, we suggest that the small steps triggered by practice-based learning lead to incremental improvements enhancing organizational performance. This should hold in particular when the underlying business model is labor-rather than capital-intensive.

We examine these ideas in the context of the public sector, which dedicates growing attention to innovation and learning (Hartley et al., 2008). Ferlie, Hartley and Martin (2003) explicitly call for quantitative research to complement existing qualitative studies and highlight the public sector as a particularly promising setting for conducting robust panel data analyses. Similarly, Easterby-Smith, Lyles and Peteraf (2009) highlight the need for longitudinal dynamic capabilities research in under-explored contexts such as the public sector. Responding to these calls, we present findings from dynamic panel data analyses based on a dataset covering all 153 public non-specialist hospitals in England over the three-year period from April 2004 to March 2007.

Overall, this study is dedicated to extending our understanding of the complex phenomenon of practice-based learning. To do so, we employ the dynamic capability view as our overarching theory. The latter provides the basis for decomposing practice-based learning into its constitutive routines and for developing four distinct hypotheses, which are tested by drawing on panel data from the particular setting of public, non-specialist hospitals. Our study thus contributes to research on organizational learning (e.g. Zietsma et al., 2002) and dynamic capabilities (e.g. Easterby-Smith, Lyles and Peteraf, 2009). At the same time, the empirical setting this study is located in allows us to add to an important line of research on organizational change and learning in the public sector in general (e.g. Cinite, Duxbury and Higgins, 2009; Hartley, Benington and Binns, 1997) and in public health care in particular (e.g. Ashburner, Ferlie and FitzGerald, 1996; Desai, 2010; Desombre et al., 2006; McNulty, 2003; Oborn and Dawson, 2010).
CONCEPTUAL BACKGROUND

Modes of Organizational Learning

In this study, we draw on recent conceptual developments by Jensen et al. (2007), who described, operationalized, and empirically investigated an ideal type distinction between practice-based and science-based learning, or as they labeled it, between a ‘doing, using, and interaction’ (DUI) and a ‘science, technology, and innovation’ (STI) mode of learning.

Science-based learning relies primarily on explicit, global know-what and know-why. It explores fundamentally new knowledge that might challenge the firm’s basic assumptions. Science-based learning is driven primarily by the generation or adaptation of new scientific knowledge, which is usually codified to assume a more global meaning beyond the specific context of its emergence. Given the obvious complexity, science-based learning projects are frequently concentrated on an ‘elite’ group of highly qualified scientists and engineers, and tend to be conducted as dedicated R&D projects that are somewhat removed from everyday operations. Science-based learning is thus strongly skewed towards technology-intensive, radical learning.

Practice-based learning, in contrast, relies primarily on implicit, local know-how and know-who. It is typically driven by rather mundane challenges and is motivated by a wide range of pragmatic problems encountered during regular work activities. Practice-based learning gradually expands and exploits the firm’s current knowledge base; it typically does not fundamentally depart from, but improves upon current knowledge. It largely thrives on learning by doing and learning by using. Internal ownership is hence ideally not limited to a specific hierarchical level or functional specialization but highly distributed across the entire organization. Moreover, practice-based learning typically occurs informally as part of regular work activities. The same individual can hence naturally integrate the role of a worker, learner
and innovator (Brown and Duguid, 1991), rendering the common separation between learning and work practice less appropriate.

Table 1 juxtaposes these two stylized learning modes. It is important, though, to emphasize that this is an ideal-typical distinction for analytical purposes only. Science- and practice-based learning as depicted here can be thought of as constituting the two extreme points of a continuum (Brown and Duguid, 1991). The demarcation between these learning modes is hence rather fuzzy, such that actual learning activities will more often than not include elements of both learning modes.

Practice-Based Learning as a Dynamic Capability

The Dynamic Capabilities View understands less organizational resources per se than their effective (re)configuration as a key source of sustained superior performance (Zollo and Winter, 2002). From a dynamic capabilities perspective, the competitive advantage of organizations results from their superior ability to adapt, adjust or reconfigure their resource base and operating routines in response to changing requirements (Eisenhardt and Martin, 2000; Teece, Pisano and Shuen, 1997). We follow Zollo and Winter (2002, p. 340) in defining dynamic capabilities as “a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness.” Ambrosini, Bowman and Collier (2009) distinguish between three levels of dynamic capabilities, which they label incremental, renewing and regenerating dynamic capabilities. Building on this theoretical work, we conceptualize practice-based learning as an incremental dynamic capability given its focus on continuously improving rather than radically altering the organizational resource base.
An understanding of practice-based learning as an incremental dynamic capability derives much of its appeal from a focus on routines. Capabilities, regardless of whether they are dynamic or substantive, are conceived of as bundles of organizational routines (Helfat and Peteraf, 2003; Macher and Mowery, 2009). According to Edmondson, Bohmer and Pisano (2001, p. 686) routines are “repeated patterns of behavior bound by rules and customs”. Although routines have long been thought of as a possible cause of organizational inertia (Hannan and Freeman, 1984), there is now a growing recognition of the transformative potential of routines (Feldman, 2000; Howard-Grenville, 2005; Amburgey, Kelly and Barnett, 1993). It is therefore not surprising that Levitt and March (1988) conceptualize organizational learning as being composed of distinct routines. Such learning routines can hence be the building blocks for dynamic learning capabilities (Dyer and Nobeoka, 2000). Consequently, it is by decomposing practice-based learning capabilities into its constitutive routines that we seek to explicate the complex nature of the concept.

