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Controlling adaptation at the edges: dual-process organizational learning

Abstract

This research uses dual-process models of individual cognition to build a theory of organizational dual-process learning: the ability of distributed managers to make tradeoffs between exploitation and exploration in response to mechanisms deployed centrally. Through ongoing adjustment of slack and managerial discretion at distributed locations, the theory explains how central leadership can dynamically invoke exploration at the edges and why they should. To investigate the theory, the authors report results of a field study of a major retail chain. Findings suggest that the model can provide insights regarding performance outcome differences across retail outlets, despite the fact that the outlets have the same level of resource inputs.

Keywords: organizational adaptation, retail chains, knowledge creation, slack, managerial discretion, information processing.

JEL Classification: L22.

“Maintaining an appropriate balance between exploitation and exploration is a primary factor in system survival and prosperity.”

James March, 1991

Introduction

Research in organizational adaptation has consistently cited the need for a balance between exploitation and exploration (March, 1991; Levinthal and March, 1993; Brown and Eisenhardt, 1998). For understanding how to achieve this balance, two themes have emerged. The first one is the issue of temporal ordering, addressing whether exploitation and exploration can and should occur simultaneously. For example, in the context of replicated chains such as Starbucks, Winter and Szulanski (2002) suggest the need to first explore and then rapidly exploit for fast growth. A second emergent theme addresses how to buffer exploration processes from exploitation-based ones. The ambidextrous organizational form (Bradach, 1997; Sutcliffe et al., 2000; Tushman and O'Reilly, 1997; Benner and Tushman, 2003; Ho, Fang and Lin, 2011; Mom, van den Bosch, and Volberda, 2009; Raisch et al., 2009) is prescribed for ensuring that the two modes of action can proceed unimpeded by the conflicting culture and aims of the other. By segregating exploration and exploitation processes from one another, they can take place simultaneously.

These temporal perspectives on how to support the coexistence of exploration and exploitation neglect an important information processing dimension. Exploration relies on knowledge creation, and knowledge creation requires novel informational inputs (Nonaka, 1994; Mishra and Bhaskar, 2011) and weak ties (Granovetter, 1992; Levin, 2004; Boer,

Berends and van Baalen, 2011). Thus any organizational design that seeks to balance exploration and exploitation must concern itself with the source of informational inputs necessary for exploration. Lack of novel information and weak ties are likely to drive action toward the exploitation end of the spectrum, where it tends to fall naturally (Abernathy, 1978; Levinthal and March, 1993). Increasingly, the edges of the organization are being recognized as an important source of the novel information and weak ties that underlie successful exploration capability (Volberda, 1997; Simon, 1993; Goodale et al., 2011). Firms need to create mechanisms for ensuring that information garnered during edge-based experiences with customers, suppliers, employees and others is channeled to this end.

The need to source novel information at the edges for explorative capability is problematic for large ambidextrous firms, as follows. Ambidextrous firms can segregate exploitative and exploratory processes from each other either by isolating entire facilities geographically, or by separating exploratory product lines and processes from exploitative ones (Bradach, 1997; Sutcliffe et al., 2000; Tushman and O'Reilly, 1997; Benner and Tushman, 2003). Those choosing the geographic option do so by designating particular facilities as exploratory and optimizing the rest for exploitation. Yet these firms face the problem of how to determine which facilities are most likely to source the kind of information that spurs exploration. Central leadership cannot determine a priori which facilities are likely to provide the most potent novel informational inputs since these definitions are unpredictable. By designating certain facilities as exploration-oriented and others as exploitative, the firm risks not exploring insights generated at the exploitative sites that could lead to experimentation. This problem is exacerbated by the fact that exploration is costlier and riskier than exploi-

tation (March, 1991), and short-term gains from exploitation suggest that exploitation processes will dominate (Levinthal and March, 1993; Lavie, Stettner, and Tushman, 2010).

Further, where market heterogeneity fluctuates over time, a facility designated for exploitation may find itself located in the heart of a newly-turbulent market, yet unable to capitalize on the novel information that turbulence generates. Exploration aside, uniform operating procedures cannot optimize performance across diverse locations (Minkler, 1992; Kaufman and Eroglu, 1999). Where heterogeneous markets necessitate local adaptation, disbursed managers must be able to *explore* opportunities for experimentation as they appear, since their unique location at the boundary of the firm makes them the first line of interpretation.

Heterogeneous markets create unpredictable opportunities for exploration and experimentation. Disbursed managers facing such markets must be able to both exploit existing routines and explore for new ones. In such cases it makes sense to attempt to co-locate exploration and exploitation processes. Ambidextrous firms do this by designating some product lines or processes as exploration-oriented and others as exploitative (Benner and Tushman, 2003). A fundamental problem with this is that these designations arrive at the edges from the top down, yet novel information and interactions may transpire at the edges to inform exploratory capability around exploitative products. That is, exploration entails knowledge creation. When ideas strike at the edges, they can either be developed or ignored. When it co-locates exploratory and exploitative capabilities, the ambidextrous firm seeks to prevent the application of novel information to the design of experiments around exploitative products and processes. By centrally determining a priori that certain information should be ignored, these firms run the risk of not capitalizing on good ideas when they pertain to exploitative products and processes. Also, since there is a natural drive towards exploitation (Levinthal and March, 1993), there is a tendency for the culture of exploitation to spill over into the culture of exploration. This makes exploration challenging whenever it is co-located with exploitation, and creates the innovation paradox (Andriopoulos and Lewis, 2009).

