



International Journal of Organizational Analysis

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Article information:

To cite this document:

Saurav Snehrat, Amit Kumar, Rahul Kumar, Swarup Kumar Dutta, "The state of ambidexterity research: a data mining approach", International Journal of Organizational Analysis, <https://doi.org/10.1108/IJOA-06-2017-1182>

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<https://doi.org/10.1108/IJOA-06-2017-1182>

Downloaded on: 15 April 2018, At: 00:34 (PT)

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The state of ambidexterity research: a data mining approach

Abstract

Purpose - The academic discipline of ambidexterity is recognized as an established field within strategic management and organization theory. Extant works in the field recognize the recent burgeoning academic emphasis on ambidexterity and suggest either an impending focus or a decline for the field. Although there have been attempts to review the field of ambidexterity, most of these reviews have not followed a systematic and scientific approach to extricate the key themes emerging within. The purpose of the study is to inductively and systematically capture the main elements constituting the current boundary of the field.

Design/methodology/approach - To achieve the stated purpose, this study employs data/text mining to analyze abstracts of scholarly ambidexterity articles published over the past two decades (1997-2016) in academic journals. Using text-mining, lexical analysis is performed to compute the frequency distribution of words. The frequently occurring words are studied in detail and their association with ambidexterity is also studied by means of co-relation. This analysis (used for generation of first order themes) is then complemented by a manual analysis of each first order theme to come up with trends and sub-themes lying within.

Findings - The analysis extracts eight distinct themes that indicate the current boundary of ambidexterity research. The findings highlight the potential areas for future academic attention such as networks, business models, leadership, dynamic capability and their inter-linkages with the field of ambidexterity. Overall, the field of ambidexterity is receiving heightened academic interest coupled with a dynamic proliferation across a host of related management fields. Apart

from the required future consolidation, the field also needs new insights to enhance its explanatory power.

Research limitations/implications - This study analyzes abstracts of 504 works on ambidexterity (in the last two decades) to inductively indicate the current boundaries of the field using a data/text mining approach. Papers that do not explicitly mention ambidexterity in their abstracts, title or keywords are not included in the analysis.

Practical implications - The insights of the analysis will not only help researchers but also offer practitioners a good view point about the myriad of paths (not restricted to contextual, structural and temporal) through which ambidexterity can be promoted within and at the organization level.

Originality/value - The three-fold contribution of this study is: a systematic and scientific approach adopted to define the current boundary of the field of ambidexterity, followed by an exploration of a set of eight distinct themes and finally the identification of ongoing debates, research gaps and future research questions in light of the analysis performed.

Keywords: Ambidexterity, Data/Text mining, literature review, themes, current state

1. Introduction

Many authors in the fields of strategic management, organizational design and behavior have suggested that long-term organization performance depends on the organization's ability to exploit current capabilities and explore new opportunities (March, 1991; Raisch *et al.*, 2009). Organizational ambidexterity refers to 'an organization's ability to be aligned and efficient in its management of today's business demands while simultaneously being adaptive to changes in the environment' (Raisch & Birkinshaw, 2008). Various conceptualizations of ambidexterity have pointed at the tension between exploitation and exploration. March (1991) refers to exploration as activities like 'search, variation, risk taking, experimentation, play, flexibility, discovery, innovation' while exploitation refers to activities like 'refinement, choice, production, efficiency, selection, implementation, execution'. The academic field of ambidexterity has received considerable attention in the last two decades with established forms of Structural (Tushman & O'Reilly, 1996), Contextual (Gibson and Birkinshaw, 2004) and Temporal/Punctuated Equilibrium (Tushman & Romanelli, 1985), which focus on the separation between exploration and exploitation across structures, context and time respectively.

Organizational ambidexterity literature has seen impressive growth and a wide variety of applications in various fields such as technological innovation and product design (Gupta, Smith and Shalley, 2006; Andriopoulos and Lewis, 2010) using mostly the firm/business unit (Gibson & Birkinshaw, 2004) as the level of analysis. However, there is an increasing corpus of papers that explore ambidexterity at the individuals/teams level of analysis (Kauppila & Tempelaar, 2016; Mom, Van Den Bosch, & Volberda, 2007). Many authors have asked for more consolidation as well as clarity on the boundaries and scope of ambidexterity. However, these scholars have also pointed at the lack of multi-level works in ambidexterity leading to the

absence of an overarching theory of the field (Simsek, 2009; Birkinshaw and Gupta, 2013). Birkinshaw & Gupta (2013) suggest the field could either lead to focus or decline in the coming years. Other scholars in the field of ambidexterity have pointed at unexplored areas of research like the interaction of leadership (O'Reilly and Tushman, 2013) and business model innovation (Markides, 2013) with ambidexterity in organizations.