Informed by previous research on dynamic capabilities and organizational learning (e.g. Brown and Duguid, 1991; Chiva and Alegre, 2009; Crossan, Lane and White, 1999; Day and Schoemaker, 2004; Teece, 2007; Zollo and Winter, 2002), we identify three constitutive routines of practice-based learning capabilities, which we label ‘detecting problems’, ‘suggesting ideas’, and ‘participating in change’.²

**Detecting problems**

The first routine consists in observing, recognizing and reporting problems and errors that occur as part of daily work activities. Such problems encountered in actual practice can constitute important “moments of breakdown” (Gherardi and Nicolini, 2001, p. 49) that provoke reflection and thereby trigger learning processes (Cook and Brown, 1999). This

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² As suggested by the information processing view, the sequence of these three routines is not strictly linear and unidirectional. Rather, there will be several feedback loops, through which outcomes at one stage shape subsequent iterations of information processing activities at earlier stages (Day and Schoemaker, 2004).
perception is shared by behavioral research. Cyert and March (1963) for instance suggest that perceived performance problems constitute a vital trigger of organizational learning and adaptation - a proposition that has received strong empirical support in the private (Greve, 2003) and the public sector (Salge, 2011). Similarly, Borins (2000) analyzed more than 400 innovation projects in the public sector and found that most were indeed driven by internal problems or crises. The fundamental importance of errors, near misses or incidents as key occasions for organizational learning is also highlighted by the literature on learning from failure (Baum and Dahlin, 2007; Haunschild and Sullivan, 2002; Perrow, 1984; Weick and Sutcliffe, 2007; Zhao, 2010). Indeed, this literature even suggests that organizations learn more effectively from prior failure than they do from previous success (Madsen and Desai, 2010; Sitkin, 1992).

**Suggesting Ideas**

Problem detection by itself is obviously not sufficient for any meaningful learning to occur. Rather, ideas to alleviate the performance problem at hand need to be proposed. Suggesting such ideas is therefore the second constitutive routine of practice-based learning. As von Hippel (1999) observes, such ideas are often best developed by those intimately familiar with the problem rather than by “specialists” detached from the specific context. When confronted with a problem or puzzle in their own community of practice, members are hence best positioned to engage in so-called “productive inquiry” designed to find a solution to the problem at hand (Cook and Brown, 1999). This process involves developing ideas for possible solutions, testing them by means of small experiments and discussing the outcomes (Brown and Duguid, 1991). Productive inquiry is hence a highly discursive activity, as part of which members of a community of practice jointly seek to identify the most appropriate solution (Gherardi and Nicolini, 2002; Wenger, 1998). In this process, ideas might be generated that break with existing work practices and suggest something new (Orr, 1996).
Developing and suggesting such ideas is at the very heart of practice-based learning and represents the creative variation generating mechanism that constitutes the vital engine of all evolutionary processes (Nelson and Winter, 1982). Given its importance, organizations need to encourage the suggestion of new ideas (Brown and Duguid, 1991). This can be achieved by creating a climate of psychological safety consisting in “a shared belief that the team will not embarrass, reject, or punish someone for speaking up” (Edmondson, 1999, p. 354). If this is coupled by active staff encouragement (Edmondson, 2003; Nemhhard and Edmondson, 2006) and a positive attitude towards risk and experimentation (Bozeman and Kingsley, 1998), chances are that employees feel motivated to suggest new and potentially challenging ideas (Zollo and Winter, 2002).

**Participating in change**

For practice-based learning to occur, new ideas need to become part of actual work activities. If learning is understood as “competent participation in practice” (Wenger, 1998, p. 137), it becomes apparent that members of a community of practice need to be involved in deciding upon changes that affect their work area. Only then can they feel and act as legitimate members of their respective community (Gherardi and Nicolini, 2002; Lave and Wenger, 1991). The third routine thus consists in collectively implementing those novel ideas that are perceived as being particularly effective in addressing specific problems (Chiva and Alegre, 2009). As research from social psychology shows (Baer and Frese, 2003), an organizational climate that advocates staff initiative and participatory decision-making is likely to positively affect the organizational ability to learn and to reap the benefits of innovative ideas. Dialogue and joint action are crucial to the development of shared understanding and to the institutionalization of learning, that is, to embedding learning into organizational systems, structures, procedures and strategy (Crossan, Lane and White, 1999). Involving staff from across the organization is particularly important for practice-based learning, which relies
heavily on front-line employees’ learning by doing and learning by using (Brown and Duguid, 1991; Orr, 1996; Rosenberg, 1982).

All three routines depicted above are expected to play a vital role for practice-based learning across a range of settings. This however applies only when each routine is examined at a relatively high level of abstraction, which is the case in our quantitative study. That said, learning is always “enacted within the boundaries of a domain of knowing and doing” (Gherardi, 2001, p. 131). When examined at a more concrete level, the specific nature of each learning routine is hence likely to vary depending on the particular context it is situated in (Lave and Wenger, 1991; Gherardi and Nicolini, 2001).

**HYPOTHESES**

**Temporal Persistence**

The assumption of temporal persistence is implicit in the conceptualization of practice-based learning as a dynamic capability consisting of a bundle of organizational routines defined as “a learned and stable pattern of collective activity” (Zollo and Winter, 2002, p. 340, emphasis added). We therefore expect considerable path-dependence in the extent to which organizations demonstrate practice-based learning capabilities (Sydow, Schreyögg and Koch, 2009). Several arguments can be advanced in support of this proposition.

First, positive market feedback is expected to drive a virtuous cycle between learning capabilities, learning success and organizational performance (Malerba, Orsenigo and Peretto, 1997; Nelson and Winter, 1982). Such ‘success-breeds-success’ models indicate that successful engagement in learning leads to greater financial and non-financial returns, which are invested in resources that facilitate future engagement in learning activities. Organizations with effective practice-based learning routines will thus be inclined to further invest in strengthening them.
Second, temporal persistence in practice-based learning capabilities may also be the result of the cumulative nature of organizational learning. What an organization learns depends on what it already knows, on the length of its history, and on the development stage of its organizational routines (Cohen and Levinthal, 1990; Zahra and George, 2002). More specifically, engagement in practice-based learning is likely to improve not only specific operating routines but also the practice-based learning routines themselves through ‘learning-by-doing’ and ‘learning-to-learn’ effects (Geroski, Van Reenen and Walters, 1997; Malerba, Orsenigo and Peretto, 1997).