In heterogeneous markets then, firms are challenged with the need to support both exploitation and exploration simultaneously, at the edges. Yet exploration is resource intensive (March, 1991), and certainly this precludes ongoing and unimpeded exploration at disbursed facilities. How then can central leadership affect the balance of exploitation and exploration at the edges so as to dynamically ad-

dress heterogeneous markets and to capitalize on important sources of novel information? To address this dilemma, this research presents a theory of *dual-process organizational learning*, in which mechanisms dynamically deployed by centralized leadership serve to affect the balance of exploitation and exploration at the edges. We are not suggesting that distributed managers make their own determinations regarding the balance of exploitation and exploration they engage in. Effective *dual-process organizational learning* describes the ability of disbursed managers to *respond* to mechanisms deployed by centralized leadership aimed at manipulating the exploration-exploitation tradeoff at the edges. When exploration has been stimulated, distributed managers have the discretion and slack to respond to novel information sourced at the edges regardless of whether or not the associated product line or process has been designated as exploratory. As the market for a particular outlet location stabilizes, exploitation will come to dominate as levels of discretion and slack are lowered. Thus centralized leadership provides the catalyst for exploration but not the substrate.

The theoretical model of dual-process organizational learning presented below is based on a widely accepted, individual-level theory of human information processing called the Heuristic Systematic Model (HSM) (Chaiken, Lieberman and Eagly, 1989). This model is the dominant one of many dual-process theories of individual cognition. In doing so, we extend the tradition of applying individual-level learning theories to the domain of organizational phenomena (March, Sproull and Tamuz, 1991; Cohen and Levinthal, 1990). While not all elements of this individual-level theory apply at the level of the firm, there is a clear link between the way individuals process information according to HSM and the way that organizations process information for exploration and exploitation. This theoretical orientation offers a model for implementing strategy such that the organization can oscillate between 'planned' and 'flexible' forms (Volberda, 1997).

This paper is organized as follows. We begin with examining extant theory on exploration and exploitation in the context of retail chains, since retail chains represent an important industry that is geographically disbursed yet tends to be governed centrally. We then discuss the individual-level dual-process theories as a basis for understanding the proposed dual-process organizational learning. Next we extend this body of theory to the organizational level and address the key roles of slack and managerial discretion for affecting the exploitation-exploration balance at the edges. We then describe an empirical study of a large, well-established company-owned retail chain in order to assess the applicability of the theory to the field.

1. Theoretical background

The empirical portion of this research took place at a large North American retail chain. The leadership of this organization adheres to the prescriptions of early replication researchers to minimize variation across retail outlets through routinization and standardization (Nelson and Winter, 1982). Centralized staff members determine the buying, merchandising, advertising, promotions, inventory levels, and computerization processes for all store outlets. By minimizing variation and maximizing economies of scale, they have been able to reduce costs. But despite these efforts, they continue to experience significant performance variation across stores. The theoretical model we develop below provides a framework for understanding the source of this variation.

The international retail sales market is massive and growing. In the United States alone, there are 1.6 million U.S. retail establishments, more than 24 million employees, and 2006 sales of \$4.7 trillion (Grannis, 2007). These firms are clearly very important to the economy, yet there is little in the way of theory to guide the management of these large established chains. Nelson and Winter's (1982) early work on replication has guided the leadership of established chains in their quest to reduce variance and hence control costs across outlets. Building on this, replication strategy (Winter and Szulanski, 2001) is important for understanding how centralized leadership can best grow through rapid diffusion of new outlets when these outlets are small and carry limited product lines. However, replication theory does not address how to implement strategic organizational learning in large established outlets with a broad spectrum of product lines. Nor is the literature on franchising relevant, since franchising generally involves decentralized managerial decision-making, and the means of production is generally located within the franchise itself. To the extent that managerial decision-making in large retail chains are centralized, managers at the periphery do not have the same exploratory options as franchisers, nor are production processes at the edges. The supply chain as the organizational edge has been investigated in terms of the role of exploration and exploitation (i.e., Subramani, 2004), but theory on this topic in the retail context lags. For supporting the strategy implementation needs of the senior leadership, large established retail chains are under-theorized, particularly in the area of exploration and exploitation.

Early replication theorists prescribed use of organizational routines across outlets in order to minimize variation and maximize economies of scale (Nelson and Winter, 1982). More recently, theorists attempting to explain variation in business performance

have increasingly focused on differences in the areas of organizational knowledge and competence (c.f., Zollo and Winter, 2002). Exploitation-based organizational learning (March, 1991) extends the concept of organizational routines to organizational learning. Thus for replicated, standardized retail outlets, we should expect to find that performance will accrue to those outlets with highest levels of exploitation. To the extent that these firms face homogenous markets, organizational learning takes place by means of refining existing routines. This learning strategy – termed *exploitation* by James March (1991) – represents the dominant learning mode for company-owned retail chains (Sorenson and Sorenson, 2001). Successful exploitation decreases the variability of firm performance as behavior becomes routine and fewer unexpected situations develop (Levinthal and March, 1993). Thus, exploitation is an important capability for reducing short-term performance variation across retail chain outlets.

H1: Ceteris paribus, exploitation will be positively associated with short-term store performance.

However, it is not clear that the performance improvements associated with exploitation can endure for the long run. Exploitation enables efficiencies and cost-controls that can reap short-term results, but it also creates competency traps (March, 1991) that drive out the capability for exploration (Levinthal and March, 1993). Since exploitation refines existing routines but does not identify new ones, it does not enable firms to respond to discontinuous shifts in the market and competitive environment (March, 1991). Thus the organization finds that its competencies become outmoded as the world changes and leaves it behind. To the extent that high levels of exploitation tend to drive out exploration (Levinthal and March, 1993), exploitation will be negatively associated with long-term performance.