Such divergent academic thoughts have led to ambiguity in the boundary and scope of the field of ambidexterity as well as its theoretical power in addressing problems across fields and levels of management. This paper attempts to consolidate the essence and scope of extant works in ambidexterity by inductively identifying themes that emerge from the corpus of existing works. Further, the paper identifies themes that find place in the extant discussion regarding ambidexterity. The motivation of the study is to systematically evaluate the possibility put forward by scholars suggesting an impending focus or a decline in the field (Birkinshaw and Gupta, 2013).

Although the field of ambidexterity research can be traced back to Duncan (1976), the seminal work of Tushman & O'Reilly (1996) is widely considered to be the study that led to a renewed attention and proliferation of the field (Birkinshaw & Gupta, 2013; Raisch & Birkinshaw, 2008). The year 2016 marks the end of two decades of ambidexterity research and hence gives an opportune moment to review how far the field has evolved. This study attempts to collate research in the discipline of ambidexterity for the past two decades (1997-2016) and attempts to gain meaningful insights into its progress through the use of a systematic and scientific approach.

Although the field of ambidexterity has been reviewed recently (Raisch *et al.*, 2009; Simsek, 2009; Birkinshaw and Gupta, 2013; O'Reilly and Tushman, 2013), these reviews cannot be classified as a systematic and scientific approach involving a majority of papers published on the

topic over two decades. This paper follows a systematic approach from document search till text aggregation. Additionally, a scientific approach is adopted by using data/text mining to reveal several themes of the field.

The approach adopted in this study helps us to define the current boundary of the ambidexterity literature in the form of different themes, which in itself is a novel endeavor. Although data/text mining and lexical analysis have been used earlier in a variety of fields, application of the method has not been tried to derive meaningful insights in the field of ambidexterity. The identified themes are further analyzed and their inter-relationship with ambidexterity is elaborated. This article paves the way for scholars of the field to explore in detail the varied discussion of interactions of the concept of ambidexterity and its corresponding themes, thus, hopefully providing clarity and boundaries to the exploding field of ambidexterity.

The remainder of the paper is as follows: the subsequent section presents well discussed trends in the field of ambidexterity. Next, in section 3, the methodology adopted for this study is discussed. In section 4, the uncovered themes of ambidexterity have been elaborated along with its inter-relationships with the literature. Our findings from each theme are consolidated in the discussion section (section 5). Lastly section 6 concludes this work and gives implications for future research.

2. Two decades of Ambidexterity Research

Early academic thought on whether organizations could balance efficient exploitation and effective exploration pointed towards the inherent conflicts and the impossibility of a practical balance between the two. Many scholars argued that an organization could survive only by either focusing on exploitation or exploration. (Hannan and Freeman, 1977; Miller and Friesen, 1986)

However, subsequent work in the field of organizational ambidexterity inform academic

literature of ways to deal with conflicts emerging from the dual pursuit of exploration and exploitation. Most papers have considered the balancing of conflicting yet necessary dualities at the organizational level. Many such dualities like efficiency versus flexibility, exploration versus exploitation, alignment versus adaptability etc. have been analyzed in the ambidexterity literature.

The theoretical underpinnings to the field of ambidexterity are provided from organizational learning literature. Conceptualizing exploration and exploitation as learning activities, March (1991) pointed to the inherent trade-offs between the two activities. He further posits that ‘maintaining an appropriate balance between exploration and exploitation is a primary factor in system survival and prosperity.’

Developments in the field of ambidexterity have identified at least three forms through which firms attain a balance between exploration and exploitation: Structural (Tushman & O’Reilly, 1996), Temporal/Punctuated Equilibrium (Nickerson and Zenger, 2002) and Contextual (Gibson and Birkinshaw, 2004). Initial emphasis in the field of ambidexterity was centered on structural and temporal design solutions that enabled organizations to overcome the competing demands of exploration and exploitation (Adler, Goldoftas, & Levine, 1999; Duncan, 1976; Tushman & O’Reilly, 1996). Structural ambidexterity refers to the use of ‘... structural mechanisms to cope with the competing demands faced by the organization for alignment and adaptability’ (Gibson & Birkinshaw, 2004). It entails the creation of separate organizational units: typically small, decentralized exploratory unit with loose processes separated from larger exploitation unit with tight processes (Raisch & Birkinshaw, 2008; Tushman & O’Reilly, 1996).