Third, organizations dedicate considerable attention and resources to the institutionalization of dynamic capabilities (Teece, Pisano and Shuen, 1997). As for practice-based learning capabilities, such investment might consist in establishing formal idea suggestion systems, quality improvement circles or specific incentive schemes (Jensen et al., 2007). Such support infrastructure is likely to contribute to greater temporal stability in the level of practice-based learning capabilities. We therefore expect the latter to be characterized by considerable path-dependence. Hence:

**Hypothesis 1:** Practice-based learning capabilities will demonstrate high temporal persistence, such that past levels of practice-based learning capabilities will be closely related to current levels.

**Slack Resources**

The development, maintenance and exercise of dynamic capabilities are highly resource-intensive activities (Zahra, Sapienza and Davidsson, 2006). This is also likely to hold for practice-based learning capabilities. Organizations will have to invest in developing an appropriate organizational infrastructure and a supportive organizational climate, if they are to build and maintain effective practice-based learning capabilities. Similarly, human and
financial resources will be required for problem detection, idea suggestion and change implementation. As resources are scarce, those dedicated to building, maintaining and exercising practice-based learning capabilities might be lacking elsewhere within the organization. The extent to which organizations can invest in their practice-based learning capabilities is thus likely to depend on their level of uncommitted excess resources (Voss, Sirdeshmukh and Voss, 2008). Operational slack - for instance in form of uncommitted staff time - appears particularly important for practice-based learning in that it provides employees with the autonomy and flexibility required to engage in problem detection, idea suggestion and change implementation (Singh, 1986). Consistent with these theoretical arguments, recent empirical studies have revealed a positive link between slack and innovation in a number of private and public sector settings (Chen, 2008; Danneels, 2008; Greve, 2003; Kim, Kim and Lee, 2008; Salge, 2011).

At the same time, researchers have argued that excessive levels of slack can be detrimental for innovation and learning (Jensen, 1986; Jensen, 1993; Nohria and Gulati, 1996). In particular, excessive levels of slack are assumed to result in loose managerial controls and ineffective use of organizational resources for initiatives that are more closely aligned with employees’ own preferences than with organizational goals. Perhaps more importantly, however, excessive slack can provide a false sense of security that contributes to organizational inertia at the expense of continuous adaptation (Hannan and Freeman, 1984). In such a case, decision-makers are likely to favor stability, hence dedicating less attention and resources to building, maintaining and exercising practice-based learning capabilities.

Considering these arguments, it appears likely that the marginal effect of slack on learning will decline as operational slack increases. As a consequence, operational slack will be positively associated with practice-based learning up until the point where slack becomes excessive. Once this turning point has been reached, however, excessive slack is expected to
drive inertia rather than adaptation leading to a negative marginal effect of slack on learning. Overall, we hence assume a curvilinear, inverse U-shaped relationship between operational slack and the level of practice-based learning capabilities. The latter will hence be optimized at moderate levels of slack, while both too much and too little slack is likely to be suboptimal. Although this proposition has not yet been examined with regards to practice-based learning capabilities, Nohria and Gulati (1996) found empirical support for a curvilinear link between slack and innovation. We therefore suggest:

**Hypothesis 2:** There will be a curvilinear (inverse U-shaped) relationship between operational slack and the level of practice-based learning capabilities.

**Performance Consequences**

Dynamic capabilities are widely assumed to positively affect organizational performance (e.g. Helfat and Peteraf, 2003; Teece, Pisano and Shuen, 1997; Winter, 2003). In particular, dynamic capabilities are conceived of as being the engine of organizational adaptation to changing external requirements. More specifically, dynamic capabilities allow organizations to renew their resource base and operating routines (Eisenhardt and Martin, 2000). This is of great strategic value in times of competitive and fast moving market and technology environments (Teece, 2007). Consequently, organizations with strong dynamic capabilities are expected to exhibit superior performance (Zahra, Sapienza and Davidsson, 2006; Zott, 2003).

Following these arguments, we suggest that practice-based learning capabilities are likely to enhance organizational performance. Detecting problems, suggesting ideas and implementing change clearly constitute key routines to modify or reconfigure existing operating processes, thereby adapting to changing environmental requirements. Over time, practice-based learning capabilities are hence expected to contribute to extending and updating the organizational knowledge base. They therefore enable the organization to change the way it solves its
problems in pursuit of improved effectiveness. Although such change might come in small steps, we expect their sum to matter greatly. Consistent with extant learning (e.g. Pisano, Bohmer and Edmondson, 2001) and innovation research (e.g. Damanpour, Walker and Avellaneda, 2009; Jansen, Van Den Bosch and Volberda, 2006; Han, Kim and Srivastava, 1998), we therefore propose that organizational performance will tend to improve with higher levels of practice-based learning capabilities. Thus:

**Hypothesis 3:** There will be a positive relationship between the level of practice-based learning capabilities and organizational performance.

**Moderating Role of the Business Model**

Despite its hypothesized overall performance-enhancing effect, we do not expect practice-based learning capabilities to be of universal value. Rather, we assume that organizations are likely to differ in the extent to which they will benefit from practice-based learning. We thus advocate a contingency view of practice-based learning and examine the extent to which the pay-off from practice-based learning is contingent on the type of business model adopted by the focal organization - a crucial factor that has hitherto received little attention in organizational learning research (Chesbrough and Rosenbloom, 2002).

