Examining strategic ambidexterity as an antecedent of functional and cross-functional ambidexterity

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Summary:

Literature has identified disparate organizational mechanisms that facilitate ambidexterity. However, the questions remain as to what strategy processes underpin these organizational mechanisms, and how they can be aligned with functional and cross-functional activities to implement ambidexterity. This study aims to examine the effect of strategic ambidexterity on functional and cross-functional ambidexterity, taking into account contingent factors such as environmental turbulence and firm size. We first conceptualize and operationalize strategic ambidexterity as the integration of planned and autonomous strategy processes, and then find that strategic ambidexterity is an important antecedent of functional and cross-functional ambidexterity with particular reference to market and technological business functions. Finally, we find that such effects do not differ with the level of environmental turbulence, nor with firm size. Our findings have managerial implications and also identify several fruitful avenues for future research.

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INTRODUCTION

Ambidexterity as a firm's ability to simultaneously explore new capabilities and exploit existing capabilities is considered an essential precondition for its short-term performance and long-term success (Tushman and O'Reilly, 1996; Raisch et al., 2009; Simsek et al., 2009; Birkinshaw and Gupta, 2013). This is especially the case for high-tech firms operating in a dynamic environment where the rate of technological obsolescence accelerates and the product life cycle is shortened (Gibson and Birkinshaw, 2004; Wang and Rafiq, 2014). Firms need to exploit their existing capabilities for their current viability, and explore new capabilities for their future sustainability (Levinthal and March, 1993). A selective focus on either exploitation or exploration may erode firms' competitive advantage over time: firms focusing exclusively on exploitation are unable to gain rewards from a new stock of knowledge arising from exploration; firms completely dependent on exploration suffer from inefficient use of an existing stock of knowledge and a lack of proficiency in its day-to-day operations (March, 1991). Research has broadly conferred that ambidexterity contributes to superior firm performance (Markides and Charitou, 2004; Gibson and Birkinshaw, 2004; He and Wong, 2004; Lubatkin et al., 2006; Cao et al., 2009; Wang and Rafiq, 2014).

Motivated by the performance implications, research has examined mechanisms or conditions that promote ambidexterity, such as structural separation (O'Reilly and Tushman, 2008), meta-routines (Adler et al., 1999), behavioral contexts (Gibson and Birkinshaw, 2004), organizational culture (Wang and Rafiq, 2014), and top management team behavioral integration (Smith and Tushman, 2005; Lubatkin et al., 2006). Undoubtedly, these disparate organizational mechanisms provide insight on the antecedents of ambidexterity, but the strategy processes underpinning them remain under-researched. The processes of strategy formation, implementation, and change (Hutzschenreuter and Kleindienst, 2006) shape and direct firms' resource recognition, allocation and utilization towards attaining competitive

advantage. Effective strategy processes are aligned with the structural, cultural and behavioral contexts within a firm, as well as the environmental context outside a firm. An investigation into organizational ambidexterity at the strategic level provides an opportunity to understand the strategic underpinning of the various organizational antecedents in the existing literature, and hence to develop a strategic approach to ambidexterity (Raisch and Birkinshaw, 2008; Birkinshaw and Gupta, 2013). In particular, Raisch and Birkinshaw (2008) call for future research to focus on strategic ambidexterity, examining how strategic and organizational activities work together to implement ambidexterity.

Implementing strategic ambidexterity requires the alignment of functional and cross-functional activities with firms' strategy processes, but there is insufficient knowledge on how this can be achieved in practice. The only exception is Voss and Voss (2013), who differentiate functional ambidexterity (i.e. product exploration and exploitation; and market exploration and exploitation) from cross-functional ambidexterity (i.e. market exploration and product exploitation; and market exploitation and product exploration), and from pure exploration (market exploration and product exploration) and pure exploitation (market exploitation and exploitation). Voss and Voss (2013) label these as 'strategic emphasis combinations', but they have not explicitly examined the effect of strategy processes on functional and cross-functional ambidexterity. In other words, how strategic ambidexterity can be implemented through functional and cross-functional activities remains a vacuum area.

Motivated by the above research gaps, we aim to examine the effect of strategic ambidexterity on functional and cross-functional ambidexterity, taking into account contingent factors such as environmental turbulence and firm size. We contribute to the organizational ambidexterity literature in three ways. First, we define strategic ambidexterity as a firm's ability to adopt both exploratory and exploitative strategy processes, and

operationalize it as an integration of two generic strategy processes - planned (conducive to exploitation) and autonomous (conducive to exploration) (e.g., Bower, 1970; Bourgeois and Brodwin, 1984; Chaffee, 1985; Nonaka, 1988; Hart, 1991, 1992; Mintzberg et al., 1998; Bailey et al., 2000; Burgelman, 2002). Prior study has not directly examined strategic ambidexterity, and as a result, strategic ambidexterity has been more of a management ideology without much guidance on its implementation. Our study provides tangible solutions to implementing strategic ambidexterity. Second, building on Voss and Voss (2013), we focus on functional and cross-functional ambidexterity with reference to the technology and market functions, as these are two basic functions within high-tech firms (Song et al., 2005) and represent distinct dimensions for exploration and exploitation (O'Reilly and Tushman, 2008). In particular, we define functional ambidexterity as an integration of technology exploration and exploitation, or an integration of market exploration and exploitation; cross-functional ambidexterity as integration of technology exploration and market exploitation, or an integration of technology exploitation and market exploration. More importantly, we extend Voss and Voss (2013) by explicitly examining the effect of strategic ambidexterity on functional and cross-functional ambidexterity, providing evidence on how strategic, functional and cross-functional activities can be aligned to implement ambidexterity. This responds to the call for research examining organizational ambidexterity at multiple levels of the firm and across different domains (Raisch and Birkinshaw, 2008; Lavie et al., 2010). Finally, we examine the relationship between strategic ambidexterity and functional and cross-functional ambidexterity in the context of firm size and organizational environment, in order to draw the boundary conditions of organizational ambidexterity. Our findings have implications on how managers can align strategic, functional and cross-functional ambidexterity, and implement it at different levels of the organizational and across different business functions.

