

On the Paradoxical Nature of Exploration and Exploitation: Can They Co-exist? Insights, Considerations, and Managerial Implications

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Abstract

Few are the constructs that attract as much attention in the strategic management discourse as do the twin managerial orientations of exploration and exploitation. They are unique and distinct and share a paradoxical existence. While related, exploring and exploiting activities are incompatible and compel organizations' top managers to engage in two seemingly contradictory but necessary and indivisible acts. Organizations large and small must pursue both to ensure their vitality and continued growth in the face of an ever-changing competitive landscape. Neglecting exploitative and exploratory initiatives creates a creeping organizational paralysis that can lead to a firm's ultimate demise. This paper explores the exploitation—exploration incompatibility as a tension generator, touches on the dilemma they present managers with, and surveys existing approaches for addressing their inherent conflict. Four widely accepted solutions are discussed. We highlight top management's role in managing the exploration-exploitation orientations, and stress the importance of negotiation, collaboration, and conflict management strategies in that process. The paper concludes with a set of recommendations worthy of consideration.

Introduction

Exploration and exploitation occupy a central place in the strategic management literature. March (1991), was first to offer distinct characteristics associated with each orientation that help define both, as well as shed light on their paradoxical co-existence. For instance, while exploration is associated with discovery and with risk-taking, variance-enhancing and experimentation, exploitation is associated with refinement, efficiency, routinization, and variance-reduction. And, whereas explorative activities seek divergence of information, processes and experience, exploitative activities are characterized by the converging of information, processes, and experience (de Visser & Faems, 2015). These distinct characteristics establish the unique context and boundaries within which exploration and exploitation operate. Moreover, they also help dispel the negative connotation associated with the term exploitation that may be shared by readers. In this article exploitation means the continuous extraction of benefits from new learning, and from the refinement of existing and newly introduced products and services.

Undoubtedly, both orientations appear critical to firms' survival and continued growth, as exploring and exploiting affect both the current operations of a firm and its future viability. Extant research suggests that their tentacles reach across numerous aspects of business operation including technology innovation and product development, knowledge extraction and organizational learning, firm adaptation and survival, and

competitive advantage and sustainability. In addition to their scope of influence, research has long established that engaging in both orientations is essential for firm adaptation, particularly in times of rapid change that affects resource allocation and turns current technology and existing knowledge into a state of obsolescence (e.g. Maleti, Maleti, Dahlgaard, Dahlgaard-Park & Gomiscek, 2014; Lisboa, Skarmeas & Lages, 2013; de Visser, Faems & Top, 2011).

A quick glance at the relevant literature suggests an evolution in the way research approached exploration and exploitation. An indication of the dynamic nature characteristic of the twin orientations, it also suggests a marked shift in focus with the passing of time. Early works focused on the apparent conflict and tension between these twin constructs given that they call for contradictory mind-sets and processes and given that they compete for the same scarce resources (Hannan & Freeman, 1977; Sorensen & Stuart, 2000). Later works highlighted the need for firms to balance a mix of exploitation and exploration to ensure firms' performance and continued growth (Benner & Tushman, 2002; Feinberg & Gupta, 2004). More recent research stressed the need for organizational ambidexterity – the simultaneous pursuit of both exploring and exploiting activities - through structural modifications at the firm level (Jansen, van den Bosch & Volberda, 2005; Jansen, Tempelaar, van den Bosch & Volberda, 2009). Other recent studies focused on the critical role of top firm managers in negotiating conflicts and reconciling tensions emanating from exploration and exploitation activities. Attention is given to behaviors and cognitions of senior managers that influence decisions to engage in either or both activities (de Visser & Faems, 2015; O'Reilly & Tushman, 2008).

While exploring and exploiting activities are essential for firm survival, they also create paradoxical challenges that compel firm managers to be adaptive and engage in two seemingly contradictory but indivisible learning activities. On one hand, exploiting existing knowledge and refining current products, and on the other hand, exploring concurrently new knowledge and developing novel products. Yet, assessing conflicting demands while essential is but one initial step. As crucial is the firm's effective handling of related key issues that carry practical implications. For instance, are exploration and exploitation two opposite ends of a continuum? Are they two independent orthogonal orientations? Should they be viewed as complementary, or in competition with one another? Furthermore, should a firm strive for a balance between exploration and exploitation? And if so, should this be done through ambidexterity (i.e. the simultaneous pursuit of both via a structural separation of units that specialize in either exploring or exploiting), or through a punctuated equilibrium (i.e. continuously alternating between periods of exploration and exploitation)?

The effective undertaking of such issues bears heavily on the firm's managers. For top managers, such activities present supreme challenges that necessitate the mastering of effective negotiation skills, and the utilization of appropriate conflict management practices. Ultimately, their ability in negotiating tensions and resolving contradictions that emanate from exploration and exploitation, also determines the ability of the firm to adapt to changing market conditions and withstand the competition. Notwithstanding their paradoxical dynamics, firms must be proficient in both exploring and exploiting. How well a firm can both explore and exploit determines its growth trajectory and viability, or on the other hand its decline and ultimate demise.

This article addresses several related aspects of exploration and exploitation. We explore some of their merits; their paradoxical states; the dilemma they present to organizations; key practical solutions for balancing both orientations and for adequately addressing related constraints; and, we conclude with the critical role of top managers in coordinating and reconciling conflicting activities that are part of exploration and exploitation. We note the importance of negotiation and collaboration as mediums for ensuring that a discord that can potentially arise from these twin constructs, is diffused and converted to a more harmonious existence between these two equally important drivers of firm growth.

A Paradoxical Co-existence

Exploration and exploitation share a paradoxical existence. They are driven by contradictory mindsets and guided by opposing objectives. They call for inconsistent architectures and require conflicting competencies. Left unattended, the tensions emanating from exploration and exploitation can fuel discord at the workplace and expose the firm to harmful internal conflict. Recognizing some of the contradictions that exploration and exploitation share is a first step. Ultimately, it helps firm managers define related dilemmas and adopt proper solutions for reconciling such tensions and conflicts.