A business model is of vital strategic importance in that it constitutes an abstract representation of the economic “money earning” logic of an organization (Froud et al., 2009; Magretta, 2002; Zott and Amit, 2010). As such, business models specify the customer value proposition as well as the mechanisms for value creation and value capture (Chesbrough, 2010; Teece, 2010). Since business models constitute complex systems, they can vary along various dimensions including the targeted market segment or the value chain elements covered (Chesbrough and Rosenbloom, 2002). Inter-organizational variation along these dimensions is likely to be reflected in distinct resource configurations. As the latter are at the heart of the dynamic capability view, we propose a resource-oriented distinction.
Although resources come in various forms and shapes (Barney, 1991), we focus on the relative importance of labor and capital as two elementary, mutually substitutable resource types. Following this approach, business models can be positioned on a continuum with highly labor- and highly capital-intensive business models as its two stylized endpoints. Both ideal-type business models are likely to have very different learning requirements. Organizations with highly capital-intensive business models tend to rely primarily on sophisticated state-of-the-art technologies and facilities. To adapt and reconfigure such a resource base, science- rather than practice-based learning capabilities appear to be paramount. Organizations with high relative capital intensity are hence expected to benefit more from rigorous R&D activities conducted by highly qualified experts than from more mundane and pragmatic problem detection, idea suggestion and change implementation routines fueled by front-line employees. Conversely, organizations with a highly labor-intensive business model rely heavily on motivated and skilled personnel and its ability to satisfy customer needs. As operating routines tend to be less sophisticated technologically, its continuous reconfiguration is not the sole responsibility of a small scientific elite, but the collective mission of all employees. In doing so, the latter detect problems, suggest ideas and implement change in a joint endeavor to adjust and further improve operating routines.

Given these distinct learning requirements, the type of business model is expected to moderate the pay-off from learning. As for practice-based learning, we suggest that the performance effect is likely to increase with the level of relative labor intensity. Hence:

**Hypothesis 4:** The level of relative labor intensity will positively moderate the relationship between practice-based learning capabilities and organizational performance, such that the effect is higher in organizations with a labor-intensive than with a capital-intensive business model.

Figure I summarizes our hypotheses and illustrates our theoretical model.
METHODOLOGY

Setting and Data

We examine our hypotheses in the context of public hospital services in England. As health care is a highly knowledge intensive service facing the continuous challenge of optimizing clinical outcomes with increasingly limited resources, innovation and learning are clearly paramount (Djellal and Gallouj, 2005; Metcalfe, James and Mina, 2005; Salge and Vera, 2009). In choosing this setting, we also contribute to broadening the empirical evidence base on organizational learning and dynamic capabilities – two research areas, where large-scale empirical studies located in the public sector remain surprisingly absent despite their apparent relevance (e.g. Easterby-Smith, Lyles and Peteraf, 2009; Harvey et al., 2010).³ This is all the more important, as public sector organizations tend to differ significantly from their private sector counterparts not least with regards to their stronger exposure to political influence, competitive forces, public scrutiny and internal bureaucracy (Bozeman and Bretschneider, 1994; Boyne, 2002). All of these are likely to affect the highly context-specific phenomenon of organizational learning (e.g. Miner and Mezias, 1996; Bapuji and Crossan, 2004).

Public hospitals in England operate as so-called Acute Trusts under the umbrella of the National Health Service (NHS). Each Acute Trust is an independent legal entity with its own board and annual financial statements. Our dataset includes all 153 non-specialist Acute Trusts in England. Each is observed over the three-year period from April 2004 to March

³ See Moynihan and Landuyt (2009) for a rare exception.
2007 for a total of 459 observations. It is precisely the absence of such panel datasets that has long constituted a major obstacle to empirical learning research in the public sector (Ferlie, Hartley and Martin, 2003). Similarly, such a dataset is needed to respond to recent calls for more longitudinal research on dynamic capabilities (Easterby-Smith, Lyles and Peteraf, 2009). The database underlying this study was populated by integrating archival data provided by numerous actors in the English health system, which include the Department of Health, the NHS, Dr Foster, the Care Quality Commission and Monitor. Whenever archival records were incomplete, we collected the missing information directly from the individual Acute Trusts drawing on published material such as annual reports or responses to our own information requests. This process resulted in a complete and balanced panel dataset that was not affected by any missing data problems.

Measures

Practice-based Learning Capabilities

The measurement of dynamic capabilities in general and practice-based learning capabilities in particular is inherently difficult, as they materialize only when exercised (Easterby-Smith, Lyles and Peteraf, 2009). Jensen et al. (2007) for instance relied on a survey to solicit top management’s view on the presence of certain organizational practices thought to enhance practice-based learning. These included interdisciplinary work groups, quality circles and suggestion systems among others. Although clearly valid, this approach captures only managerial perceptions, which are likely to diverge from organizational reality.

In the present study, we therefore follow recent calls for multi-informant designs (e.g. Doty and Glick, 1998; Van Bruggen, Lilien and Kacker, 2002; Walker and Enticott, 2004) and rely on the assessments of a large number of employees in each organization distributed across hierarchical levels and functional areas. Such unique multi-informant data on practice-based
learning was collected by means of three waves of an annual staff survey carried out by the NHS. This survey covers all NHS Trusts, each of which draws a random quota sample among all of its staff members. Response rates across all Trusts amount to 56.58 percent in 2004, 54.54 percent in 2005 and 51.55 percent in 2006. As for the practice-based learning items, for the three-year period from April 2004 to March 2007, an average of 409.21 individual staff responses are available per organization and year (sd=69.94; min=131; max=563).

Consistent with our theoretical conception and recent empirical studies in the dynamic capabilities literature (e.g. Macher and Mowery, 2009), we adopt a routine-based measurement approach. In particular, we measure practice-based learning capabilities by means of three items with five-point Likert-type scales ranging from “strongly disagree” to “strongly agree”. These are “My Trust encourages us to report errors, near misses or incidents” for routine 1 (‘detecting problems’), “Managers encourage staff to suggest new ideas for improving services” for routine 2 (‘suggesting ideas’), and “I am involved in deciding on the changes introduced that affect my work area / team / department” for routine 3 (‘participating in change’). We then aggregated these individual-level perceptions of learning routines to the hospital level. To justify such aggregation, we needed to demonstrate the reliability of learning routine means across units. For this purpose, we calculated intraclass correlation (ICC) statistics and found an ICC(2) of 0.92, well above the 0.70 benchmark required to justify aggregation (Klein and Kozlowski, 2000). Moreover, the overall measure of practice-based learning capabilities demonstrated an adequate reliability coefficient alpha of 0.76.