THEORY AND HYPOTHESES

Functional and Cross-Functional Ambidexterity

Early research posits that exploration and exploitation are inherently at odds with each other (Levinthal and March, 1993) due to a multitude of reasons. First, exploitation builds on a firm's existing market and technological knowledge, and its resource base, whilst exploration entails a shift towards new market and technological expertise (Lavie et al., 2010). Institutionalized learning (what has already been learned and embedded in the organization) in the form of existing knowledge may act as inertia against the acquisition and assimilation of new market and technological knowledge (Crossan et al., 1999). Second, exploitation requires cognitive efforts aimed at generating new ideas (variation) and selecting, evaluating and legitimizing the most appropriate ones, whereas exploration relies on behavioral mechanisms facilitating the assimilation of a new idea or knowledge into the existing sets of routines for the execution of that particular task and its replication in diverse contexts (Zollo and Winter, 2002). Therefore, exploitation and exploration are associated with specific organizational structures, systems or processes, which may favour one at the expense of other (Benner and Tushman, 2002, 2003; Duncan, 1976; Floyd and Lane, 2000; Ghemawat and Ricart I Costa, 1993; Sheremata, 2000). Third, compared to returns from exploitation, returns from exploration are "systematically less certain, more remote in time and organizationally more distant from the locus of action and adaptation" (March, 1991, p.73). Managers who prefer more certain and proximate returns over less certain and distant returns may allocate resources in favour of exploitation, but against exploration (March, 1991). The trade-off effect between exploration and exploitation means that they need to be structurally separated (e.g. Benner and Tushman, 2003; O'Reilly and Tushman, 2004) - in different business units or different business functions. Cross-functional ambidexterity reflects this approach: a firm can either exploit current technologies for attracting new customer markets (i.e. a market

development growth strategy), or explore new technologies that target current customer markets (i.e. a technology development growth strategy).

Recent research recognizes that exploration and exploitation may complement each other under certain conditions, and can be simultaneously integrated in the same business unit or the same business function (e.g. Adler et al., 1999; Gibson and Birkinshaw, 2004; Wang and Rafiq, 2014). For instance, an organizational context that jointly emphasizes high performance (discipline and stretch) and social support (support and trust) (Ghoshal and Bartlett, 1994) encourages individuals to make integrative judgments as to how to best divide their time between the conflicting demands for alignment associated with exploitation and adaptability needed for exploration (Gibson and Birkinshaw, 2004). Such ambidexterity is facilitated by an organizational culture integrating organizational diversity (values and norms that encourage and tolerate differences) and shared vision (values and norms that promote organizational members' active involvement in developing and implementing organizational goals) (Wang and Rafiq, 2014). Organizational diversity and shared vision together nurture the generation of a range of ideas for exploration and the implementation of selected ideas effectively for exploitation. Functional ambidexterity reflects this approach: technological ambidexterity entails simultaneous exploration of new technological capabilities and exploitation of current technological capabilities, and market ambidexterity encompasses simultaneous exploration of new customer markets and exploitation of current customer markets.

Strategic Ambidexterity

We contend that functional and cross-functional ambidexterity is underpinned by organizational strategy processes. Strategy processes, taking into account a firm's internal resources and capabilities and its external environment, encompass the processes through

which strategic decisions are arrived at, implemented, and changed (Chakravarthy and Doz, 1992). Effective strategy processes are aligned with functional and cross-functional activities, including market and technological functions.

We focus on two generic types of strategy processes - planned and autonomous (e.g. Bower, 1970; Bourgeois and Brodwin, 1984; Chaffee, 1985; Nonaka, 1988; Hart, 1991, 1992; Mintzberg et al., 1998; Bailey et al., 2000; Burgelman, 2002). A planned strategy process consists of formal analysis, such as environmental scanning, portfolio analysis, and industry and competitive analysis (Hart, 1992). Top management institutionalizes such formal analysis by setting detailed strategic plans, which are then implemented by middle managers. As the formal analysis is often based on the current market and technological capabilities, a planned strategy often directs resources to exploit such capabilities. Planning integrates dispersed information, ideas, and knowledge into collective action. It also unifies diversified actors in a firm under a single plan and helps detect any deviation from such a plan (Lorange and Vancil, 1977; Kukalis, 1991; Miller and Cardinal, 1994). This helps integrate actors and coordinate their actions for exploitation. Therefore, a planned strategy process “exploits initiatives that are within the scope of a company's current strategy and that extend it further in its current product-market environment” (Burgelman, 2002, p.327).

Conversely, in an autonomous process, strategy emerges from initiatives by middle managers and lower-level employees who engage in gatekeeping, bootlegging and idea generation activities to generate a stream of initiatives that diverge from existing strategies (Burgelman, 1983). Based on these autonomous initiatives, middle managers negotiate change in strategies with top management, and act as mediators between employees and top management. Top management's role is to retrospectively rationalize what has actually already taken place, rather than making comprehensive and analytical decisions for future course of actions. An autonomous strategy process allows and even creates room for

exploration in areas beyond an organization's current market and technological capabilities. It enables organizational members to indulge in risk-taking and experimentation to address emerging opportunities (Burgelman, 1991; Claver et al., 1998; Mascitelli, 2000; Andriopoulos and Lewis, 2009). As such, an autonomous process "exploits initiatives that emerge through exploration outside of the scope of the current strategy and that provide the basis for entering into new product-market environments" (Burgelman, 2002, p.327).

The respective roles of planned and autonomous strategies on exploitation and exploitation are well recognized in the prior conceptual work, but their integrative effect on organizational ambidexterity is under-researched in theoretical and empirical terms. In this study, we define strategic ambidexterity as the effective integration of planned and autonomous strategy processes, and delineate how strategic ambidexterity is implemented in functional and cross-functional levels below.