H2: Ceteris paribus, exploitation will be negatively associated with long-term store performance.

The effects of exploitation on performance help to explain performance differences among retail stores when levels of exploitation vary. However, this doesn't take into account the need to explore at the edges. Firms cannot afford to do all their exploration at headquarters (Volberda, 1996). The boundaries of the organization are fertile ground for interpreting the novel information needed to design of exploratory initiatives. Through *in situ* communication with customers, suppliers, employees and others, managers of retail outlets can rapidly design and field their own experiments. Analyzable results of such experiments are likely to be available sooner than if the experiment were designed and imple-

mented from distant headquarters. Further, because such exploratory initiatives are designed in response to immediate information signaling the needs of a supplier or customer, for example, they are less likely to be distorted than if they had been communicated along a chain of command.

Yet organizations cannot afford to engage in local exploration for exploration's sake. In implementing a strategy of *selective exploration*, centralized leadership can control which outlets are engaging in exploration at any time, in response to available resources and environmental discontinuities. For example, a store that is located in a very turbulent market may need the capability to explore until that dynamism subsides, since greater turbulence demands greater adaptive capability. Perhaps a competitor has moved in on a group of stores that together need to engage in exploration in order to compete effectively. Yet these stores cannot explore forever – they should return to exploitative actions once they have come to grips with the new competitor. We call this dynamic capability *dual-process exploration*, after the individual-level information processing theory upon which it is based.

We now discuss the body of individual-level, dual-process cognitive theories that underlie the proposed theory. We then use it to explain how centralized leadership can wield design principles to engender the ongoing, dynamic capability for balancing exploitation and exploration at the edges.

1.1. Dual-process information processing theory. Dual-process theories of human information processing describe how individuals process received information, and are widely accepted among cognitive psychologists and other theorists (Strack and Deutsch, 2003). This body of theory originated from individual-level, laboratory-based social psychology research, and has since been applied to many domains as a way of understanding how people process received information (Dijkstra, 1999; Kahlor et al., 2003; Watts Sussman and Siegal, 2003; Darke, Freedman and Chaiken, 1995). Below we describe the dual-processing approach and draw parallels between it and how organizations dynamically process novel information.

The dual-process approach to information processing encompasses a family of theories, all of which examine both the information content of received information and factors in the surrounding content (Gilbert, 1999). Here we focus on the heuristic-systematic model (HSM) (Eagly and Chaiken, 1993) as a representative and well-established variant of this theory base. According to the HSM, people process received information in two ways – heuristically and systematically. When faced with new

information, individuals apply pre-existing frames and heuristics to process it most efficiently, and/or they undertake the relatively greater cognitive effort required to systematically analyze the new information. For example, during heuristic processing, people may utilize simple decision rules such as “credibility implies correctness” (Chaiken, Liberman & Eagly, 1989) to assess content validity. Alternatively, they may disregard the source entirely and analyze the content in order to assess its validity on the basis of its inherent merit, independent of its associated context.

Individuals are continuously undertaking one or both of these two types of cognitive processes as they go about interpreting the mass of new information they attend to daily. Heuristics provide a very important means for dealing with the vast quantities of information people face. Due to bounded rationality, and because of the cognitive effort involved, individuals are not able to systematically process all the novel information in their environment. For example, we utilize heuristics to determine which emails to delete without reading them, which advertisements to attend to, and how closely to listen to the airline steward as he explains the safety features of the aircraft we are seated in. The rules of thumb embedded in expert systems reflect heuristics used by experts to process complex information most efficiently.

A critical aspect of this theory for our purposes is that it explains the mechanisms underlying how people make tradeoffs among these two processing modes: the greater the cognitive resources available, and/or the greater the motivation to process the information, the greater is the likelihood that an individual will undertake the cognitive effort of systematically processing that information, as opposed to heuristically processing it with relatively less effort. For example, a person that is highly involved in a topic will be more motivated to undertake the effort of systematically processing novel information related to that topic. However, even individuals that are highly motivated to systematically process are not necessarily able to do so (Petty & Cacioppo, 1986). Lack of expertise in the subject, limitations in terms of time and energy, distractions and disruptions, and so on can force people to rely on heuristic processing. In this way HSM helps to explain why individuals react differently to identical information.

Managers, after all, are human, and we suggest that this individual-level theory of information processing offers insight into how managers interpret new information on the job. Learning requires informational inputs, as does exploration. Thus how individuals process received information in the service of learning should inform how organizations process received information in the service of exploration.

The parallels between the HSM and the proposed theory of *dual-process organizational learning* are clear. Both heuristic and systematic processing are necessary for effective information processing, just as both exploitation and exploration are necessary for effective organizational information processing (March, 1991). Systematic processing requires a marshalling of resources in response to novel information, whereas heuristic processing is the least-cost default response. Likewise, exploration requires a marshalling of resources when it occurs in response to novel information, whereas exploitation is the least-cost default response. Relative to heuristic processing, systematic processing is resource intensive, just as exploration is costlier and riskier to the firm than exploitation. Finally, the relative balance of systematic and heuristic processing in response to new information is determined by the *available cognitive resources* and the *motivation* to deploy them. Similarly, under effective dual-process organizational learning, the balance among exploitation and exploration activities should respond to *available resources* in the form of slack, and to the *motivation* to explore, in the form of managerial discretion. And because levels of slack and managerial discretion at the edges can be adjusted by centralized actors and policies, these represent the context of the information processing at the edges and form the organizational-level element of the proposed theory. We discuss the role of these constructs and this level-of-analysis issue in detail in the following section.