As alluded to in our introduction, March (1991) was first to offer a set of differentiated characteristics encapsulating the twin orientations' conflicting nature. According to March, exploration involves search and discovery, play and experimentation, and calls for a decentralized architecture coupled with a loose culture. It seeks little or no formalization of procedures and routines and involves radical-revolutionary innovation. Its prime efforts are directed at exploring new technologies as well as new knowledge and learning.

On the other hand, exploitation is driven by efficiency, production, control and refinement, and calls for a centralized architecture with a tight culture. It seeks high degree of routinization, and greater formalization of procedures. Exploitation quest involves incremental-evolutionary innovation. Its efforts are directed at exploiting current technologies, as well as on utilizing existing knowledge and learning.

For the sake of clarification, we should note that incremental innovation and radical innovation represent two distinct processes. While radical innovation leads to the creation of a novel product that did not exist beforehand, incremental innovation is concerned with the refinement of existing products and with their continuous improvement. For illustration purposes, consider Apple's premier product – the iPhone. iPhone 4 is considered a radical innovation for being the very first mobile communication product introduced by Apple. All the iPhone variations that followed – from iPhone 5 through iPhone X - represent incremental innovation as they are all based on the basic iPhone 4 model, with each newer model embedding added features aimed at extending the life of the handheld devices.

An explicit and succinct framework is proposed by Andriopoulos and Lewis (2009). Their framework singles out three robust paradoxes between exploration and exploitation driven activities. The authors assert that conflict may rise from contradictory strategic intent, customer orientation, and from differing personal orientation. Whereas exploration

stresses technology breakthrough, loose-coupling customers and individual's passion, exploitation stresses profit, tight-coupling customers, and organizational discipline.

Exploration and exploitation also differ over their strategic focus, as well as over the processes they employ, over their time horizon, and over their expected returns. Exploitation's intent and focus is on addressing the firm's existing customers' wants and needs through the refinement of existing products and services. Exploration is focused on serving new customers in new markets with new products and services. Exploitation utilizes processes that reduce variability, enhance productivity and efficiency, and uses existing technological trajectories. Exploration utilizes processes that increase variation, foster autonomous environment and culture, and pursue experimentation with new technological trajectories.

Exploitation calls for a defined resource commitment, as well as for the deployment of available competencies, and is guided by a pre-calculated and predictable rate of return. Exploration calls for larger investment, tends to consume more resources, and involves a return on investment that is unclear and less certain (Cui, Walsh & Zou, 2014). By efficiently deploying existing resources, and by refining the value of existing products through incremental innovation, exploitation follows a predictable, low-risk path with limited operational deviations, and lower production cost (Vos & Vos, 2013).

Exploration focuses on the development of new product designs through revolutionary innovation. New products are likely to strengthen the firm's market position relative to its competitors (Jin, Zhou & Wang, 2016). Following in this path, exploration lowers the risk of obsolescence and increases the firm's competitive advantage. However, the pursuit of this trajectory requires greater investments, more risk and unpredictable costs.

Since explorative effort is aimed at radical innovation, it requires time and investment, as well as risk-taking and failure tolerance. Radical innovation also involves search for new knowledge within the firm and outside, hence it involves knowledge transfer and knowledge sharing with external parties. And contrary to the exploitative effort, calculating with certainty the time it takes to convert new ideas to new products, and the returns from commercialization of such radical products, are difficult to estimate. Unlike exploration, exploitative effort that is driven by evolutionary innovation, exploits feedback from current customers and chain suppliers about existing products and services. These products allow for a more accurate estimation of returns but are easy to imitate by competitors. Overdependence on existing products, regardless of the improvements introduced through incremental innovation, can lead to obsolescence in the absence of new knowledge and new products.

Exploitation strives to shore up existing capabilities and current resources for meeting the firm's present goals, and for gaining the upper hand relative to the current competition. Exploration seeks to develop new capabilities and gain an upper hand relative to future competitors. And, whereas exploitation activities target the survival needs of the firm, exploration activities address the firm's sustainability needs and future growth (Sinha, 2015).

Finally, while exploratory innovation is necessary to reduce risk of obsolescence, and seek new markets, it intends on generating abnormal returns by exploring new markets, new offerings, and new customers. As such, it is riskier and more complex, and calls for relatively heavy funding and new knowledge. Furthermore, market opportunities for such

innovation are not clearly marked, and competition is uncertain. Such characteristics of explorative innovation results in increased interdependence as well as in an increase in information exchange, information sharing, and knowledge sharing. And while exploitation related innovation seeks improvements in current products, caters to existing customers, and uses current technology, it cannot sustain itself for long.

Table 1. The contradictory nature of exploration and exploitation.

Key Features	Exploration	Exploitation
Associated terms	Search, discovery, play, flexibility, variance-increasing, loose culture.	Refinement, efficiency, routinization, variance-decreasing, tight culture.
Strategic intent	Breakthrough technology, loose-coupling client, and passion.	Profit, tight-coupling customer, and discipline.
Preferred structure	Decentralized systems. Organic organizational principles.	Centralized systems. Mechanical organizational principles.
Type of Innovation	Radical. Development of novel products and new competencies. Leveraging new technologies.	Incremental. Improvements of current products. Exploiting existing competencies and leveraging current technologies.
Targets	New products, new customers, and future markets.	Existing products, current customers, and existing markets.
Time perspective	Long-term benefits. Future growth.	Immediate benefits. Current growth.
Risk and returns	Risk-taking. Uncertain returns on investment.	Risk-averse. Predictable returns on investment.
Knowledge and learning	Explore new knowledge and new learning.	Exploit existing knowledge and current learning.
Trap susceptibility	Failure trap. Failure in search, leads to more search, and possibly to more failure.	Success trap. Current success reduces incentive for doing things differently.