Hypotheses

Literature advocates the desirability of integrating planned and autonomous strategy processes simultaneously (Mintzberg, 1973; Anderson, 2004). An integrated approach to planned and autonomous strategy processes reflects a pattern of interaction between the roles performed by the top managers at one extreme, and employees at the other, and represents a highly specialized, tacit, and causally ambiguous resource set that maybe available to a firm (Hart and Banbury, 1994). Firms that calibrate both processes require a complex pattern of coordination between many players and diverse resources that are difficult to grasp and imitate. Consequently, these processes provide a firm different approaches to resource allocation, which can be calibrated upon to influence its technology and market strategies. For instance, a planning process provides a comprehensive approach that facilitates a better understanding of the organization's competitive situation (Lorange and Vancil, 1977; Ansoff,

1991) towards resources allocation on capitalizing current market and technological opportunities. An autonomous process reflects a decentralized strategy making approach that helps organizational members to take initiatives that are outside of the firm's current competitive strategy, and to focus on exploration of emerging markets and technologies (Burgelman 1991, 2002). Firms that can integrate both processes not only take comprehensive decisions based on current market and technological capabilities, but also negotiate room for manoeuvre to explore future market and technological opportunities.

There are at least two ways in which a firm can integrate planned and autonomous processes. First, a firm can manage different types of processes in different business functions, in particular, market and technology. For instance, Mintzberg (1973, p. 49-50) observes of a hotel business that "Where the operations were largely routinized and predictable, as in housekeeping and the front office, the planning mode was used. In marketing, where there was room for imagination and bolder action, the hotel tended to act in an entrepreneurial [autonomous] fashion". Clearly, different functions of a firm can employ planned and autonomous processes that best fit their particular requirements for exploration or exploitation. In other words, a firm may deploy a planned process in the technology domain, and an autonomous process in market domain, or vice versa. In such cases, cross-functional ambidexterity can be achieved through a simultaneous integration of technology exploitation and market exploration (a market development strategy), or technology exploration and market exploitation (a technology development strategy). Hence, we hypothesize the following:

Hypothesis 1: An integration of planned and autonomous strategy processes will have a positive impact on cross-functional ambidexterity featuring (a) technology exploitation and market exploration, or (b) technology exploration and market exploitation.

A second way is to integrate planned and autonomous strategy processes within the same business function, for example, within the market or technology functions. It has long been observed that distinct work groups exist within a business function. For example, Omnitel Pronto Italia, a wireless communication provider grouped its technical staff in semi-independent teams which were responsible for activities over well-defined technical areas (Narduzzo et al., 2000). Similarly, Appleyard et al. (2000) find that semiconductor companies are often required to manage technology exploration and exploitation simultaneously. They also find that high performers in the industry tend to partition exploratory technology teams with its own staff and a leader under an autonomous strategy process where team members are encouraged to experiment and drive new ideas; at the same time, the rest of the technical staff is engaged in day-to-day activities governed by a very comprehensive (planned) strategy process. Such case-based anecdotal evidence suggests that ambidextrous firms are adept at deploying different strategy processes for different semi-independent teams within same business function. Hence, we hypothesize the following:

Hypothesis 2: An integration of planned and autonomous strategy processes will have a positive impact on functional ambidexterity featuring (a) technology exploitation and exploration, or (b) market exploration and exploitation.

Environmental turbulence, defined as "rapid market and technology changes that managers perceive as hostile and stressful conditions for their firm" (Atuahene-Gima, 2005, p.66), puts constrains on the working of firms. It is suggested that turbulent environment requires a "more sophisticated level of analysis and information processing than does a stable or simple dynamic environment" (Hart and Banbury, 1994, p.257). Such kind of environment necessitates a more complex strategy process that can cope with complicated

information processing needs of a firm (often fulfilled by a planned strategy process), and a more emergent and dynamic strategy process that responds to future opportunities (often entailed in an autonomous strategy process). A planned strategy alone would put a firm at the risk of core rigidity (Leonard-Barton, 1992) or being trapped in its own success (Wang et al., 2015) associated with pure exploitation; whereas an autonomous strategy alone would increase the risks of a firm pursuing new technology or market without capitalizing on its current capabilities, or even fall into a failure trap associated with pure exploration (Gupta et al., 2006). Early evidence suggests that firms combining different strategy processes out-perform in turbulent environment (Hart and Banbury, 1994). In contrast, stable environment is much simpler and does not put high information processing demand on a firm. As a result, combining planned and autonomous strategy processes may not be cost effective for firms in a stable environment, or even put a firm at a disadvantage due to over complicating strategy processes and decreased strategic and operational efficiency. Thus, the effect of strategic ambidexterity on functional and cross-functional ambidexterity may be contingent upon a firm's external environment.

Hypothesis 3: As the turbulence in the environment increases, so does the effect of integrated planned and autonomous strategies on (a) both types of cross-functional ambidexterity; and (b) both types of functional ambidexterity.

The significance of strategic ambidexterity may also be contingent upon firm size. Early research provides initial evidence that a process that combines different types of strategy processes contributes to performance in larger firms but not necessarily in smaller firms (Hart and Banbury, 2004). As the number of employees increases, so does the complexity and coordination issues. As a result, the direct relationship between top

management, middle managers and employees breaks down. In such cases, a planned strategy process acts as a formal coordination mechanism that brings together different perspectives and monitors deviations (Lorange and Vancil, 1977; Kukalis, 1991; Miller and Cardinal, 1994). Similarly, with an increase in size, it becomes almost impossible for top management to remain in touch with day-to-day activities of the firm, losing direct contact with technological and market changes. This makes them more dependent on employees, who understand the pulse of the customers, to get feedback on the market. Therefore, top management reluctantly or otherwise has to give more autonomy to employees to experiment and come up with new ideas. Thus, larger firms have more incentives to integrate planned and autonomous strategy processes. Conversely, in smaller firms, top management is more likely in direct contact with operational activities (Lubatkin et al., 2006) and in touch with technological and market development. Smaller firms are less likely to have coordination problems, and much of the coordination is done by the top management. Thus, smaller firms have less incentive to integrate planned and autonomous strategies. Therefore, we hypothesize the following:

Hypothesis 4: With the increase in firm size, the effect of integrated planned and autonomous strategy processes will have an increasingly positive effect on (a) both types of cross-functional ambidexterity; and (b) both types of functional ambidexterity

RESEARCH METHODS

Data and Sample

We focused on high-tech firms in India in this study. High-tech firms are argued to face severe challenges of implementing ambidexterity at strategic and functional levels (Gibson and Birkinshaw, 2004; Wang and Rafiq, 2014). We utilize the setting of India because, Indian

technology-based firms face turbulent environment, which epitomizes the need for ambidexterity. We selected three industry sectors: bio-technology, electronics, and information technology, classified as high-tech sectors by the Organisation for Economic Co-operation and Development (OECD, 1999). Our final list of firms in the three industries consisted of 3,186 high-tech firms - our initial sample.