1.2. Application of HSM to exploration and exploitation. Organizational interpretation processes are important for responding to unfamiliar events (Barr, 1998). Yet managers differentially interpret novel information. This occurs because limited information processing capability results in selective perception and biased filtering of information (cf. Nisbett and Ross, 1980). Thus managerial perceptions are systematically associated with the way interpretation of new information is framed (Kahneman and Tversky, 1979). The way that managers frame and interpret new information determines the set of actions available for responding to it.

When exploration occurs in response to novel information triggers, managers may respond to these triggers variously. That is, one manager may frame novel information as an opportunity for strategic learning and experimentation (Henderson, Sussman and Thomas, 2001), while another manager may interpret that same information within the context of exploitation-based routines. For example, a manager at a retail store may receive a request from a customer that he cannot fulfill under existing routines,

such as a particular type of returns processing. A manager that does not have the resources or motivation for exploration will tell the customer that the request cannot be fulfilled in the particular variation requested, doing his best to modify the existing returns routine in a way that resembles the customer's request. In this way the manager exploits and modifies the current routine for returns processing. Yet, another manager may frame the customer's request as an opportunity for experimentation with new processes and procedures. Provided that organizational control structures do not preclude a degree of discretion for this manager, he/she may frame this interaction as an opportunity to design a more optimal routine for returns processing, and subsequently institutionalize the new and improved process. In this example, the first manager interpreted novel edge-sourced information in terms of exploitation, while the second manager viewed the same information as an opportunity for exploration. According to the HSM-based theorizing above, we suggest that the second manager framed the new information in terms of exploration because he/she felt he/she had greater *resources* in terms of slack, and greater *motivation* in the form of managerial discretion. According to the HSM, resources and motivation are the two mechanisms that affect peoples' allocations of cognitive effort on systematic and heuristic processing in response to novel information.

In this way the HSM informs how centralized, geographically-distal management can affect the relative balance of exploitation and exploration at the edges as it unfolds continuously over time. According to the HSM, increases in available cognitive resources and/or motivation correspond to a greater prevalence of systematic processing. Extended to the organizational domain, this suggests that increased resource availability and managerial motivation ought likewise to reduce reliance on routines exploitative actions. Below we argue that *slack* provides the additional resource function of this mechanism, while *managerial discretion* serves to support the motivational impetus for exploration. By continually adjusting the balance of slack and managerial discretion at distributed locations, centralized leadership has a dynamic tool for adjusting the relative balance of exploitation and exploration at the edges.

1.3. Slack and dual-process organizational learning. Slack is the pool of resources in an organization that is in excess of the minimum necessary to produce a given level of output (Nohria and Gulati, 1996). Firms can use slack to address variations in performance (Kamin and Ronen, 1978), to respond to environmental perturbations (Meyer, 1982), and to engage in experimentation (Levinthal and March,

1981). Since slack represents resources beyond the minimal set necessary for functioning, we suggest that it is analogous to the increased cognitive resources necessary for engaging in systematic processing over and above those necessary for heuristic processing. The more cognitive resources are available, the more likely it is that we will undertake systematic processing, instead of or in addition to heuristic processing. The more slack distributed managers have, the more likely it is that they will undertake exploration and experimentation in response to novel information. And conversely, the less slack they have, the more they should be exploiting existing efficient routines. Thus, stores with little slack will be most likely to perform well when they are engaging in exploitation rather than exploring new opportunities for experimentation. Hypothesis 3 below reflects this logic:

H3: For stores with low levels of slack, exploitation will be associated with high short-term store performance.

However, when stores that are provided with slack for exploration continue to engage in high levels of exploitation, we presume that they are utilizing slack resources in other ways than for exploration, since culturally, high-levels of exploitation and exploration cannot co-exist at the same location (Abernathy, 1978; March, 1991). This hypothesis reflects the fact that exploration at the edges is very difficult to measure in the context of retail chains, thus we focus for now on variations in levels of exploitation.

H4: For stores with high levels of slack, exploitation will be associated with low long-term store performance.

Thus, according to *dual-process organizational learning*, dynamic and selective applications of slack resources to particular outlet locations ought to affect the relative balance of exploitation and exploration that are engaged in at that facility. Note that, since the provision of slack is a structural and not an interpersonal construct, the proposed theory reflects an organizational level phenomenon, the organization in this case being the retail outlet. Also, while the store manager is an important driver of exploration, explorative action is accomplished by multiple members located at the disbursed location. This also supports our view that the theory is not an individual-level one, despite the central role played by the disbursed manager in channeling the structural constraints and opportunities represented by the centralized adjustment of slack. We now turn to the other mechanism that can affect the exploration-exploitation balance at the edges – managerial discretion.

1.4. Managerial discretion and dual-process organizational learning. Managerial discretion refers to managers' ability to affect important organizational outcomes, and is a function of the task environment, internal organization, and managerial characteristics (Hambrick and Finkelstein, 1987). Despite its name, it is not an individual-level construct, since managers cannot affect important organizational outcomes in isolation from the actions of those reporting to them. From a personality-situation interactionist perspective, it has been shown that managerial and situational characteristics can interact to affect the discretion managers perceive themselves to have over organizational issues (Weiss and Adler, 1984). Managerial discretion moderates the relationship between executive characteristics and performance (Finkelstein and Hambrick, 1990).