Table 1 depicts key contradictions between the twin orientations that shed light on the challenges top managers face when pursuing both. Having such opposing orientations within the same firm challenges managers on two key fronts. Managers must be cognizant and aware of simmering tensions and conflicts that characterizes exploration and exploitation paradoxical co-existence. And as critical, it requires skill and knowledge as to the best strategies for negotiating conflicts and reconciling differences. And not least, one must recognize the importance of collaboration and consensus-building as an essential strategy for minimizing destructive tensions. While goal incongruence, divergent strategic objectives, and cultural differences increase tensions between exploration and exploitation units, mutual dependence increases the likelihood and incentives for managers to collaborate.

Key Managerial Considerations

Top firm managers must be cognizant of key considerations that should be addressed at the firm level. Indicative of the complex nature of exploration and exploitation, such considerations deserve a closer look. Firms must be aware of the success and failure traps associated with exploration and exploitation; firms should assess the compatibility aspects that are related to both orientations; firms must consider the benefits of

ambidexterity; firms should weigh the effects of balancing exploration and exploitation, or their combined effects; and finally, firms should be cognizant of the divergent capabilities of each orientation.

Considering Potential Traps

Exploration may lead to a failure trap while exploitation tends to lead to a success trap. A failure trap occurs when a firm concludes that an innovation failed, and rather than pause and study the failure, it engages in a premature attempt of pursuing another innovation track and may be too quick in adopting new technology and new knowledge. This exploratory path leads to more investment and involves more risk and potential failure (Gupta, Smith & Shalley, 2006). No firm can survive a recurring cycle of exploration and failure for long.

As is the case with recurring failure, recurring success has the potential of negatively affecting firm survival. Long periods of exploitative success can lead to complacency by clouding managers' assessment of the changing environment, and the need to adapt to pressing changes. Rigidity sinks in, and with the absence of incentives for new learning, managers may be content to stay on a current track rather than explore a superior alternative (Choi & Chandler, 2015). Both traps carry fundamental implications for firm managers as is discussed later. Being cognizant of their associated pitfalls is of paramount importance.

Considering Compatibility

Exploration and exploitation place inherently conflicting resource and organizational demands on the firm. An early view asserts that they are incompatible on three grounds: they conflict with each other since they compete for scarce firm resources, thus following a zero-sum game path; both orientations are self-reinforcing given that exploration is susceptible to a failure trap, while exploitation is vulnerable to a success trap; and, the mental model and focus that exploration calls for is fundamentally different from the one exploitation calls for. The former, thrives on openness, breadth and insight, whereas the latter thrives on commitment, narrowness and cohesiveness (March, 1991). March concluded that exploration and exploitation, being radically incompatible, should be viewed as two opposite ends of a continuum, and thus they cannot be pursued simultaneously.

Contrary to March's argument and conclusion, later works treated exploration and exploitation as orthogonal (Beckman, Haunschild & Phillips, 2004). Since they function in two different domains, resource constraints and differing mind-sets may generate less conflict. Furthermore, each orientation calls for different kind of resources (Rangan, 2005). Thus, orthogonality treats exploration and exploitation as simultaneously achievable.

While these conflicting views may cloud managers' judgement as to which argument to consider, Gupta, Smith & Shalley (2006) propose a practical approach. These authors integrate the opposing arguments relative to compatibility by succinctly suggesting that the probability of having exploration and exploitation on the opposite end of the continuum (i.e. cannot co-exist; they are mutually exclusive) is greater the scarcer are the

resources needed for exploring and exploiting. However, across different domains that are loosely connected, exploration and exploitation will tend to be orthogonal (i.e. can co-exist regardless of the level of exploration or exploitation in their respective domains). Whether operating in single or multiple domains, exploration and exploitation can be viewed as two ends of a continuum, or as orthogonal to each other.

Considering Ambidexterity

A large body of research argues for the need to pursue exploration and exploitation simultaneously considering the speed by which innovation turns obsolete. It further associates both constructs with improved adaptation and enhanced firm performance (Gupta, Smith & Shalley, 2006; Hernandez-Espallardo, Sanchez-Perez & Segovia-Lopez, 2011; Matzler, Uzelac & Bauer, 2014). This view, referred to as ambidexterity, perceives exploitation and exploration to be complementary rather than diametrically opposite each other, hence the need for the firm to simultaneously engage in search and discovery that leads to new products (exploration), and at the same time invest in extending the life of existing products through refinement and existing knowledge (exploitation).

Top firm managers should be cognizant of the fact that ambidexterity requires establishing highly differentiated units that specialize in either exploration or exploitation. An ambidextrous structure is perceived as a primary means by which a firm can achieve a state of balance between exploring and exploiting activities (Benner & Tushman, 2003). While the differences between the business units are indeed striking, the structural separation of these units enables the firm to pursue both exploration and exploitation simultaneously. The prescription for success rests with the firm's top management team. Their ability to negotiate contradictions and tensions emanating from each subunit, while inspiring members of each unit not to lose sight of the common good, is critical (Mom, J. M., Fourné, P. L., and Jansen, J. P., 2015; Tuncdogan, B., Mom, T., Bosch, J., and Volberda, H., 2017; Tuncdogan, B., Bosch, D., and Volberda, H., 2015).

Considering Balancing Benefits

An unevenness between exploration and exploitation exposes the firm to risks (Benner & Tushman, 2015; Gupta, Smith & Shalley, 2006). Consider that when a firm's attention is overly tilted toward exploitation, the likelihood of over-exposure to obsolescence increases. Such a condition may lead to short-term benefits triggered by over exploitation of existing knowledge and refinement of existing products. Long-term benefits can only be ensured through exploration of new knowledge and development of new products and new competencies. On the other hand, a firm that is overly tilted toward exploration is likely to experience over-spending on search and discovery activities. Such activities are associated with risk and uncertainty but may also yield new knowledge that cannot be fully exploited given the overall firm's reduced attention for exploitation (Benner & Tushman, 2015; Gupta, Smith & Shalley, 2006). In sum, a balance between exploration and exploitation is perceived as an optimal state to be maintained within the framework of ambidexterity, since it serves as a superior mechanism for the mitigation of potential risks.