We conducted a web survey using Qualtrics to collect detailed data on firms' strategic and functional capabilities as well as other characteristics, which were not publicly available. Following Dillman's (2007) total design method for mail and internet survey, we conducted the web survey in five phases. In total, 289 responses were received, a 9.1% total response rate. After deducting unusable ones, 260 were our final sample, an effective response rate of 8.2%. This rate is comparable to that of other similar studies (Ling et al., 2008). Respondents included top managers (e.g., CEOs, founders, owners, partners, chairmen, and managing directors) and senior managers in technical, marketing, finance, and human resources functions (see Table I). Respondents had, on average, 9.3 years of experience with their respective firms, and 18.7 years of experience in the industries in which their firms operated (see Table I). This provided evidence of the respondents' knowledge and competence to report about their firms and environments.

We tested non-response bias, first by comparing the differences in the key variables between early and late respondents (the first third vs. the last third) (Armstrong and Overton, 1977). Significant differences were found in only 2 of the 29 variables, suggesting that non-response bias was not a major concern. Second, we examined whether the non-responding firms were different from the responding firms in terms of firm age and size, and found no significant differences ($p > 0.05$).

We employed procedural methods to control for common method bias, and used statistical techniques to assess its likelihood. First, we assured respondents of the complete

anonymity and confidentiality in the emails and the front page of the survey, and also encouraged them to answer the questions as honestly as possible. This technique decreases tendency of respondents to make socially desirable responses or be compliant in their responses (Podsakoff et al., 2003). Second, to reduce item ambiguity we carefully avoided double meaning questions and vague concepts, and kept questions as simple as possible (Tourangeau et al., 2000). Third, we performed the Harman's one-factor test (Podsakoff and Organ, 1986), by including all the study variables in an exploratory factor analysis. The results showed there were 7 factors with eigenvalues greater than 1 and these factors together accounted for 70.83 percent of the variance; the first factor explained 30.53 percent of the variance, and unrotated factor structure didn't show any general factor. This suggests that common method bias was not a problem. Fourth, we controlled for an unmeasured latent common method - a more stringent test (Mihalache et al., 2012; Podsakoff et al., 2003), by performing a confirmatory factor analysis on which items were allowed to load onto both a latent common method variance factor as well as their theoretical constructs. The results confirmed that common method bias was not a serious concern.

Finally, to test single respondent bias and the accuracy of our measures, we gathered information from a second respondent in a total of 26 firms (10% of the sample). We first calculated r_{WG} which is the most common index of inter-rater agreement (LeBreton and Senter, 2008). The average r_{WG} of all the 7 constructs ranged from 0.60 to 0.90, and median r_{WG} ranged from 0.73 to 0.97. This indicates adequate agreement (LeBreton and Senter, 2008). Next, to measure response convergence we calculated the intraclass correlations, ICC (1). For all the 7 constructs, we obtained ICC (1) clearly exceeding Bliese's (1998) 0.1 cut-off. Both r_{WG} and ICC (1) results indicate that single respondent bias was not a problem.

INSERT TABLE I ABOUT HERE

Measurement

We used established measures (see Table II) where appropriate to increase the validity of our constructs, and all the items dealt with relevant issues at the strategic business unit (SBU) - our unit of analysis.

Independent variables: We operationalized strategic ambidexterity as an integration of planned and autonomous strategy processes - a second-order formative construct consisting of first-order planned and autonomous strategies. Further, the planned strategy process was measured using six items from Bailey et al. (2000) to gauge the extent to which the strategy process is intentional, logical, sequential, analytic and deliberate. The autonomous strategy process was measured using three items adapted from Lumpkin et al. (2009) to capture the extent to which strategy is driven by the autonomous initiatives of employees.

Moderating variables: Environmental turbulence was assessed using five items from Atuahene-Gima (2005), encompassing the pace of change in technology, customers and competitors. For firm size, we asked respondents to indicate the number of employees that their firms had.

Dependent variables: We operationalized both functional and cross-functional ambidexterity as second-order formative constructs consisting of market and technology exploration and exploitation in different combinations. Specifically, the four first-order constructs were measured using items from Danneels (2012): market exploitation encompassed a firms' ability to serve a particular group of existing customers; market exploration assessed a firm's ability to identify and penetrate markets previously unserved;

technology exploitation captured a firm's ability to produce a product or service for its customers; and technology exploration assessed a firm's ability to identify and adapt new technologies.

Control variables: To test that the hypothesized relationships were independent of known variables, we controlled the effect of firm age, industry type, and SBU (differentiating a single SBU that solely forms a firm from a SBU that belongs to a firm with multiple SBUs), as these variables have been proposed to affect ambidexterity (Raisch and Birkinshaw, 2008).

INSERT TABLE II ABOUT HERE

RESULTS

We employed PLS structural equation modeling using SmartPLS (Ringle et al., 2005). PLS has recently gained popularity in strategy and management research (e.g., Gruber et al. 2010; Ciabuschi et al. 2011), especially in handling second-order constructs (Chin and Newsted, 1999), as it avoids both factor indeterminacy and inadmissible solutions (Fornell and Bookstein, 1982).

Measurement models

First-order factors

To test first-order factors, we first performed exploratory factor analysis of all the variables. Items were dropped to remove cross-loading and improve the consistency of the scales when necessary, and the expected pattern of seven factors emerged: two strategy processes (planned and autonomous), four functional exploratory and exploitative capabilities (market

exploration, market exploitation, technology exploration, and technology exploitation), and environmental turbulence. The factor analyses on each scale separately showed they had a single eigenvalue greater than 1, proving their unidimensionality. Cronbach's alpha of each scale was found to be above the threshold limit of 0.7 (Nunnally, 1978) (Table III). The composite reliability of all the constructs exceeded 0.7 as recommended by Fornell and Larcker (1981), providing evidence of internal consistency. The average variance extracted (AVE) for each construct was above the threshold limit of 0.5 (Fornell and Larcker, 1981), proving the convergent validity of the model. Finally, we performed a related test for discriminant validity recommended by Hair et al. (2010), and found that the square roots of the AVE along the diagonal of the correlation matrix were greater than all other entries in the same row and column (see Table III).