Managers differ in the amount of discretion they perceive (Carpenter and Golden, 1997), and may consequently respond differently to the same novel information. Managers who perceive themselves to have a lot of discretion are most likely to attend to critical contingencies (Carpenter and Golden, 1997). Managerial discretion is analogous to the concept of autonomy that is present at lower levels of the organization. Enhanced motivation benefits are associated with the high levels of autonomy of enriched work environments (Hackman and Oldham, 1980). More recently, learning has been found to be more effective under high levels of autonomy in high-exploration contexts (McGrath, 2001).

According to the HSM, higher levels of motivation increase the likelihood of systematic processing. That is, the more motivated an individual is to undertake the additional cognitive effort of systematic processing, the more likely he or she is to do so. The organizational-level corollary suggests that the more motivated a manager is to undertake the relatively greater effort and risk of exploration – relative to exploitation – the more likely he or she is to do so. Thus at low levels of managerial discretion, we should see more exploitation activity, since these managers are less motivated to explore than those with more discretion.

If in fact dual-process organizational learning is associated with higher performance levels, then high performing retail stores will report more exploitation behavior under conditions of low managerial discretion:

H5: For stores with low levels of managerial discretion, exploitation will be associated with high short-term store performance.

As with slack, we expect that the positive performance impacts of exploitation under low levels of discretion will not be enduring. In the long run, the need for

exploration will manifest itself in lower performance in stores where, despite high levels of managerial discretion, exploitation activity is dominant:

H6: For stores with high levels of managerial discretion, exploitation will be associated with low long-term store performance.

The above discussion explicates why *dual-process organizational learning* is apparent when levels of exploitation vary appropriately in response to adjustments in levels of slack and managerial discretion. The resultant hypotheses are illustrated in the model below:

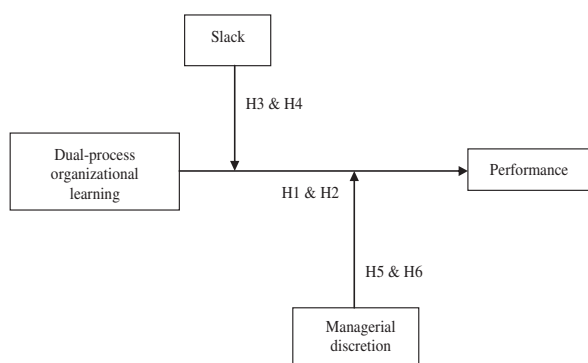


Fig. 1. Theoretical model

2. Method

Because our theoretical model focuses on implementation of the strategy of dual-process organizational learning, we gathered empirical data from the field for this preliminary investigation. In this exploratory attempt to validate the model, we investigated a major North American retail chain. Both qualitative and quantitative data were collected in a two-phased approach. First, thirty unstructured interviews were undertaken to gather rich qualitative data about the phenomenon. These took place at four sites – two high-performing and two low-performing stores. Based on findings from these interviews, a survey was developed and conducted by soliciting responses from all 123 store managers.

The unit of analysis for the study is the retail store. Perceptions and reported behaviors of store managers were investigated for significant associations with objective performance at the store level. Below we briefly describe the qualitative phase of this study. We then discuss the methods and results of the quantitative phase of this research. Before we begin these descriptions, we discuss the research site, since it is common to both phases of the study.

2.1. Research site. This research investigates a large North American retail company. This department store chain employs 45,000 people across 123 retail stores and their headquarters. They earned \$6.2 billion in sales in 2002, across product categories as

diverse as apparel, home, appliances, and hard goods. Their decision-making is centralized and most of their processes are standardized across their retail stores. For example, headquarters determines which products will be sold at each store, along with appropriate inventory levels. Human resources are allocated based on a formula that is consistent across stores. Each store is provided with identical computer software capabilities. There are four types of stores, based on their sales volume per square foot and their customer profile. Certain item category availability is more limited at the smaller stores than at the larger ones.

All stores except for the smallest category have assistant store managers reporting to the store managers. Most assistant managers and all store managers have their own offices and their own computers. They use their computers to access email and the “dashboard” that consists of analytical tools available to store management.

2.2. Preliminary qualitative study: methods and analyses. Since the model builds a new theoretical perspective, a qualitative study was deemed necessary as a first step to understanding the phenomenon and refine survey instruments. The qualitative phase of this research took place in two major North American cities, one covered by each of the two authors. In each location, one day was spent interviewing at a high performing store and one day at a low performing store, with 7-8 interviews conducted each day. Interviewees ranged in job role from store manager to lowest sales associates. Other roles included were associate sales managers, sales team leads, support leads, inventory control managers, a floating human resource specialist, buyers, and a customer service representative. Ethnographic, open-ended interviews were conducted to elicit informants’ perceptions regarding store processes in terms of exploration and exploitation, and confidentiality was assured. We sought to understand when, why and how routinized actions were invoked, and also when, why and how exploration and experimentation was engaged in.

During analyses of the interview data we sought to understand the extent that store interpretations and actions reflected our theoretical model and to explore ways in which the theory might not be applicable. Interaction effects are a key component of the model, and we were unable to get a sense of these from the qualitative data, so we focused on understanding differences between high and low performing stores. To this end, two dimensions emerged as different between high and low performing stores – slack and managerial discretion. Managers of high performing stores viewed themselves as having sufficient resources and support

for exploration and experimentation, and we collected stories of some of these experiments. Managers of low performing stores viewed themselves as being in a mode we describe as “crisis driven”. They did not believe they had the resources or the discretion with which to explore and experiment. This distinction was interesting to us since ostensibly the stores had fairly consistent levels of resources and also procedures governing experimentation. This led us to believe that at least some of the differences in store levels of slack and managerial discretion were perceptual. From these and similar data we concluded that the theoretical model was sufficiently supported to proceed with a quantitative phase of the study, described below.