Considering Combining Benefits

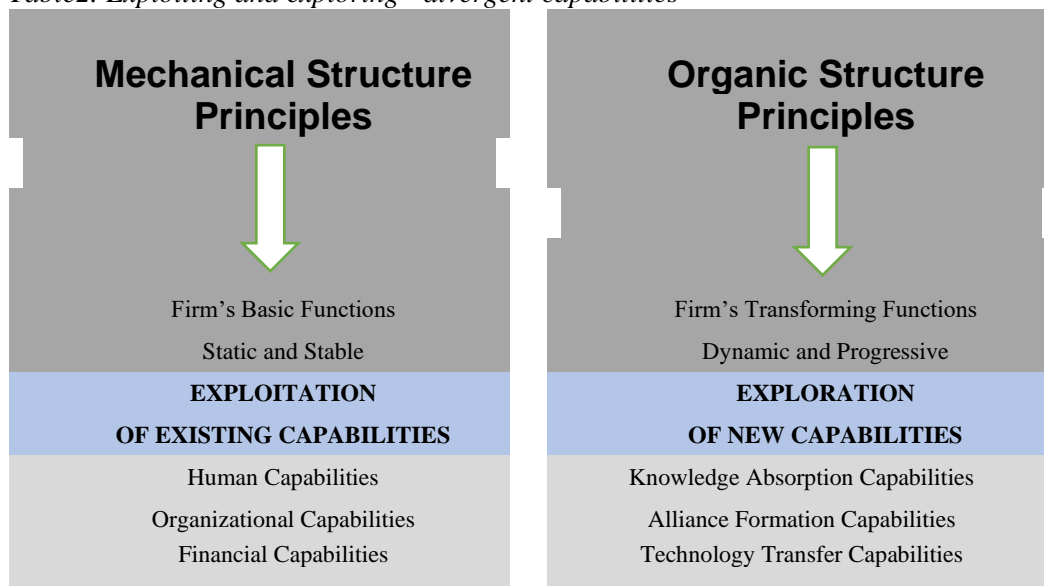
Extant research supports the notion that exploring, and exploiting do not necessarily compete for the same resources. Rather, they can support each other and are mutually enhancing (Cao, Gedajlovic & Zhang, 2009; Gupta, Smith & Shalley, 2006). Proponents of this view argue that proficiency in activities of one orientation incentivized activities in the other orientation. For instance, proficiency in exploiting current knowledge signals to firm managers where the current firm’s boundaries and innovative limits are, and the importance of exploring new knowledge and developing new markets and novel products. Proficiency in exploration increases the pool of competencies and knowledge that are available for exploitation. In sum, knowledge and resources that are available for exploration and exploitation can be combined and leveraged for the benefit of firm performance. The takeaway for top managers appears to be clear: whether a balancing act or a combining act, empirical evidence establishes that in addition to their independent contribution, the integration of both approaches yields unique synergistic performance benefits in the form of new capabilities (Cao, Gedajlovic & Zhang, 2009).

Considering Divergent Capabilities

Both exploration and exploitation are viewed as competencies that are vital for firm survival. Exploitation is recognized as a main first-level internal function given its focus on existing resources and current firm capabilities, whereas exploration is perceived as a domain-level external function with its focuses on new knowledge and new capabilities. Exploitation aims at improving existing products and services, while exploration aims at new reconfigurations, adaptation and integration that results in new products and services (Dutta, 2012; Marin-Idarraga, Gonzalez & Medina, 2016; Raisch, 2008).

Exploitation strives for efficiencies and control which requires a high degree of formalized processes. As such, it fits well with the guiding principles of mechanical structures.

Table2. Exploiting and exploring - divergent capabilities



Exploration, on the other hand, seeks variance, risk-taking, search and experimentation. It requires a high degree of flexibility, and thus it fits well with principles that guide organic structures. Table 2 depicts the capabilities and antecedents of exploration and exploitation.

Top firm managers must also consider related antecedents of exploration and exploitation. Exploration's antecedents are associated with capabilities of knowledge absorption, inter-organizational relationships, and alliances for knowledge mining, as well as capabilities that drive financial leverage and market projection. Exploitation's antecedents are associated with capabilities that involve the firm's existing human, organizational and physical competencies.

Table 2 helps illustrate the possible place that various organizations may occupy on a hypothetical continuum. This place is defined by the degree of openness to exploring-exploiting activities, and is influenced by key organizational variables. Such variables may include the organization's competitive posture, sheer size, leadership support, adequacy of resources, employee attitudes, and incentivization schemes in support of one or both activities. One can assume a degree of variation amongst organizations relative to each variable, which in turn triggers variation in the level of openness to one or both orientations.

As an example, consider a large, well established manufacturer of telecommunication gear with global operations. The likelihood that such an organization embraces both exploring and exploiting activities is high given the competitive environment within which it operates. And, given its competitive posture, this manufacturer may devote enough resources in support of both orientations as well as in support of incentives for its managers and employees.

It is also likely that on the low end of this continuum one may find a small not-for-profit local agency that is probably underfunded and lacking in adequate resources. Absent market competition, the pursuit of innovation may not be considered critical by the agency's management and employees. Instead, its focus may be on cutting cost, and on refining and improving existing service offerings to current audiences. Thus, the not-for-profit adopts exploitative activities as a primary driver of its operations.

Somewhere in the middle of our continuum – between the not-for-profit agency and the manufacturer – one may find a startup, or a new venture that was established around a promising new product - a water filtering device. This venture is likely to operate in a competitive environment, thus adopting a competitive posture like our manufacturer. However, unlike the established manufacturer, it is small and enjoys limited resources that in turn limit the level of incentives offered managers and employees. The new venture values innovation and knowledge transfer and given its newness may strive to formalize its internal procedures and grow its customer base. These are all exploring and exploiting activities on a smaller scale dictated by its initial small size and limited resources.