INSERT TABLE III ABOUT HERE

Second-order factors

The convergent validity and item reliability of formative constructs cannot be assessed in the same way as reflective constructs due to the very nature of formative constructs (Hulland, 1999). Diamantopoulos and Winklhofer (2001) suggest an alternative method in the form of testing for multicollinearity among the items (first-order constructs in this case) that constitute formative constructs. Therefore, we tested for multicollinearity by calculating variance inflation factors (VIFs) on the first-order reflective constructs that constitute formative constructs. The VIF values for all first-order reflective constructs are well below the threshold criterion of 10, and thus there is no excessive multicollinearity between the

first-order constructs. The low multicollinearity suggests that the first-order reflective constructs are rightly tapping into different dimensions of formative constructs (Petter et al., 2007).

Structural Model

We first applied the PLS algorithm followed by the bootstrapping procedure with 1,000 subsamples to test for statistical significance. The best fit between the data and the model is presented in Figures 1 and 2. The coefficient of determination R^2 is used for evaluation purposes in PLS as there are no overall goodness-of-fit statistics for a PLS model (Hulland, 1999).

Figure 1 summarizes the results related to cross-functional ambidexterity (H1a and H1b). The model explained 34 percent of variations in cross-functional ambidexterity of market exploration-technology exploitation, and 30 percent of variation in cross-functional ambidexterity of technology exploration-market exploitation. The variance explained in endogenous variables are in line with similar studies (Trichterborn et al., 2015). The path coefficient from strategic ambidexterity to market exploration-technology exploitation was significant and positive ($\beta=0.55$, $p<0.001$) providing support for Hypothesis 1a. The path coefficient from strategic ambidexterity to technology exploration-market exploitation was significant and positive ($\beta=0.53$, $p<0.001$), providing support for Hypothesis 1b.

Hypotheses 3a pertaining to the effect of environmental turbulence on the hypothesized relationships in H1a and 1b were tested using an interaction moderation analysis. Our results indicated that interaction of strategic ambidexterity and environmental turbulence had no significant effect on cross-functional ambidexterity of technology exploration-market exploitation ($p>0.05$), and on market exploration-technology exploitation ($p>0.05$). Thus,

Hypothesis 3a which predicts that strategic ambidexterity will contribute towards both types of cross-functional ambidexterity more in turbulent environment was not supported.

Hypotheses 4a pertained to the effect of firm size on the hypothesized relationships in H1a and H1b. Similarly, we performed an interaction moderation analysis. Results showed that interaction of firm size and strategic ambidexterity had no effect on both types of cross-functional ambidexterity: technology exploration-market exploitation ($p>0.05$), and market exploration-technology exploitation ($p>0.05$). Thus Hypothesis 4a that predicts that with increase in the size of firm the combined processes effect on both types of cross-functional ambidexterity will increase was not supported.

INSERT FIGURE 1 ABOUT HERE

Figure 2 summarizes results related to functional ambidexterity (H2a and H2b). The model explained 40 percent of variations in functional (market) ambidexterity (market exploration-market exploitation), and 19 percent of variation in functional (technology) ambidexterity (technology exploration- technology exploitation). The variance explained in endogenous variables are in line with similar studies (Trichterborn et al., 2015). The path coefficient of strategic ambidexterity on market ambidexterity was significant and positive ($\beta=0.40$, $p<0.001$), providing support for Hypothesis 2a. The path coefficient of strategic ambidexterity on technology ambidexterity was also significant and positive ($\beta=0.61$, $p<0.001$), providing support for Hypothesis 2b.

Hypothesis 3b predict the moderating effect of environmental turbulence on the hypothesized relationships in H2a and 2b. Interaction moderation analysis revealed that the interaction of strategic ambidexterity and environmental turbulence had no significant effect on both types of functional ambidexterity: market ambidexterity ($p>0.05$) and technology

ambidexterity ($p<0.05$). Thus Hypothesis 3b that predicts that with increase in turbulent environment the effect of combined processes on both types of functional ambidexterity will increase was not supported.

Hypothesis 4b predict the moderating effect of firm size on the relationships between strategic ambidexterity and two types of functional ambidexterity. Results showed that interaction of firm size and strategic ambidexterity had no effect on market ambidexterity ($p>0.05$), and technology ambidexterity ($p>0.05$). Thus Hypothesis 4b that predicts that with increase in the size of firm the combined processes effect on both types of functional ambidexterity will increase was not supported.

INSERT FIGURE 2 ABOUT HERE

DISCUSSION

Ambidexterity is an important lens through which firms' activities can be looked into (Tushman and O'Reilly, 1996; Gibson and Birkinshaw, 2004; Raisch et al., 2009; Simsek et al., 2009; O'Reilly and Tushman, 2013). Despite the excessive attention it has attracted (Birkinshaw and Gupta, 2013), the ambidexterity literature has accumulated evidence on disparate organizational mechanisms that enable different types of ambidexterity. However, the strategic underpinning of these organizational mechanisms has been relatively unexplored. Despite the call for future research on strategic ambidexterity (Raisch and Birkinshaw, 2008), there is a glaring gap on how to gauge a firm's strategic ambidexterity and how it can be aligned with organizational activities within and across business functions for strategic implementation. This study is an attempt in that direction.