2.3. Quantitative study methods. Following completion of the qualitative data analysis, quantitative data were gathered by soliciting survey responses from all 123 store managers across the country. An initial email was sent to all stores from a senior executive at headquarters introducing us and requesting that store managers complete the survey. Next the survey was posted at an online survey support site and the researchers sent email directly to each store manager requesting their participation in the survey. This email contained a brief overview of the research purpose, instructions, and assurances of confidentiality. After seven days, 52 responses had been received, so another email was sent by the researchers reminding managers of the original request.

Out of the 123 sales managers, 93 attempted to complete the survey, but 6 of these had technical difficulties preventing them from moving beyond the first page of the survey. We were unable to rectify this technical problem and ultimately had to eliminate these managers from the process, leaving us with a sample size of 87. This reflects a 71% response rate, which we consider to be reasonable considering the demands placed on the time of these managers.

2.4. Measures. We collected perceptual measures of the independent and moderator constructs of the model. For dependent measures, we utilized objective, quantitative store performance data collected by the focal organization as follows.

To measure short-term performance, we utilized 3rd quarter sales volumes as provided by headquarters. This number reflects each stores’ sales achievements relative to planned sales for that quarter. The planned sales figure for each store was generated for that store by headquarters, based on a formula that takes into account prior year sales and sales growth, as well as predictable fluctuations in market demand and known competitor moves.

In order to measure long-term store performance, we used customer loyalty as a surrogate. Customer loyalty

is known to be an important indicator of long-term organizational viability (Molina and Ortega, 2003). Here it reflects the opinions of a random sample of customers selected at each store, who then completed the standard customer loyalty survey that the centralized organizational headquarters administers twice annually. These surveys were administered by independent employees of the retail firm and are not affiliated with any particular store. The survey is comprehensive and consists of 18 questions that are then aggregated into a single numerical score for each store according to a standardized formula. We used this final aggregated figure for the dependent measure of customer loyalty, as a surrogate for long-term performance.

Perceptual measures of exploitation, slack and managerial discretion were collected and these items are listed in Appendix. We assume a causal link between managerial perceptions and objective organizational outcomes. The measure of managerial autonomy was adapted from Lonti and Verma (2003). We were unable to locate a suitable prior measure of exploitation, nor of slack as it applies to the service context. Thus these two measures were developed by the authors and pre-tested on a sub-sample of store managers.

3. Quantitative analysis and results

3.1. Demographics and descriptive statistics. Of the 87 survey respondents, 76% are male, reflecting the higher percentage of male managers employed by the organization. Respondents’ mean tenure at their current store is 2.73 years, mean age is 49.4, and mean organizational tenure is 25.9, reflecting the highly established nature of this organization. Stores fell into their four categories, as indicated in Table 1.

Table 1. Respondent percentage by store type

Store category	% respondents
Very large	20%
Large	47%
Boutique	24%
Small	9%

T-tests were used to test for effects of respondent characteristics. There were no significant differences by gender, age, store tenure, or organizational tenure. However, the smallest category of stores was significantly negatively associated with performance. For this reason, and also because these stores have a flatter management structure than the rest, these eight stores were eliminated from the sample.

3.2. The measurement model and preliminary analyses. For reasons described above, results are reported based on a sample size of 79. Independent constructs were assessed perceptually based on the survey items, while the dependent measure utilized objective store performance figures. Data were assessed for normality visually and by the skewness and kurtosis of each

and came within acceptable parameters with the exception of exploitation. Exploitation is skewed toward high levels, reflecting the social desirability of this measure, thus it was standardized for the following analyses. Table 2 below presents the means and standard deviations of all constructs in the model ($n = 79$), along with construct Pearson correlations. No significant correlations among independent constructs were found. All variables are measured using a standard 7-point Likert scale.

The measurement model was tested by examining the reliability of individual items, the internal consistency

of constructs, and the discriminant validity between them. An acceptable measurement model was built using reliability and factor analyses of the survey data provided by each respondent ($n = 79$), and hypotheses were tested based on this model using standard regressions, with results presented below.

Discriminant validity was assessed using factor analysis and items loaded acceptably on their respective constructs. Internal consistency was assessed using Cronbach's alpha, and the reliabilities reported in Table 2 are within acceptable levels for exploratory research (Nunnally, 1967, p. 226).

Table 2. Internal consistency of model constructs, descriptives and correlation matrix

Variable	No. of items	Cronbach's alpha	Mean	S.D.	Scale range	1	2	3
1. Exploitation	2	.6681	5.21	.95	1-7			
2. Slack	3	.6064	3.85	1.57	1-7	.06		
3. Managerial discretion	2	.5951	2.93	1.06	1-7	.03	.20	

3.3. Hypothesis testing using OLS. Hypothesis 1 states that higher levels of exploitation will be associated with significantly higher levels of short-term store performance. To test for this effect, short-term performance was regressed onto exploitation ($n = 79$). Results were significant as predicted by the model ($F = 4.22$, $p < .05$), with an adjusted R^2 of .04 (d.f. = 1.78) and a beta coefficient of .22.