Figure 1 below illustrates our example by depicting a typology of various organizations, and their position on a hypothetical continuum shaped by internal and external variables. The continuum extends from a low/limited state, to a high/adequate state. In our example, the higher the position of an organization on the continuum the more open it is to pursue both exploration and exploitation. Table 2 and Figure 1 also highlight the vital role of key organizational systems - such as, product development,

human resources, marketing, sales, and customer service – in support of exploring and exploiting activities.

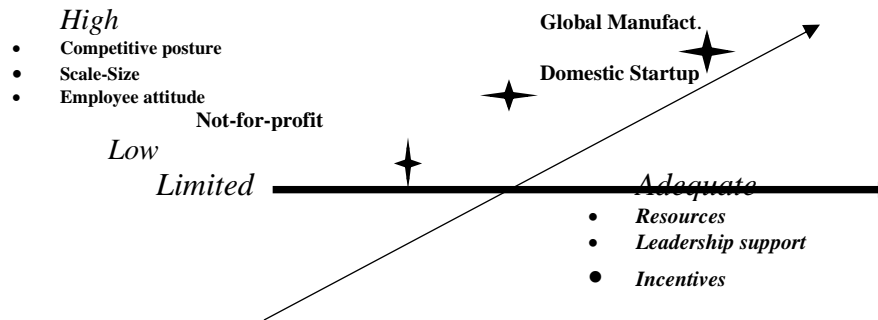


Figure 1. Organization type and degree of openness to exploration and exploitation.

Product development is an internal exploring system with an exclusive focus on radical innovation – the creation of new products and services aimed at developing new markets and reaching new customers. Once tested and debugged, novel products are produced and maintained through exploitation activities, are launched and promoted by the marketing unit, and ultimately reach the marketplace and consumers with the help of the sales unit. Customer service is another support system in this process; it acts as the eyes and ears of the organization by feeding customer generated input back into the exploitation system, thus assisting in the refinement and further improvement of current products. The human resource function supports the organization by aligning each of the systems' efforts with the strategic goals of the organization. HR support is expressed through selective hiring and proper placement of employees, as well as through adequate compensation and effective incentivization schemes. Talent retention and continuous training are additional essential functions of the human resource system. No less critical is HR's overall responsibility in support of a harmonious atmosphere and cooperation between the exploration and exploitation units.

The Emerging Dilemma and Related Solutions

The Dilemma

The test of a first-rate intelligence is the ability to hold two opposing ideas in mind at the same time and still retain the ability to function. – F. Scott Fitzgerald

March (1991) stated succinctly that the basic dilemma confronting an organization is to engage in enough exploitation to ensure its current viability, and, at the same time, devote enough energy to exploration to ensure its future viability. While pursuing both is vital, doing so is difficult given the fundamental differences between these twin orientations, as well as the natural tendency among firms of gravitating toward exploitation at the expense of exploration (Benner & Tushman, 2015; Gupta, Smith & Shalley, 2006). Firms pursue what they are comfortable with and what they already know; they tend to follow what is certain and within reach – all of which are features characteristic of exploitation. Exploration, on the other hand, is radically different, as it

involves a high degree of unpredictability, with outcomes that are often costly and risky, and returns that are distant and uncertain.

This natural tilt toward exploitation, while understandable, is detrimental to the firm's long-term survival. It may well yield some positive short-term results, but it exposes the firm to technological and product obsolescence and is taxing for customers in the long run. Engaging less in exploration, or ignoring it altogether, exposes the firm to vulnerabilities vis-à-vis the competition, particularly when facing technological changes and market turbulence.

The natural tilt toward exploitation also involves over reliance on process management approaches (e.g., Lean Six Sigma, Just-in-Time, Balanced Scorecard, and TQM) that further inhibit exploration. Increased process management tends to be associated with an increase in exploitative innovation, and a decrease in exploratory innovation. Support for this assertion is reported by several works. For instance, Benner and Tushman (2015) found that efficiency and variance reduction associated with exploitation appear to have a dampening effect on exploration activities. The authors find support for their argument in the poor long-term performance of several renown companies following the adoption of process management practices, and their continued struggle to reinvigorate. One such firm is Motorola, the inventor of Six Sigma, that succeeded in its pursuit of efficiency and reliability but failed to gain any long-term success in the mobile phone industry. Such failure was attributed to its preoccupation with incremental innovation, coupled with process management, at the expense of exploration activities, thereby reducing its ability to adapt to a changing landscape in the cellular industry (Benner & Tushman, 2015).

Similarly, Hindo (2007) recounts a conversation with George Buckley, the newly appointed CEO at 3M, who succeeded James McNerney. Unlike McNerney, who was a strong proponent of process management, Buckley ushered in a management philosophy that sought a more balanced approach between efficiency and innovation. Attempting to resuscitate a renown innovative company in decline, Buckley singled out Six Sigma as a costly mistake that eroded the long-term benefits of innovation. Lamenting the company's preoccupation with Six Sigma,

Buckley concluded that the pursuit of practices that reduced variation (i.e. process management), also reduced creativity that was a core value at 3M. 3M acknowledgement coupled with Motorola's failure magnify the dilemma that many large and small firms face regarding exploration and exploitation. Attention and resources must be devoted to both orientations and follow a symmetric trajectory that equally benefit exploring and exploiting activities. Paraphrasing F. Scott Fitzgerald, a firm must pursue two opposing orientations at the same time and still retain the ability to function and prosper well into the future. Ambidexterity attainment is at the heart of the challenge, but the more desirable goal to pursue.

The Solution

Extant research offers several practical solutions for addressing the dilemma at the core of the exploration-exploitation debate. Four such solutions deserve a closer look: structural separation, sequential punctuated equilibria, organizational context, and behavioral integration.