The idea of temporal separation is consistent with the discussion on punctuated equilibrium in organization theory (Burgelman, 2002; Tushman & Romanelli, 1985). Punctuated equilibrium

models suggest that long-term adaptation of organizations involve a series of discrete periods with each period focused on maximizing the returns from available opportunities (Burgelman, 2002). ‘Organizations evolve through convergent periods punctuated by reorientations (or recreations) which demark and set bearings for the next convergent period’ (Tushman & Romanelli, 1985).

More recent research, however, uncovered other solutions, that could promote ambidexterity. Gibson and Birkinshaw (2004), argued that the organizational contexts of performance management and social aspects like support and trust were also capable of fostering ambidexterity in organizations. They defined contextual ambidexterity as the ‘...behavioral capacity to simultaneously demonstrate alignment and adaptability across an entire business unit’ (Gibson & Birkinshaw, 2004). In the contextual approach, the choice between exploration and exploitation is made at the individual/team level (Gibson and Birkinshaw, 2004).

In general, a large majority of studies in the field have employed a firm/business unit level of analysis (Benner and Tushman, 2002; Birkinshaw and Gibson, 2004; Birkinshaw and Gupta, 2013) with relatively few attempts at addressing multi-level analysis in the same study (Simsek, 2009). However, there are increasing number of studies that define ambidexterity at the individual level and explore its impact on organizations (Mom, Van Den Bosch and Volberda, 2007; Kauppila and Tempelaar, 2016).

Birkinshaw & Gupta (2013) suggest three discernible phases in the growth of ambidexterity as an academic discipline. The authors consider 1995-2005 as the period that defined the field and provided the theoretical background, whereas the period of 2005-2009 is considered as the growth phase with a wide proliferation of studies. The period of 2009-2013 is termed as the phase of consolidation within the field with attempts to converge the area around major themes.

Further, the authors suggest that the discipline might lead to either a decline or focus leading to more consolidation of the field (Birkinshaw & Gupta, 2013). The preliminary trends post 2013 suggests that there are no such sign of a decline of the field. A simple frequency analysis of 501 academic journal papers, focused on ambidexterity, from EBSCO Business Source Complete database is presented in Figure 1. It graphically depicts the year of publications and counts of papers dealing with ambidexterity.

Insert Figure 1 about here

In terms of the other possibility put forward by Birkinshaw and Gupta (2013), i.e. focus leading to more consolidation of the field, Figure 2 depicts the proliferation of ambidexterity across different management fields over time.

Insert Figure 2 about here

Figure 2 represents key management fields identified through an analysis of the scopes of the journals publishing ambidexterity research (Source: EBSCO Business Source Complete). Some academic disciplines such as entrepreneurship, economics, arts and accounting are not included in the study to avoid complexity. The figure suggests increasing diversity among a whole range of topics such as marketing, information systems and human resources. The preceding analysis

suggests that the scope as well as numbers of papers on ambidexterity display a burgeoning range of topics and management fields.

3. Data Mining Approach to Ambidexterity Research

3.1 Overview

This paper adopts a systematic approach to unveil the conceptual themes of the field of ambidexterity. Since the conceptual themes are implicit, we aim to study what other scholars of the field think or perceive about ambidexterity. To attain this objective, we use text mining techniques to analyze abstracts of all the scholarly articles (504) published in the past two decades (1997-2016). Using text-mining, lexical analysis is performed to compute the frequency distribution of words. The frequently occurring words are studied in detail and their interpersonal association with ambidexterity is also studied by means of co-relation. The different distinctive words are identified and grouped into eight major themes by comprehending the distinctive vocabulary of the field.

3.2 Document search and text aggregation

In order to explore the themes of ambidexterity, documents were aggregated from relevant academic sources. Foremost, the search query consisted of words: “ambidexterity” or “ambidextrous” in the title or keywords using EBSCO Business Source Complete. This source has been used recently by other strategic management and entrepreneurship scholars (cf. Gnyawali & Song, 2016). Additionally, some other studies in management also exclusively use the source for analysis (for example, see Uysal, 2010). The articles were chosen solely from peer reviewed academic journals and other sources such as trade publications, magazines and books were excluded. The examined articles were in the English language and published in the past two decades from 1997 to 2016. The entire filtering process yielded 500 papers. Additionally, four seminal papers of Adler et al. (1999), Benner & Tushman (2002), Nickerson & Zenger (2002)

and Tushman & O'Reilly (1996) are added to the base set. This addition is done to include initial papers that were very influential in the development of ambidexterity but did not show up in our search. The combined 504 papers constitute the final reproducible base set for this study. The entire process is summarized in Table 1.