**Organizational Performance**

When examined from a service user perspective (Ferlie, Hartley and Martin, 2003; Vigoda-Gadot et al., 2008), the quality of public services is expected to be the central performance metric. Given hospitals’ primary mission to cure ill or injured patients, quality, at the most basic level, consists in guaranteeing the survival of as many admitted patients as possible, that
is, low mortality rates. The latter, however, are obviously affected by the specific characteristics of a hospital’s patient mix and hence need to be risk-adjusted to take inter-hospital differences in patient mix into account. For this purpose, the so-called Hospital Standardized Mortality Ratio (HSMR) has been developed and is now widely established as a standard measure of hospital quality (e.g. Jarman et al., 1999). The HSMR corresponds to the ratio of actual deaths to expected deaths. Risk-adjustment is achieved by taking into account standardization factors such as gender, age, primary diagnosis and co-morbidities. The HSMR is centered to 100 corresponding to the expected death rate with values greater (smaller) than 100 indicating a higher (lower) death rate than normally expected. Since a higher HSMR represents lower performance, we calculated organizational performance as 200 - HSMR.4

**Operational Slack**

Operational slack consists in unused or underutilized physical resources, e.g. excess production capacities, unoccupied facilities or excess staffing levels. In the hospital sector, a key physical resource is the number of beds, which is also by far the most common indicator for hospital size (e.g. Kimberly and Evanisko, 1981; Goes and Park, 1997). Therefore, in the present study we measure operational slack by the share of unoccupied hospital beds.

**Relative Labor Intensity of Business Model**

We argued that relative labor intensity, i.e. the ratio between labor to capital investments, is a key factor to distinguish different types of business models. Consistent with previous research (e.g. Dewenter and Malatesta, 2001), we measure relative labor intensity as the ratio between the number of full-time equivalents employed by the Trust and the value of fixed assets as specified in the hospital’s balance sheet.

4 While the HSMR reflects in particular a hospital’s success at addressing the most severe cases where survival is at stake, it might also serve as a suitable proxy for the quality of care in less severe cases. For instance, a low HSMR is likely to reflect a superior ability to avoid medical errors and hospital acquired infections, both of which can be a cause of death among less severely ill patients.
**Control Variables**

We also controlled for a number of factors that are regularly associated with differences in hospital performance (Chadwick, Hunter and Walston, 2004; Fottler, 1987; McCracken, McIlwain and Fottler, 2001). First, we measured the *size* of each hospital by the total number of hospital beds available for use - the dominant size measure in the health care management literature and commonly assumed to be an important predictor of care quality (e.g. Wouters, Jansen-Landheer and van de Velde, 2010). Second, by means of a dummy variable we captured whether an organization was granted *foundation trust* status leading to greater managerial autonomy. Third, we included a dummy measure of the hospital’s *university affiliation*. Fourth, given the increasingly competitive nature of the public hospital landscape in England (Martin and Smith, 2005), we also control for *environmental competitiveness* measured as the share of unoccupied beds within the local market, assuming that higher excess bed capacity within a market leads to intensified competition for activity volumes among local hospital service providers. Fifth, the *environmental rurality* of the hospital’s location measured by a rurality index on a scale from 0 (metropolitan) to 100 (rural) was used as a control variable. Last, we control for *year effects* by means of time dummies.

**Analyses**

Our dataset includes a cross-sectional and a temporal dimension and, consequently, calls for suitable panel data techniques such as random or fixed effects estimators (Halaby, 2004). To test hypothesis 1 pertaining to the temporal persistence of practice-based learning capabilities, however, we needed to include a lagged dependent variable. Such an autoregressive model cannot be estimated reliably using standard panel data techniques given the risk of potential endogeneity biases due to the inclusion of a lagged dependent variable (Cefis and Orsenigo, 2001). We therefore rely on a one-step system General Method of Moments (GMM) estimator explicitly developed for estimating autoregressive models based on panel data with many
cross-sectional, yet few temporal observations (Arellano, 2003). GMM models directly address the endogeneity bias that can arise particularly in so-called “small T, large N” panels with lagged dependent variables, which are necessarily correlated with the error term. GMM models do so by using lagged values of the regressors as instruments, instead of drawing on instrumental variables external to the structural equation. Furthermore, GMM estimation accounts for time-invariant, unobserved organization-specific heterogeneity, which is eliminated by transforming all regressors, typically by first-differencing, and thereby minimizes the risk of spurious persistence estimates. Given these advantages, we employ the Arellano-Bond System GMM estimator with heteroscedasticity and autocorrelation consistent standard errors (Wawro, 2002; Uotila et al., 2009). Consistent with good practice in strategic action-performance studies, we lag all independent variables by one year to establish the temporal sequencing that is required when seeking to identify cause and effect relationships.

RESULTS

Table 2 presents descriptive statistics and pairwise correlations. Descriptive statistics indicate considerable inter-organizational variation in all variables. Given the purpose of this study, it is particularly important to note the considerable variation in organizational performance and the low correlations between our key variables organizational performance, practice-based learning, relative labor intensity and operational slack.

Table 3 presents GMM panel data regression results with respect to the antecedents of practice-based learning capabilities. Model 1 contains only controls. Main effects are then introduced in model 2.

5 In our GMM models, we follow previous research and treat time effects and control variables as exogenous, main and interaction effects variables as endogenous and all other independent variables as predetermined.
As for the control variables, coefficient estimates are negative and statistically significant for ‘organizational size’ and ‘environmental rurality’, but positive for ‘foundation trust status’. These findings are consistent across models 1 and 2, suggesting that small foundation trusts in metropolitan areas have particularly high levels of practice-based learning capabilities.