Structural separation

Structural separation, also known as structural ambidexterity, is a mechanism that enables a firm to engage in exploration and exploitation activities simultaneously by creating distinct, loosely coupled organizations with experimenting units that are separated from the exploiting units. The exploratory units are small and decentralized and are characterized by loose culture and processes. The exploitation units are larger and centralized, with tight culture and processes. The former units succeed through experimentation and increased variation; the latter units succeed through variability reduction, and increased efficiency and control. Benner & Tushman (2003) argue in their seminal paper, that these contrasting units must be physically and culturally separated and should have distinct incentives and managerial teams. As critical, these differentiated units must be strategically integrated by the firm's most senior team. To be effective in an ambidextrous dual-structure, "the senior team must develop techniques that permit them to be consistently inconsistent, as they steer a balance between the need to be small and large, centralized and decentralized, and focused both on the short term and long term simultaneously." (Benner & Tushman, 2003, p. 248). Being able to negotiate tensions, and form strategic alliances between the subunits, and between the subunits and partners outside the firm, determines the success of the top management team in balancing the synchronous pursuit of exploration and exploitation.

Sequential punctuated equilibria

Sequential punctuated equilibria, also known as sequential ambidexterity, argues against organizational disintegration and related coordination costs that are part of a physical separation of two mutually exclusive modes of innovation and learning (Burgelman, 2002; Lavie, Stettner & Tushman, 2010). Alternatively, the firm should sequentially pursue each activity. Punctuated equilibrium is a related concept that is being used by proponents of sequential ambidexterity. Accordingly, exploration and exploitation activities alternate between convergent and reorientation phases that are triggered by stress and conflicts within and outside the firm. From a relatively long convergent period of exploitation, the firm transitions to a relatively short reorientation period of exploration that follows again with convergent period of exploitation.

Organizational context

Organizational context, also known as contextual ambidexterity, refers to the ability of the firm to simultaneously exhibit adaptability and alignment across business units. As is the case with any decision capable of impacting firm survival, management role is paramount. Within the context of ambidexterity and firm management, Gibson and Birkinshaw (2004) assert that intellectual faculties and behavioral capacities of top executives to negotiate tensions, reconcile contradictions, and manage conflicting demands are essential for alignment in support of exploitation, and adaptability in support of exploration. Adaptability involves activities designed to meet changing demands in the firm's environment for the long run, while alignment reflects coherence amongst all

activities across a business unit for the short term. The authors find support for their assertion that an organizational context characterized by a combination of stretch, discipline, support, and trust is superior in achieving contextual ambidexterity. Gibson and Birkinshaw's findings suggest that a manager's faculties and capacities complement the firm's structural arrangements relative to the way exploration and exploitation are pursued.

Behavioral integration

Following in a similar vein, Lubatkin, Simsek, Ling and Veiga (2006) building on the concept of behavioral integration, propose another link between a firm's top managers social and tasks characteristics, primarily their collaborative behavior, and ambidexterity attainment. The authors' main argument is that a structural separation of exploration and exploitation activities while necessary, is not enough for achieving ambidexterity. Additional factors that rest with the firm's top managers influence their ability to pursue both orientations and therefore must be considered as well. Their assertion is that top managers' behavioral integration – a term coined by Hambrick (1994), referring to the degree of collaborative behavior, as well as the quality-quantity of information exchanged, and the degree of a joint decision making - determines the firm ability to deal with the contradictory knowledge processes emanating from exploration and exploitation. The greater the integration the higher the likelihood of concurrently attaining ambidexterity. Specifically, an elevated behavioral integration amongst top management teams, means a better synchronization of social and task processes that are associated with collaborative behavior amongst its members. Absent behavioral integration, top managers' collaboration is diluted, and the quality of interactions is largely reduced.

Reflecting on the proposed solutions, some related drawbacks are worth mentioning. While structural separation may work well for relatively large companies with enough resources in support of exploration and exploitation activities, it may be too taxing for small firms given operational and coordination costs. And while temporal sequencing may be a viable option for smaller firms, it is an insufficient mechanism in times of fast environmental turbulence and change that require quick alignments. Unlike structural separation, contextual ambidexterity does not require a dual structure. Instead, it calls for top managers to create administrative mechanisms that foster certain behaviors from members of a business unit who are engaged in both exploration and exploitation. contextual ambidexterity is considered a higher-order approach capable of generating long term benefits, given its focus on organizational culture. Culture as a context refers to the dominant set of values, beliefs and principles capable of influencing individual and collective behaviors toward ambidexterity, thereby reconciling tensions between what Andriopoulos & Lewis (2009) termed discipline and passion. Discipline calls for conformity with the firm's existing objectives, thus it is aligned with exploitation. Passion stresses engagement with search and creativity, and with challenging new radical discoveries, thus it is associated more with exploration.

Top Managers' Role

Extant research supports the centrality of firm's leadership in ensuring the successful execution of either structural or contextual ambidexterity (Gibson & Birkinshaw, 2004; Lubatkin, Simsek, Ling & Veiga, 2006; Simsek, Heavey, Veiga & Souder, 2009). Top firm managers establish and nurture appropriate context that fosters ambidexterity. Perceived in empirical works as an antecedent as well as a moderator, firm leadership characteristics, processes, composition and behavioral integration are reported to play an essential role in ensuring a balance between exploration and exploitation activities (Beckman, 2006; Lavie, Stettner & Tushman, 2010; Smith & Tushman, 2005).

Upper echelon theory (Hambrick, 2007), for instance, links top firm managers' decisions and actions with their experiences, personal characteristics, values and personalities. This theory establishes that top managers' processes and composition influence firms' outcomes and performance. An interesting finding, in this respect, suggested that top managers with long affiliation with their firm tend to engage more with exploitative activities, while 'outsiders' with shorter affiliation with their current firm tend to engage more with exploratory activities (Beckman, 2006). The argument is that sharing the same values and frame of reference prevents affiliated managers from thinking differently, thus making the composition and diversity of the firm top managers the more critical.