Our study contributes to the organizational ambidexterity literature in several ways. First, strategy processes as a critical factor for implementing organizational ambidexterity have never been studied till now. Prior literature has examined related issues, such as organizational structure (O'Reilly and Tushman, 2008), behavioral contexts (Gibson and Birkinshaw, 2004), and organizational culture (Wang and Rafiq, 2014). However, these are just a tip of the iceberg, and the strategy processes underpinning such organizational contexts have been neglected. Whilst scholars generally acknowledge the importance of understanding ambidexterity from a strategic perspective (Raisch and Birkinshaw, 2008), the concept of strategic ambidexterity has been much of a management ideology, without much guidance on how it can be implemented. Recent work has attempted to examine how exploration and exploitation can be combined strategically (Voss and Voss, 2013), but the strategy processes have again been stripped out of the equation. Our study brings strategy processes to the fore, and conceptualizes planned and autonomous strategy processes as two complementary aspects of strategic ambidexterity. Planned (deliberate) and autonomous (emergent) strategies have been widely studied (e.g., Bailey et al., 2000; Bourgeois and Brodwin, 1984; Bower, 1970; Burgelman, 2002; Chaffee, 1985; Hart, 1991, 1992; Mintzberg et al., 1998), and practised by firms. However, it is the integration of the strategy processes to draw out their synergies that forms strategic ambidexterity. Such integration enables a balanced approach to resource acquisition and allocation on exploratory and exploitative activities, and it is through the interacting planned and autonomous strategy processes that exploratory and exploitative knowledge is produced. Hence, our conceptualization of strategic ambidexterity addresses a key weakness of the cultural and contextual approach to ambidexterity that fails to identify the source of production of exploitative or explorative knowledge. As Kauppila (2010) observes, a key shortcoming of contextual and cultural based ambidexterity research is that it 'does not really consider how a firm can simultaneously conduct radical forms of exploration

and exploitation. It simply assumes that exploratory knowledge is produced somewhere and is available for use' (p.286).

Second, implementing ambidexterity is not easy due to the competing demands of exploration and exploitation (March, 1991; Smith and Tushman, 2005; Voss and Voss, 2013). For example, it is suggested that firms have a favourable cultural and behavioral context that encourages individuals to make integrative judgments as to how to best divide their time between exploratory and exploitative activities (Gibson and Birkinshaw, 2004). Companies such as Google and Atlanssian adopted this approach and set a 20% down time policy to allow employees to explore new ideas, but are now both quietened for their policy due to not meeting the desired effects. In this study, we link strategic ambidexterity to functional (market or technology) or cross-functional (market and technology) ambidexterity, to provide tangible solutions to strategically implementing ambidexterity. Exploration and exploitation can be co-produced in different work groups within the same (market or technology) function and across different (market and technology) functions. These work groups are governed by different strategy processes (planned or autonomous) and assessed by different performance criteria. For instance, work groups that are governed through the planned process will take comprehensive decisions, and have senior managers imprinted on these decisions, whereas the role of other members is limited to implementing those decisions (Appleyard et al., 2000). Conversely, work groups that are governed through the autonomous process make spontaneous decisions in line with the emerging ideas from employees and opportunities arising from the market; the role of senior managers is limited to retrospectively rationalizing those decisions (Appleyard et al., 2000). Such practice was previously noted as possible in anecdotal cases (Appleyard et al., 2000; Narduzzo et al., 2000), and our study provides robust evidence on such functional and cross-functional ambidexterity. A critical success factor of both functional and cross-functional ambidexterity is that firms need to maintain both

"planned processes in which there is a significant role for senior management as well as evolutionary [autonomous] processes in which other members of the organization can influence strategy through their actions" (Rotemberg and Saloner, 2000, p. 694).

Third, our study also addresses the boundary conditions of aligning strategic, functional and crossfunctional ambidexterity. We find that strategic ambidexterity has a universal effect on functional and cross-functional ambidexterity in firms operating in different levels of environmental turbulence. This is contrary to previous research findings (e.g., Hart and Banbury, 1994) that suggest combined strategy processes contribute more towards firm performance in a changing environment. For instance, Nonaka (1988) argues that a combined process has value in an environment in which not only the intensity of information creation is high but also there is a high pressure to respond to those changes quickly. There can be at least three different explanations for our somehow intriguing finding on the environmental turbulence effect. First, the sample of this study belongs to high-tech sectors where on an average the turbulence is more than that faced by firms in non-high-tech sectors. In addition, the high-tech sectors we studied are situated in an Indian environment which is itself more turbulent compared to average growing economies. What it could mean is that there is no sharp contrast in terms of environment turbulence faced by firms in our sample; even those that are facing relatively less turbulent environment might be compelled to use both planned and autonomous strategy processes – a case which might not be true for non-high-tech firms and/or firms situated in economies that have an overall stable environment. Second, some have argued and others have shown that a firm can combine more than two processes (e.g., Nonaka, 1988; Hart, 1992; Hart and Banbury, 1994). These researchers argue that although combining two strategy processes is difficult and its effectiveness depends on the pace of environmental change, but a more difficult task is to combine more than two processes, the fate of which is more dependent on environmental turbulence. Therefore, environmental

turbulence may be a boundary condition for more complex processes than an integration of two strategy processes (Hart and Banbury, 1994). A final explanation of these results could be that in previous research the effects of combined strategy processes are studied in terms of their direct contribution towards firms' financial performance (Nonaka, 1988; Hart and Banbury, 1994; Anderson, 2004). However, we extend this conversation by showing that combined strategy processes have more pronounced effects on functional and cross-functional ambidexterity - a potentially missing link in the understanding of Hart and Banbury's (1994) findings on the differential performance effects of combined strategy processes in a changing environment. What it could mean is that, while the effect of combined strategy processes on firm performance might be dependent on the pace of change in environment, their more direct effects on intermediate activities (functional and cross-functional ambidexterities) might not be dependent on turbulence in environment. In other words, once a firm has embraced an integrated approach to strategy processes, it has to first align its strategic ambidexterity with functional and cross-functional ambidexterity, irrespective of changes in environment.

Our findings suggest that firm size is not a boundary condition for aligning strategic ambidexterity, functional and cross-functional ambidexterity. This somehow contradicts previous findings that combined strategy processes are more apt for larger firms than smaller ones (Hart and Banbury, 1994). One explanation could be that in today’s environment, especially in the high-tech sectors, not just larger firms but even smaller ones have the need, incentive and resources to adopt both planned and autonomous strategy processes. This may be so because high-tech companies have a large proportion of highly skilled employees compared to non-technology based companies. While it is easier to use just planning processes on an employee base that has few highly skilled staff, firms that have a large proportion of technical employees need autonomous processes in conjugation with planning

process, irrespective of size; high skilled employees will have more input on strategic processes than less skilled ones, and may demand greater say in the whole process. Moreover, the competitive nature of the business environment means that high-tech firms, regardless of their sizes, may have no choice but to explore and exploit simultaneously (Gibson and Birkinshaw, 2004).