Hypothesis 2 states that higher levels of exploitation will be associated with significantly lower levels of long-term store performance. To test for this effect, customer loyalty was regressed onto exploitation ($n = 79$). Results were significant as predicted by the model ($F = 5.08$, $p < .05$), with an adjusted R^2 of .05 (d.f. = 1.78) and a beta coefficient of -.255.

Hypothesis 3 states that slack will moderate the effects of exploitation on short-term performance as follows: stores with low levels of slack have the most to gain from exploitation since they do not have the resources to benefit from exploration. Hypothesis 4 states that slack will moderate the effects of exploitation on customer loyalty as follows:

stores with high levels of slack have the least to gain from exploitation since they have the resources to experiment with exploration.

Hypotheses 5 and 6 repeat these theoretical arguments for managerial discretion, since stores with low levels of managerial discretion can generate short-term gains from exploitation but do not have the discretion to explore and experiment in order to achieve long-term gains. To test for these moderating effects, moderated multiple regression models were built in which all data were standardized and product terms were built by multiplying the indicators of the independent construct with those of the hypothesized moderator (Jaccard, Turrisi, and Wan, 1990). Table 3 below presents results of these analyses. In it we see that the F-statistic of the change in R^2 for the H3 and H5 models is significant, indicating that the addition of the moderator significantly increased the variance explained without the moderator. Thus, slack and managerial discretion significantly moderate the effects of exploitation on short-term performance but not customer loyalty.

Table 3. Results of regressions testing for moderation effects, H5 and H6.

	Overall model	Main effect	Moderator	Interaction term	F-stat for R^2
H3: Exploitation x Slack on short-term performance	Adj. R^2 = .13 F = 4.42 Sig. < .01	β = -.52 t = -1.98 Sig. T = .05*	β = 1.74 t = 3.15 Sig. T = .002**	β = -1.73 t = -2.95 Sig. T = .04*	F = 5.22**
H4: Exploitation x Slack on customer loyalty	Adj. R^2 = .03 n/s				F = .39 n/s
H5: Exploitation x Managerial discretion on short-term performance	Adj. R^2 = .08 F = 3.33 Sig. < .05	β = .32 t = 2.18 Sig. T = .03*	β = .61 t = 2.35 Sig. T = .02*	β = -.50 t = -1.7 Sig. T = .09	F = 3.21*
H6: Exploitation x Manager discretion on customer loyalty	Adj. R^2 = .05 F = 2.14 Sig. = .10	n/s	n/s	n/s	F = .86 n/s

Note: n/s – non significant finding.

In order to investigate the direction of these effects, split-sample analyses were performed as follows. By splitting the sample at the median of slack, we find that exploitation has a significant positive relationship on short-term performance under low slack ($\beta = .44$, adj. $R^2 = .16$, $F = 7.69$, sig. = .009, d.f. 1.34) but this relationship is non-significant under high slack. Results for customer loyalty oppose this trend: under low slack there is no significant relationship between exploitation and customer loyalty, while under high slack there is a slightly significant effect ($\beta = -.31$, adj. $R^2 = .07$, $F = 3.42$, sig. = .073, d.f. = 1.33). While not highly significant, the direction of this effect is in support of the theory, suggesting that effects of exploitation on performance change depending on the type of performance sought and the associated levels of slack.

This analysis was then repeated for managerial discretion. When the sample was split at the median of managerial discretion, exploitation has a significant positive relationship on short-term performance under low managerial discretion ($\beta = .44$, adj. $R^2 = .16$, $F = 7.09$, sig. = .011, d.f. = 1.37) but this relationship is non-significant under high managerial discretion. Results for customer loyalty are less clear: under low managerial discretion there is no significant relationship between exploitation and customer loyalty, while under high managerial discretion there is a slightly significant effect ($\beta = -.36$, adj. $R^2 = .09$, $F = 3.54$, sig. = .072, d.f. = 1.24). As we would expect from the full interaction model using customer loyalty as the performance indicator, there is some evidence that an interaction effect is in the direction hypothesized but the effect is non-significant. The results for short-term performance are clearly consistent with the theory: exploitation improves short-term performance under conditions of low slack and managerial discretion, but these relationships do not hold at higher levels of perceived slack and managerial discretion.

Conclusion

Organizations need to be able to engage in both exploitation and exploration. The theoretical model we present explains mechanisms underlying a means to balance exploitation and exploration at the edges. By explaining how centralized actions can enable dynamic movement between exploitation to exploration at the edges, *dual-process organizational learning* suggests that firm can rapidly invoke exploration when the environment demands it. And once the environment has stabilized, the theory suggests how outlets engaged in exploration can return to an exploitation mode of action.

The theory is grounded in a widely-accepted model of human cognition called HSM, in which two modes of information processing – heuristic and system-

atic – are balanced according to available cognitive resources and motivation. Exploitation is the organizational information-processing equivalent of heuristic processing, since both exploitation and heuristics utilize previously established and accessible rules for processing new information. Since neither exploitation nor heuristic processing depend on interpretation of new or novel information, they function efficiently to minimize resource utilization. Similarly, systematic processing parallels exploratory activity, since both require that additional resources be applied during interpretation of novel information. Exploration necessarily enacts changes in response to novel information, just as systematic processing demands changes to cognitive schemas as new information is processed analytically. And both exploration and systematic processing take more time to accomplish than their more reflexive counterparts.