The rapid decline of General Electric illustrates this argument most vividly. The two CEOs that succeeded Jack Welch – Jeff Immelt and John Flannery – were insider CEOs. Neither of the two were able to adequately address GE's operational challenges and stop the company's financial deterioration. In fact, during their tenures, GE's market cap was slashed by close to 70 percent! Consider that GE's market cap was \$402B when Welch retired, \$222B when Immelt retired, and \$98B when Flannery was ousted in late 2018 (Gryta & Adams, 2018). Could it be that these two insiders, who spent their entire careers with GE, were exposed to some level of groupthink and had their vision clouded enough to limit their forward thinking at a time when it was needed the most? GE case may provide further support for Beckman's (2006) argument. Larry Culp who took over in late 2018 is the first outsider CEO in GE's 126-year history. Time will tell whether he is able to solve the conglomerate's problems.

In addition to context and leaders' characteristics, the degree of behavioral integration being fostered by the firm's top managers is as critical for achieving and maintaining ambidexterity. A high degree of integration leads to and is facilitated by a high degree of collaborative behavior, joint decision-making, and enough flow of information amongst top managers (Lubatkin, Simsek, Ling & Veiga, 2006).

Early works report that the ability of top managers to excel in ambidextrous firms depends on three team attributes: their shared vision, the level of their social integration, and their contingency rewards (Siegal & Hambrick, 2005; Smith & Tushman, 2005). Shared goals and values shift members attention from a potentially narrow and harmful pre-occupation with self-maintenance, toward a greater goal that is centered around the firm's viability and future. Common goals and values propound a shared vision. A higher level of top team social integration is found to be linked to negotiation and compromise, and increased collaboration across units (Jansen, George, van den Bosch & Volberda (2008).

Social integration and collaboration also lead to enhanced social interaction, cooperation and trust among top firm managers. Finally, top team contingency rewards act as the glue that bonds the first two attributes; rewards foster collaboration and create commitment to organizational goals. Team contingency rewards encourage top managers to consider both exploration and exploitation for resource allocation, reduce damaging interpersonal competition, and facilitate negotiation and collaboration (Govindarajan & Trimble, 2005).

The role of the CEO in an ambidextrous firm is no less critical. Championing shared goals and values and emphasizing a shared vision amongst top managers helps set the stage for collaborative action (Waldman, Seigel & Javidan, 2006). CEOs, as transformational leaders, are cheerleaders that help extract distinct value from units with conflicting agendas and serve as an anchor for harmonious relationships across the firm (Vera & Crossan, 2004).

Given the empirically supported benefits inherent in ambidexterity and its determinants, a question may be asked as to the conditions under which ambidexterity is likely to succeed. O’Reilly and Tushman (2008) offer five such conditions that rest largely with the firm’s top leadership. A sound ambidexterity requires a firm to have in place “a clear strategic intent, an over-arching vision and a set of values, an aligned senior team, an appropriate organizational architecture with targeted integration, and the ability of the senior team to manage the inevitable trade-offs and conflict.” (O’Reilly and Tushman, 2008). Table 3 captures succinctly O’Reilly and Tushman’s five conditions that permit simultaneous exploitation and exploration.

Table 3. Firm top leadership and ambidexterity (Based on O’Reilly & Tushman, 2008).

A clear strategic intent	Articulates the justification that necessitates the ambidextrous structure for the firm’s future survival.
Overarching vision and values	Fosters emotional and intellectual engagement and a shared identity and establishes a foundation for multiple cultures in separate subunits.
An aligned senior team	Encourages cognitive flexibility that enables oversight of ambidextrous structure. And, continuously communicates the need for ambidexterity reinforced with incentives and a common reward system.
An organizational architecture	A physical separation of sub-units for exploration and exploitation – each with its unique model of operation, competencies, incentives, and culture. A targeted integration, both a top-level and a lower level integration – is required to ensure leveraging firm-wide assets and capabilities.
Ambidextrous leadership	Leadership that tolerates contradictions and tensions emanating from multiple alignments. Leadership skilled in negotiation, and conflict management, and effective in resolving trades-offs.

Finally, exploration and exploitation compel top managers to develop ambidextrous capabilities since the mindset, skills and processes required for exploitation are radically different than those required for exploration (O’Reilly & Tushman, 2008). These capabilities stem from cognitions and behaviors of top firm managers that ensure

coordination and learning, innovation and knowledge sharing, and involve product improvement and new product development, alliances and joint ventures beyond firm boundaries. These top managers' capabilities must also include skills in conflict management, integrative negotiation and collaboration.

A collaborative management culture produces the most favorable outcomes compared with other conflict management approaches (Todaro & Stirpe, 2017). In establishing such a conflict management system, the individuals within and across subunits are given an equal opportunity to present their suggestions and opinions to the conflict. The final solution is a result of clear communication and cooperation between the conflicted parties.

Conflict Management Systems

When considering the central role that exploration and exploitation play in modern day organizations, and the inherent tension between these two orientations, formalizing and maintaining an internal conflict management system (CMS) becomes necessary and should be pursued. At the heart of CMS is the premise that the cost of resolving conflict is negligible relative to the cost of leaving it unresolved. Thus, a CMS aimed at resolving conflict between exploration and exploitation units must be guided by this operational premise. HR's role is essential and should be extended to include the design and operation of the CMS.

While the scale and scope of a CMS varies with an organization's size, available resources, and complexity of operations, a sound CMS must include three interrelated building blocks: (1) a supportive infrastructure which includes internal procedures and processes for managing conflict; (2) a conflict awareness training component for key actors; (3) and, the designation of third-party mechanisms for early intervention. For illustration purposes, consider the manufacturer we discussed earlier under Figure 3. Our manufacturer may set up and fund an administrative center as part of its CMS supportive infrastructure. The values and objectives guiding the center are aligned with those of the HR unit, and in turn with the values and goals of the organization. The center is tasked with clarifying conflict management procedures, assessing potential triggering events, and alerting third-party intervention when needed. One can envision this center, supported by a champion from the manufacturer's top echelon, to be routinely in contact with the organization's heads of product development and production facilities.