Overall, our study has gained insights on how firms can align strategic, functional and cross-functional ambidexterity within the organizational and environmental contexts of Indian high-tech firms. Our analysis of multidimensional ambidexterity departs from prior literature that often focuses on a single dimension of ambidexterity (Raisch and Birkinshaw, 2008; Lavie et al., 2010). Moreover, our study also reconciles the trade-off and the complementary approaches to exploration and exploitation. Prior literature often takes the 'either trade-off or complementary' approach to studying ambidexterity. In our study, we recognize that the trade-off approach underpins the cross-functional ambidexterity, recognizing the different degrees of exploration and exploitation placed by the market and technology functions, and that the different degrees of exploration and exploitation may co-exist in the same market or technology function. This viewpoint reflects the complex business reality.

Limitations and Future Research

Our study has limitations but also provides several directions for future research. Although we provide new insights into the alignment of strategic, functional and cross-functional ambidexterity, our findings raise several questions: Why are some firms able to integrate the planned and autonomous strategy processes while others are not? Who within a firm figures out that certain work groups or functional domains will be managed through the autonomous process, and the rest through the planned process? Is it that the matching of work group or

functional domains and strategy processes is more precedence based, and automatic routine like procedure? These questions are related to issues examined in prior research, such as structure (O'Reilly and Tushman, 2008), meta-routines (Adler et al., 1999), behavioral contexts (Gibson and Birkinshaw, 2004), organizational culture (Wang and Rafiq, 2014), and the role of top management (Lubatkin et al., 2006, Smith and Tushman, 2005). However, these are beyond the remit of this study. Future research may provide comprehensive insights on the inter-relatedness of strategy processes and other organizational factors using exploratory, qualitative research design.

We also acknowledge that our measures are self-reported, given published data on Indian high-tech firms are rarely available. In our study, we have used procedural and statistical methods maximize the validity of our measures, including the use of a second response from 10% of the sample firms. Nonetheless, future research may wish to corroborate their data by surveying multiple respondents spanning all the major hierarchies within the firm and using multiple sources for measuring main constructs.

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Figure 1. Strategic and cross-functional ambidexterity