Most critically, the individual-level HSM contributes a theoretical explanation for the importance of slack and managerial discretion. Slack, analogous to cognitive resources at the individual level, enables exploration based on the same underlying dynamics that spur systematic processing within individuals. Managerial autonomy serves to motivate exploration, just as involvement and other factors motivate systematic processing in individuals. It is these factors that provide the mechanisms by which the balance of exploitation and exploration at the edges can be manipulated by centralized decision makers.

Senior managers construe key events as either problems or opportunities and this affects how the organization responds to them (Gioia & Thomas, 1996). Dual-process exploration theory extends this line of thinking to the ranks of the middle manager, but it goes beyond this to identify particular levers that can be manipulated by centralized senior management to dynamically affect edge-based interpretation processes. It is a process theory, explaining the mechanisms underlying one particular form of dynamic response capability. It lies at the organizational level, since its inputs and outputs are organizational level constructs – slack, discretion, exploitative action, and organizational performance. Its key strength is its theoretical lineage – the widely accepted HSM.

Based on the strength of the proposed *dual-process exploration theory*, we view the contribution of this research as primarily theoretical. However, we do begin the task of empirically validating the model. Although the empirical portion of this study is limited, it is field-based, and hence takes a step beyond the formal modeling and simulation-based approaches that dominate much of the literature in this area (i.e., March, 1991; Denrell and March, 2001; Lee and Ryu, 2002). Main effect findings are significant as hypothe-

sized, with exploitation having positive effects on short-term performance and negative effects on long-term performance. Importantly, all the hypothesized moderation effects were in the direction predicted by theory. Short-term performance is significantly improved by exploitative action in stores reporting low levels of slack and managerial discretion. Regarding long-term performance, pure moderation effects are not significant but homologizer effects indicate that exploitation has negative performance consequences in stores that have the opportunity to explore – those reporting high slack and managerial discretion.

Dual-process organizational learning is a mid-range theory that has been used here to explain why variation in levels of slack and managerial discretion interact with exploitation to affect performance. One might reasonably question the direction of causality to suggest that increased performance is naturally associated with higher levels of perceived slack and discretion. Yet in the data analyzed in this field study and consistent with theory, slack and discretion are not correlated with sales performance – their effects are observed only in interaction with exploitation, consistent with dual-process organizational learning.

The findings reported here do not show that the manipulation of slack and managerial discretion at the edges has performance impacts – additional empirical work is needed to determine this. However, as a first step in assessing the proposed theory, our findings suggest that variations in store managers' perceived slack and managerial discretion do affect the strength of the association between reported exploitation and objective measures of store performance. This is particularly interesting considering that at the retail chain studied, centralized leadership did not intend to vary levels of slack or managerial discretion at the store level. On the contrary, they were following the theoretical prescription to reduce variance at the edges. Despite this, variation in objective performance persists across stores and is significantly associated with exploitation as it interacts with perceptions of slack and discretion. Alternative explanations have not been ruled out, and certainly individual-level managerial differences come into play. But these individual differences seem to manifest themselves in perceptions of slack and managerial discretion. This suggests that there may be ways to affect the balance of exploitation and exploration at the edges without actually increasing available resources, and clearly warrants further research.

This research has implications for control at the edges. Traditional models of control (Ouchi, 1979; Eisenhardt, 1985) suggest that design of control mechanisms should be based on outcome measurability and task programmability. To the extent that the task of managing a retail outlet is relatively unprogrammed and outcome measurability is high (i.e., sales performance), outcome control seems the most appropriate control prescription. However, this research suggests that the type of learning desired may be an additional factor in selection of control mechanism: when senior leadership seeks to limit local managers to exploitation, behavioral control may be desirable in order to limit managerial discretion. For motivating exploration at the edges, looser control mechanisms such as outcome control seem to be most appropriate. This presents the problem of how to move an outlet from outcome control to behavior control when transitioning it from exploration to exploitation. The link between dual-process organizational learning and control theory presents a potentially fruitful avenue for research.

The model offers practitioners a perspective on training their managers, since it suggests that managers be able to engage in both exploratory and exploitative managerial actions. An important research question is to what extent the same manager can be effective at both types of activity. It may be that rotation of managers that are trained to specialize in either exploration or exploitation is a more realistic means for altering local activity from exploratory to exploitative or vice versa.

When some markets are more turbulent than others they demand faster agility from the outlets located within them. Yet these markets may stabilize quickly just as others are becoming turbulent. Distributed organizations facing turbulent and heterogeneous markets may find that the capability to dynamically alter the learning balance at particular outlets enables them to explore where and when it is needed most. This is particularly important for organizations that have a lot to learn from novel information at the edges. Customers, employees, suppliers and others at the edges of large distributed retail chains are the first line of interpretation of much novel information. Dual-process organizational learning offers the means to capitalize on the opportunities presented by the potential of this information for exploration and experimentation.

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Appendix. Measures

1. Exploitation – 7 point Likert scale, $\alpha = .6681$.

To what extent is information from past decision outcomes used to inform current decision-making?

To what extent are experiences, tips and know-how from past events used to inform current problem-solving?

2. Perceived slack – 7 point Likert scale, $\alpha = .6064$.

How often do you eat lunch at your desk?

How often do you bring work home with you on nights and weekends?

How often do you have time to do a thorough analysis of a new situation before you act on it?

3. Perceived managerial discretion – 7 point Likert scale, $\alpha = .5951$. To what extent are you free to make store changes without notifying headquarters?

When you are sure that making a change will help your store, to what extent do you need approval from headquarters to make that change?

4. Performance – Actual 3rd-quarter performance measures as follows:

Percent of planned sales volume realized.

5. Customer loyalty – actual customer perceptions of the store.