Hypothesis 1 suggests a positive relationship between past and current levels of practice-based learning capabilities. More specifically, the coefficient estimate for the lagged practice-based learning variable in model 2 - the persistence parameter - indicates the degree of temporal persistence in practice-based learning. This parameter is expected to fall within the range from zero to one (Roberts and Dowling, 2002). Values approaching one indicate high persistence, while those approaching zero indicate low persistence (O’Toole and Meier, 1999). The persistence parameter in model 2 is 0.44 and highly significant, pointing to moderate temporal persistence in practice-based learning capabilities. Hypothesis 1 is thus supported.

According to hypothesis 2, we expect an inverse U-shaped relationship between operational slack and the level of practice-based learning capabilities. To support such a curvilinear link, the coefficient of the linear term for operational slack in model 2 needs to be positive, while the coefficient of the squared term needs to be negative and statistically significant. Both coefficients demonstrate the expected algebraic signs. However, the effects are very small in magnitude and fail to achieve statistical significance. Hypothesis 2 is thus not supported.6

Table 4 presents the results from GMM analyses explaining hospital performance. Model 3 contains only controls. Main effects are added in model 4 and interaction effects in model 5.

---

6 The lack of statistical significance might be a consequence of our indirect measurement approach of operational slack. Although it appears plausible to assume that lower bed occupancy will be associated with higher uncommitted staff time, it would have been better to measure the latter directly. As an alternative explanation, practice-based learning might be less dependent on uncommitted resources in that it can potentially make use of the resources regularly available as part of daily work activities.
As for the control variables, the strong and highly significant coefficients of ‘lagged performance’ in models 3 to 5 support a conception of public service organizations as autoregressive, inertial systems, whose past performance is often one of the best predictors of current performance (O’Toole and Meier, 1999; Meier and O’Toole, 2003). We also identify significant, positive effects of ‘university affiliation’ and ‘environmental rurality’, which are consistent across models 3 to 5 indicating particularly high patient survival rates for university hospitals in rural areas. Although hospital size is frequently considered an important predictor of care quality, we do not find larger hospitals to demonstrate higher patient survival rates.

Hypothesis 3 suggests a positive relationship between the level of practice-based learning capabilities and organizational performance. In line with our theoretical expectation, the coefficient estimate for practice-based learning in model 4 is positive and statistically significant. The effect size is substantial and practically meaningful in that it suggests that a one point increase in practice-based learning capabilities, measured on a 5 point scale, is associated with a 14.07 point increase in risk-adjusted patient survival, centered on 100. Even a one standard deviation increase in practice-based learning capabilities, i.e. an increase by 0.1 points, will be associated with a 1.41 point increase in risk-adjusted patient survival. Hypothesis 3 is thus supported.

Following hypothesis 4, we expect the positive relationship between practice-based learning capabilities and performance to be positively moderated by the relative labor intensity of hospitals’ business models. We thus expect the performance-enhancing effect of practice-based learning capabilities to become stronger as hospitals’ ratio of labor to capital investments increases. The interaction term in model 5 is positive and significant, suggesting that hospitals with greater relative reliance on human resources tend to benefit significantly
more from practice-based learning capabilities than their more capital-intensive counterparts. Hypothesis 4 is thus supported.

**DISCUSSION**

In our study, we examined the *phenomenon* of practice-based learning, employing the dynamic capability view as our overarching *theory* and drawing on panel data from the specific *setting* of public hospital services. As a result, our findings are likely to have meaningful implications for research on (1) organizational learning, (2) dynamic capabilities and (3) public and health care management as well as for (4) practice and policy.

**Implications for Research on Organizational Learning**

First and most importantly, our study adds to the literature on organizational learning. In particular, we provide one of the first quantitative and longitudinal analyses of incremental, practice-based learning. In doing so, we complement previous qualitative studies taking a practice perspective on learning (e.g. Brown and Duguid, 1991; Lave and Wenger, 1991; Sole and Edmondson, 2002). Such research has been highly useful for providing rich insights into the nature of learning as an integral part of regular work practices. However, it is less well suited for identifying systematic relationships pertaining to the antecedents, consequences and moderators of practice-based learning. Brown and Duguid (1991, p. 55) for instance highlight that “it has been unstated assumption that a unified understanding of working, learning and innovation is potentially highly beneficial.” Our study provides robust empirical support of this assumption, finding that practice-based learning capabilities indeed enhance organizational performance in a statistically significant way. This finding complements Jensen et al.’s (2007) work that uncovered innovation-enhancing effects of practice-based learning. There is hence now robust evidence suggesting the practice-based learning is beneficial not only for innovation but also for learning.
Add these findings to the fact that science-based learning is equally a key contributor to innovation and performance (Jensen et al., 2007; Salge and Vera, 2009). It then becomes apparent that the entire spectrum of organizational learning activities is highly valuable. Our findings also suggest that the payoff from practice-based learning is likely to depend on the respective business model and the resource configuration adopted. We therefore contribute to the contingency perspective on learning that has already identified a number of essential boundary conditions for effective organizational learning (e.g. Bapuji and Crossan, 2004; Miner and Mezias, 1996; Zahra, Sapienza and Davidsson, 2006, Nembhard and Edmondson, 2006). As quantitative research continues to demonstrate a pronounced bias towards the science-based end of the continuum (Jensen et al., 2007), further research is required to explore the practice-based end of the spectrum in greater detail. Such research can potentially benefit from our study that started to examine possible boundary conditions and decomposed the concept of practice-based learning into its constitutive routines thereby making it accessible to systematic measurement.