A second component of CMS is concerned with conflict awareness training of key actors. Awareness training focuses on disruptive conflict that results in destructive outcomes such as revenue loss, unnecessary spending, manipulation, personal attacks, and poor communication. However, not all conflict should be diffused given that some conflict is productive and may be rooted in a healthy intra-unit competition that can lead to a positive change. For instance, consider differentials in revenues generated from the sales of a novel product (i.e. exploration) versus revenues generated by an improved existing product (i.e. exploitation). In this case, a reward system can reinforce a constructive conflict-competition between the organization's exploration and exploitation actors, leading to an elevated productivity in both. Awareness training is designed to recognize destructive conflict and minimize its harmful effects. In essence, it trains actors in reframing most forms of conflict in a constructive and productive terms.

Awareness training may touch on ways individuals cope with conflict and explore the common five conflict modes - avoiding, compromising, accommodating, competing, and collaborating - thereby allowing actors to gain a personal awareness as to the single mode that dominates their own behavior (Cloke & Goldsmith, 2001). As essential, actors engage in identifying triggering events relative to exploration and exploitation experiences that generated a destructive conflict in past interactions. And, as important is recognizing and assessing individual reactions to various types of conflict, and how to better manage each (McClure, 2000). In sum, awareness training strengthens managers' confidence in making informed decisions, and legitimizing third-party intervention mechanisms when needed.

The third integral component of CMS requires the design and designation of neutral third-party intervention mechanisms for resolving disagreements between intra-unit actors who are unsuccessful in settling conflict situations on their own. Turning early in the conflict cycle to a third-party facilitator is essential, particularly if utilized before an incident escalates and spins out of control. A CMS neutral third-party intervention can come in one of several forms – such as conflict coaching, conciliation, and/or conflict resolution sessions (Jones & Brinkert, 2008). Taken together, these three inter-related building blocks of a CMS provide a three-legged safety-net comprised of a formal supportive infrastructure, managers' heightened conflict awareness, and third-party intervention mechanisms for resolving unreconciled differences.

Recommendations and Implications

Reflecting on the previous sections, several takeaways emerge that are worthy of consideration. Whether a large firm with research and development capabilities, or a small firm with a distinct team tasked with exploration activities such as new business development, the recommendations that follow appear vital to either organization type. One must approach the applicability of our recommendations with caution given the associated costs, risks and tradeoffs that may vary from one organization to the next. Yet, despite their differences, for-profit and not-for-profit, domestic and multinational, startups and established - are more integrated and connected in today's global economy, and thus equally exposed to external influences and discerning constituents. We argue that all organizations are likely to benefit from the pursuit of exploring and exploiting activities and should consider the following seven recommendations.

1. Pursuing exploration and exploitation simultaneously requires the articulation of a shared vision coupled with all-embracing goals, and the ability of top managers to skillfully negotiate inherent tensions that emanate from the contradictory nature of exploitation and exploration. Employing principles of integrative negotiation, using persuasion, and encouraging collaboration between teams from differentiated units, are necessary activities capable of fostering firm harmony. Effective conflict management and a proper reconciliation of contradictions may well determine the degree of co-existence between exploration and exploitation.
2. The widespread adoption of process management as a means for ensuring current customer satisfaction and near-term returns, while favorable to exploitation, tends to be less conducive to exploration. Process management techniques - such as Six

- Sigma, TQM Just-in-Time, Balanced Scorecard, and ISO 9000 – seek efficiency and control much like exploitation and its related activities. Therefore, they should be kept out of explorative activities as they inhibit creativity, impede variability and suppress change.
3. Relying on existing knowledge alone is insufficient for the development of new products. Exploiting new knowledge that may well reside outside the firm requires the formation of alliances and calls for collaboration with external partners, and for the transfer of information between parties. Such exchanges are guided by shared interests and mutual benefits and involve tradeoffs that must be carefully negotiated. Distributive negotiation, with its narrow zero-sum game mindset, is least desired and is counterproductive when seeking partnerships that involve the exchange of knowledge and new learning. Instead, an integrative negotiation approach that seeks to enhance value for all parties involved via enhanced collaboration and interaction is the appropriate path to follow.
 4. Organizational context and behavioral integration with their focus on characteristics of firm top leaders cannot be ignored. A consideration must be given to the relationship between characteristics of top managers, such as their cognitive style, and organizational contexts. Such attention should be extended during transitional periods, both following the departure of a top executive, as well as during the re-hiring process, and when a firm transition into a different strategic configuration. In addition, firm's stakeholders, particularly its investors, as well as external entities such as change agents and fund managers, should be cognizant of the collective cognitive competence of top managers as this may furnish valuable insights on a focal firm's future innovative strategy and viability.
 5. Direct implications for the firm itself must also be considered, and especially the small firm. Small firms that are in an early phase of the innovation cycle - with products in an exploratory phase, may benefit more from a leader who is intuitive in approach. Small firms that are in later phases of the innovation cycle may benefit from top executives who are more analytical.
 6. Top leaders are champions of firm's learning capability. Developing learning capability proved effective in pursuing ambidexterity and in managing the paradoxical existence between exploration and exploitation (Lin, McDonough, Lin & Lin, 2013). Learning capability is established through the combined effects of internal learning and external partnering coupled with open culture that fosters knowledge sharing and collaboration. These practices generate a follow up effect of concurrently stimulating exploration and exploitation activities.
 7. An observation made by Benner and Tushman (2015) carries a fundamental implication for the way firms' explorative activities have been conducted. Exploration today is likely to reside outside the boundaries of the firm given that open innovation enjoys a dominant trajectory. Aligning community-centered innovation with the firm's exploration activities requires awareness on the part of top managers. Such a path is worthy of consideration as a viable alternative to an exclusive reliance on costly in-house innovation practices.

On a final note, managers are primarily recognized for their technical expertise and hard

skills. In today's workplace, hard skills alone are insufficient for ensuring individual and team success and ought to be complemented by a set of soft skills. Given the challenges exploration-exploitation present managers with, acquiring and fine-tuning managers' soft skills is vital. Emphasis should be put on key areas such as personal communication and interpersonal relationships, conflict management and negotiation, consensus building and collaboration.

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