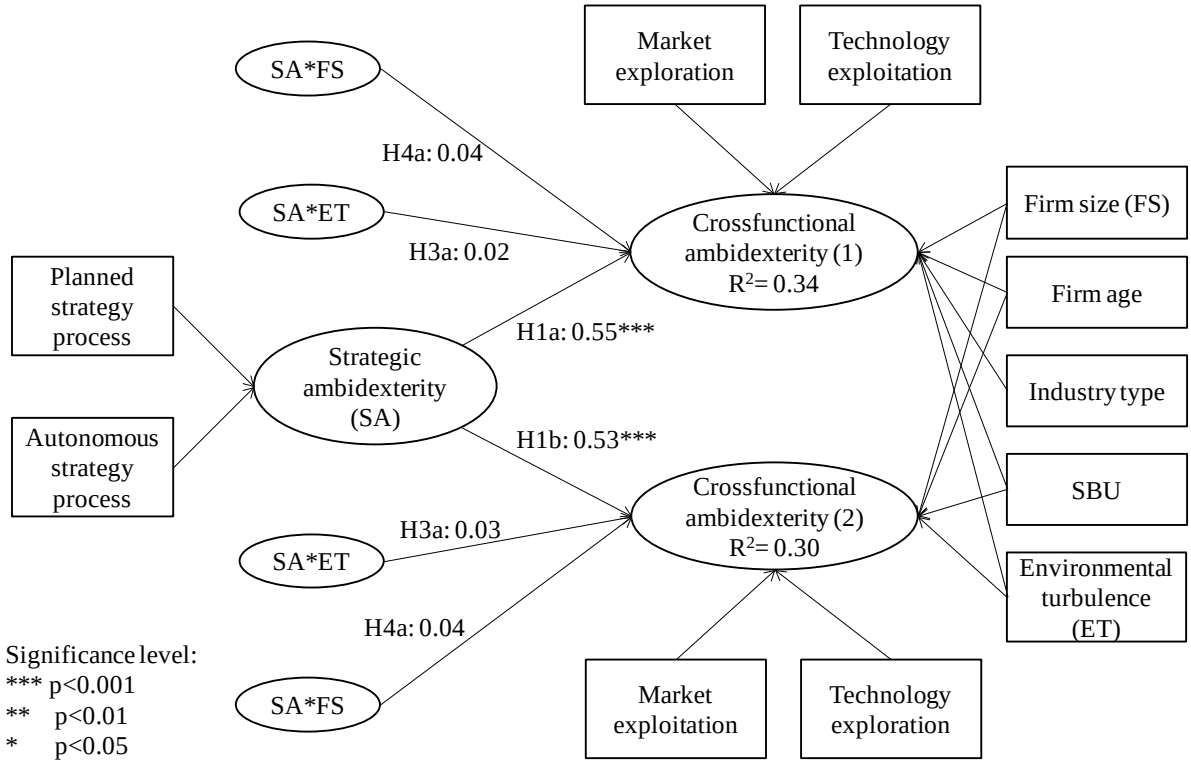

Figure 2. Strategic and functional ambidexterity

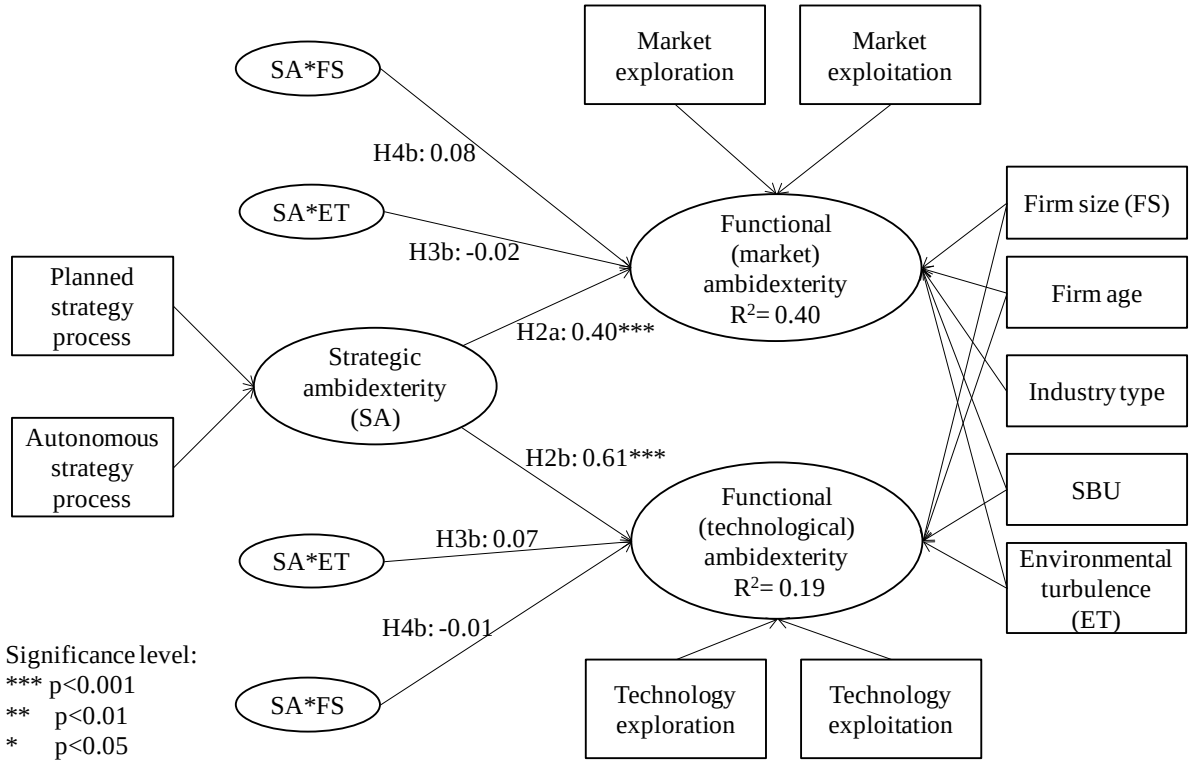

Table I: The sample profile

Firm composition (%)		**Respondent composition (%)**	
Industry		*Function*	
Electronics	26.54	Commercial function	10.00
IT	61.54	Technical function	12.08
Biotechnology	11.92	General/Strategic function*	70.83
		Other (Finance and HR) function	7.08
Firm Size		*Tenure in firm*	
<49 employees	28.85	<3 year	15.19
50-99 employees	16.92	3–5 years	27.85
100-249 employees	20.00	6–10 years	25.74
250-499 employees	10.38	11–15 years	13.50
500-999 employees	8.85	≥16 years	17.72
1,000-4,999 employees	10.00		
≥5,000 employees	5.00		
Firm age		*Tenure in Industry*	
< 5 years	17.31	≤6 year	11.02
5-9 years	20.00	6–10 years	14.83
10-15 years	22.69	11–15 years	17.80
16-29 years	31.54	16-29 years	41.10
≥ 30 years	8.46	≥30 years	15.25

* These include top managers like CEOs, founders, owners, partners, chairmen, and managing directors who have more general or strategic function in a firm

TABLE II: Scale items

Planned strategy process	**Loadings**
Our company's strategy is made explicit in the form of precise plans.	0.79
When we formulate a strategy it is planned in detail.	0.90
We have precise procedures for achieving strategic objectives.	0.88
We have well-defined planning procedures to search for solutions to strategic problems.	0.82
We meticulously assess many alternatives when deciding on a strategy.	0.78
We evaluate potential strategic options against explicit strategic objectives.	0.67
Autonomous strategy process	
The strategies we follow develop from the efforts of the individuals or groups that operate independently and outside the company's chain of command.	0.73
In our company individuals and/or teams decide for themselves what business opportunities to pursue (rather than CEO and top managers provide the primary impetus for pursuing business opportunities).	0.86
In our company individuals and/or teams pursuing strategic objectives make decisions on their own without constantly referring to their supervisors (instead of having to obtain approval from their supervisors before making decisions).	0.87
Market exploration	
Assessing the potential of new markets.	0.79
Building relationships in new markets.	0.84
Setting up new distribution channels.	0.77
Setting up a new sales force.	0.79
Researching new competitors and new customers.	0.68
Technology exploration	
Learning about technology it has not used before.	0.89
Assessing the feasibility of new technologies.	0.87
Recruiting engineers and/or scientists in technical areas it is not familiar with.	0.62
Identifying promising new technologies.	0.88
Market exploitation	
Brand reputation or company image.	0.82
Distribution channels or sales force.	0.89
Advertising/promotion resources or skills.	0.90
Technology exploitation	
Technological expertise.	0.92
Technical skills and resources.	0.95
Engineering and/or scientific skills and resources.	0.91
Environmental turbulence	
The actions of local and foreign competitors in our major markets change quite rapidly.	0.83
Technological changes in our industry are rapid and unpredictable.	0.78
The market competitive conditions are highly unpredictable.	0.84
Customers' product preferences change quite rapidly.	0.82
Changes in customers' needs are quite unpredictable.	0.75

Note: 7-point Likert scales were used.

TABLE III: Descriptive statistics of first-order factors

	Mean	SD	Cronbach's alpha	CR	AVE	A	B	C	D	E	F	G
Planned strategy process (A)	5.07	1.13	0.89	0.92	0.66	0.81*						
Autonomous strategy process (B)	3.61	1.40	0.75	0.86	0.67	0.37	0.82					
Market exploration (C)	5.21	0.98	0.83	0.88	0.60	0.60	0.29	0.78				
Technology exploration (D)	5.59	1.02	0.83	0.89	0.68	0.38	0.18	0.47	0.82			
Market exploitation (E)	4.82	1.17	0.84	0.90	0.76	0.51	0.26	0.62	0.31	0.87		
Technology exploitation (F)	5.79	0.99	0.91	0.95	0.85	0.31	0.14	0.39	0.51	0.36	0.92	
Environmental turbulence (G)	4.85	1.17	0.87	0.90	0.65	0.18	0.26	0.19	0.16	0.18	0.15	0.80

Note: SD: standard deviation; CR: critical ratio; AVE: average variance extracted. 7-point Likert scales were used.
*Diagonal value in correlation matrix depicts square root of AVE, and off-diagonal value are correlations with other constructs
Mean and SD are calculated through SPSS 21.