Our study focused on organizations’ aggregate practice-based learning capabilities and hence examined the three constitutive routines as a bundle rather than individually. That said, our findings also provide indirect support for the performance-enhancing effects of problem detection, idea suggestion and change implementation routines. This holds for instance with regards to problem detection and reporting as an essential precondition for practice-based learning. In particular, our findings are consistent with Gherardi and Nicolini’s (2001) ideas of problems as “moments of breakdown” that trigger reflection and learning. This reinforces the vital importance of error reporting (Zhao and Olivera, 2006) and of creating a climate of psychological safety that reduces the interpersonal risks potentially associated with detecting and reporting errors (Nembhard and Edmondson, 2006; Tucker and Edmondson, 2003; Edmondson 2003; Edmondson 1999).
Implications for Research on Dynamic Capabilities

Second, our study contributes to the literature on dynamic capabilities that has long been limited by the lack of longitudinal studies designed to uncover temporal dynamics and causal relationships (Easterby-Smith, Lyles and Peteraf, 2009). This holds not least for incremental dynamic capabilities meant to gradually modify the organizational resource base. As one of few large-scale longitudinal studies explicitly testing central predictions of the Dynamic Capabilities View, our research contributes to filling this research gap.

For this purpose, we respond to frequent calls for greater conceptual clarity in dynamic capabilities research (Zahra, Sapienza and Davidsson, 2006). We thus focus on one specific incremental dynamic capability, for which we provide a concrete definition, a conceptualization based on three constitutive routines as well as a measurement model. This approach makes the abstract concept of dynamic capabilities amenable to hypothesis testing.

In particular, our finding that practice-based learning capabilities are persistent over time, i.e. path-dependent, is consistent with a theorization of dynamic capabilities as bundles of routines, defined as “learned and stable pattern[s] of collective activity” (Zollo and Winter, 2002, p. 340, emphasis added). Moreover, our results support the central prediction that dynamic capabilities enhance operating routines and organizational performance (Zott, 2003) even in a public sector setting that is partly shielded from competitive market pressures (Easterby-Smith, Lyles and Peteraf, 2009). Perhaps more interestingly from a conceptual point of view, we demonstrate that the value of dynamic capabilities depends not only on environmental factors (Zahra, Sapienza and Davidsson, 2006), but also on the type of business model adopted by the focal organization - a crucial factor that has hitherto received little attention by dynamic capability researchers. Future contingency studies might thus wish to explore internal in addition to external contingency factors potentially moderating the relationship between dynamic capabilities and performance.
Implications for Research on Public and Health Care Management

Third, relevant implications for public and health care management research can be derived from our study. Here, our study contributes not least to the important literature stream that seeks to explain performance differences among public organizations in general (e.g. Boyne et al., 2005; Meier et al., 2007; Hartley et al., 2008) and hospitals in particular (e.g. Chadwick, Hunter and Walston, 2004; Fottler, 1987). Previous research in this area has revealed the importance of organizational structure, culture and strategy as determinants of performance.

Recent qualitative studies, however, suggest that specific dynamic capabilities such as the implementation of innovations (Piening, 2011) or learning through experimenting (Pablo et al., 2007) might play a vital role in explaining performance differences among public organizations. Our longitudinal study provides robust evidence in support of this proposition. In particular, our findings highlight that hospitals with more pronounced practice-based learning capabilities demonstrate notably higher risk-adjusted patient survival rates than those with less developed practice-based learning capabilities. This finding underlines the considerable value of the dynamic capability and organizational learning concepts for public and health care management research, but also points to the vital importance of practice-based learning routines. Especially in health care, the detection and reporting of problems that might take the form of errors, near misses or incidents appears particularly important, as errors will often have severe consequences (Dean et al., 2002). Our research indicates that strong routines for detecting, reporting and learning from such errors have considerable potential for improving the quality of care in hospital settings (Edmondson, 1996). That said, all three practice-based learning routines merit further, more detailed longitudinal analysis.
Implications for Practice and Policy

Last, some implications for practice and policy emerge from this study. Perhaps most importantly, our findings point managers and policy makers to the notable importance of dynamic capabilities in general and practice-based learning in particular. Clearly, the close association between practice-based learning and patient survival suggests that encouraging incremental learning occurring as an integral part of daily work activities is likely to contribute to tangible performance improvements. This reinforces findings from qualitative studies on innovation suggesting that “hidden innovation often represents the innovation that matters - the innovation that most directly contributes to the real practice and performance of a sector” (NESTA, 2007, p.4). Interviews conducted with over seventy practitioners in the English NHS indicate, however, that practice-based learning routines receive surprisingly little managerial and political attention. In contrast, more science-based initiatives enjoy substantial support from top management, R&D-specialists and external funding bodies. Similar observations have been made in other settings such as the Danish private sector (Jensen et al., 2007). There hence appears to be a general predisposition towards high-tech, science-based forms of learning. It is against this backdrop that this paper highlights that practice-based learning routines merit greater support by both managers and policy makers.

By decomposing practice-based learning into three of its constitutive routines, our study guides managers in this endeavor. For these routines to flourish, decision-makers need to encourage the reporting and open discussion of errors, incidents and other problems (Provera, Montefusco and Canato, 2010), value and act upon the ideas submitted by all staff members and involve the latter in key decisions that affect their work (Tucker and Edmondson, 2003; Edmondson 2003; Nembhard and Edmondson, 2006).


Limitations and Future Research

A number of important limitations remain for future research to be addressed.

First, our study draws on existing survey data to enable longitudinal analyses. As such, it was limited with regards to the number of items available to measure the practice-based learning construct. Therefore, we are only able to examine each routine in a rather abstract way that hides a wealth of detail and hence does not reflect adequately their inherent complexity. Future research could address this important limitation of our study by developing a broader set of items capturing the various facets of each learning routine.

Second, we rely on subjective staff perceptions of the three practice-based learning routines. Although our multi-informant approach benefits from an average of 409 staff responses per organization and year, we do not measure actual problem reporting, idea suggestion or change implementation behaviors. Future research might thus wish to collect objective rather than subjective data to capture the constitutive routines of practice-based learning.

Last, this study relies on data from public hospital services in England. Given the specificity of this setting, the question of generalizability of our findings merits particular attention. Clearly, our empirical results hold primarily for the specific context of this study. Although we believe that similar relationships may be revealed in alternative health care and public sector settings, this assumption should not remain untested. Indeed, we hope that this research will trigger further research into the nature and value of practice-based learning in the public sector and beyond.
REFERENCES


Easterby-Smith, M., M.A. Lyles and M.A. Peteraf, 2009. ‘Dynamic capabilities: Current


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FIGURES AND TABLES

Figure 1: The Conceptual Model

Table 1: A Typology of Learning Modes

<table>
<thead>
<tr>
<th>Knowledge Type</th>
<th>Practice-Based Learning (DUI Mode)</th>
<th>Science-Based Learning (STI Mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>implicit</td>
<td>explicit</td>
</tr>
<tr>
<td></td>
<td>local</td>
<td>global</td>
</tr>
<tr>
<td></td>
<td>know-how</td>
<td>know-what</td>
</tr>
<tr>
<td></td>
<td>know-who</td>
<td>know-why</td>
</tr>
<tr>
<td>Practice Integration</td>
<td>strong</td>
<td>weak</td>
</tr>
<tr>
<td>Thematic Scope</td>
<td>wide</td>
<td>narrow</td>
</tr>
<tr>
<td>Internal Ownership</td>
<td>distributed</td>
<td>concentrated</td>
</tr>
<tr>
<td>Organizational Context</td>
<td>informal</td>
<td>formal</td>
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</table>

Adapted from Jensen et al. (2007)
Table 2: Descriptive Statistics and Correlations

<table>
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<th>Variable</th>
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<th>SD</th>
<th>Min</th>
<th>Max</th>
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<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
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</thead>
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<td>1. Organizational performance</td>
<td>100.6</td>
<td>12.1</td>
<td>55.6</td>
<td>134.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Practice-based learning</td>
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<td>0.1</td>
<td>3.1</td>
<td>3.7</td>
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<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Relative labor intensity</td>
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<td>13.1</td>
<td>9.1</td>
<td>163.0</td>
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<td>0.10</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Operational slack</td>
<td>15.4</td>
<td>6.2</td>
<td>0.3</td>
<td>38.5</td>
<td>-0.04</td>
<td>0.06</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Organizational size</td>
<td>820.6</td>
<td>382.1</td>
<td>250.1</td>
<td>2512.2</td>
<td>0.14</td>
<td>-0.09</td>
<td>0.01</td>
<td>0.09</td>
<td></td>
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<tr>
<td>6. University affiliation</td>
<td>0.2</td>
<td>0.4</td>
<td>0.0</td>
<td>1.0</td>
<td>0.39</td>
<td>0.03</td>
<td>0.02</td>
<td>0.03</td>
<td>0.43</td>
<td></td>
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<td>7. Foundation trust status</td>
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<td>0.12</td>
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<td>0.10</td>
<td>0.06</td>
<td>0.10</td>
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<td>8. Environmental competitiveness</td>
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<td>2.3</td>
<td>11.0</td>
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<td>-0.01</td>
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<td>0.19</td>
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<td>9. Environmental rurality</td>
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<td>100.0</td>
<td>-0.03</td>
<td>-0.07</td>
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<td>-0.02</td>
<td>0.27</td>
<td>-0.17</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

Notes: N = 459 (153 organizations over three years (April 2004 to March 2007). * p < 0.01.

Table 3: GMM Analyses Explaining Practice-based Learning Capabilities

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
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<td></td>
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<td>S.E.</td>
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<td>Control Variables</td>
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<tr>
<td>Intercept</td>
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<td>(0.1174) ***</td>
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<tr>
<td>Organizational size</td>
<td>-0.0571</td>
<td>(0.0155) ***</td>
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<tr>
<td>University affiliation</td>
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<td>(0.0160)</td>
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<td>Foundation trust status</td>
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<td>(0.0122) ***</td>
</tr>
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<td>Environmental competitiveness</td>
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<td>(0.0012) *</td>
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<tr>
<td>Environmental rurality</td>
<td>-0.0005</td>
<td>(0.0003) *</td>
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<td>Time dummies</td>
<td>Yes ***</td>
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<tr>
<td>Main Effects</td>
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<tr>
<td>Lagged practice-based learning</td>
<td>H1 →(+)</td>
<td>0.4347</td>
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<tr>
<td>Operational slack</td>
<td>H2 →(+)</td>
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<tr>
<td>Operational slack squared</td>
<td>H2 →(-)</td>
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<td>Observations</td>
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<tr>
<td>F-Statistic</td>
<td>8.42 ***</td>
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</tbody>
</table>

Notes: Dynamic panel data estimation using one-step system General Method of Moments (GMM) with heteroscedasticity and autocorrelation consistent standard errors. * p < 0.10; ** p < 0.05; *** p < 0.01.
### Table 4: GMM Analyses Explaining Organizational Performance

<table>
<thead>
<tr>
<th></th>
<th>Model 3</th>
<th></th>
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<td>Intercept</td>
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<td>1.3900</td>
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<td>University affiliation</td>
<td>6.5440</td>
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<td>7.0350</td>
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<td>Foundation trust status</td>
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<td>Environmental rurality</td>
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<td>0.0571</td>
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<td>Time dummies</td>
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<td>Yes ***</td>
<td></td>
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<tr>
<td>Practice-based learning</td>
<td>H3 \rightarrow (+)</td>
<td></td>
<td>14.0711</td>
<td>(5.371)</td>
<td>**</td>
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<td>Relative labor intensity</td>
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<td></td>
<td>-0.1220</td>
<td>(0.057)</td>
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<td>-0.1628</td>
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<tr>
<td>Practice-based learning x Relative labor intensity</td>
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<td>F-Statistic</td>
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<td>20.64 ***</td>
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<td>18.64 ***</td>
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</tbody>
</table>

**Notes:** Dynamic panel data estimation using one-step system General Method of Moments (GMM) with heteroscedasticity and autocorrelation consistent standard errors.

* p < 0.10; ** p < 0.05; *** p < 0.01.