Insert Table 1 about here

To evaluate the adequacy of the database choice, similar searches were done on three other databases: ABI/Inform Complete (Proquest), Science Direct and JSTOR. The number of filtered matches obtained were 455, 186 and 45, respectively. It should be noted that the search included only those papers that explicitly mentioned “ambidexterity” or “ambidextrous” in their title, abstract or keywords. Since, the number of papers in Science Direct and JSTOR were relatively small, a detailed analysis was undertaken to compare the findings between EBSCO Business Source Complete and Proquest. The percentage of papers matching between the two sources was 82.54%. It should also be noted that the initial results from Proquest included 31 papers pertaining to fields like natural sciences and history that were not relevant for this endeavor.

The comparison between source databases sheds positive light on the adequacy of the database choice for this study as EBSCO Business Source Complete is more focused on business and management research. This criterion becomes important as the term ‘ambidexterity’ is originally meant for “...the ability of humans to use both hands with equal skill” (Simsek, 2009, p. 597) and may not be exclusively used in management research.

3.3 Analyzing the textual corpus

The textual information of abstracts was analyzed using lexical analysis, a text mining technique.

Lexical analysis is performed primarily to study the word frequency distributions of the unique

words or tokens (Weiss *et al.*, 2010) The motivation behind the text or content analysis is to uncover the underlying meanings and ideas in elements of the text, such as words or phrases (Nag, Hambrick and Chen, 2007). Various patterns existing in the frequency of occurrence of words or phrases have buoyed the recurring and distinctive lexicons.

We analyzed the dataset on a windows based platform using the ‘R’ language. ‘R’ remains one of the most widely accepted open source environment for statistical computing and visual graphics (Gentleman *et al.*, 2004). After the text was aggregated, pre-processing the raw data was a must in order to do away with any source of ambiguity. The sentences were parsed into different words or tokens by considering each character or word between two spaces or between a space and punctuation as a separate word (Weiss *et al.*, 2010). All numbers (0-9), symbols such as “@”, “*”, “()” and punctuation marks were removed, as they add no meaning to the literature of ambidexterity. Further, the list of unique words was reduced by converting all the uppercase letters to lower case, since both were considered as separate words or features of the text.

There are some common but highly recurring words in the English language which add little meaning to the subject of the text. Such words fall under the category of articles, prepositions or adjectives and are known as the ‘Stop words’ of the English language. These words were removed during data preprocessing to retain a parsimonious but unique list of features. With the similar objective to reduce the list of unique words before the final analysis, words which take different forms but have a common root were reduced to their root words. For example, “dexterity” and “dexterous” both stem from the root word “dexter”. Such words exist in different

forms but are used in similar contexts and hence can be condensed to the root word to add more emphasis to their frequency of occurrence (Bird, Klein and Loper, 2009).

Once the data pre-processing is done, initial analysis revealed that words such as “article”, “paper”, “research” and “study” are bound to frequently occur in scholarly articles. These words though carry meaning in their independent existence, they add little meaning to the domain of ambidexterity. Resultantly, these words are removed before conducting the final set of experiments.

3.4 Findings

Preliminary analysis was performed by studying the distribution of frequency of words. This analysis led to a set of most frequently occurring words.

As a sequential exercise, sparsity removal is an inevitable step to come to decisive conclusions. Borrowing the methodology adopted by Nag et al. (2007), words with frequency less than 10 were removed for further analysis. Additionally, words which occurred fewer than 15 and 20 times were also removed to put an emphasis on the broader themes. For the protocol with sparsity removal (<15), correlation of the remaining words with “ambidext” were computed to evaluate the strength of relation between the field of study and its corresponding themes. The themes were identified by systematically going through each distinctive word and assigning them a theme using a consensual decision process by the team of four authors. The classification of major themes are reported below in Table 2.

Insert Table 2 about here

4. Prominent themes in ambidexterity research

The major themes generated in Table 2 were complemented with a manual analysis of all relevant paper abstracts using Microsoft Excel based search tools and inputs from theory. For example to find out the various types of ambidexterity in the base set of academic papers, preceding words to “ambidexterity” were identified and analyzed to identify whether the papers positioned them as different types of ambidexterity. Similarly, to find out the key sub-themes related to dynamic capability, papers using the term were isolated using search tools and the resultant sub-set of papers were analyzed. The eight major themes identified in Table 2 are discussed separately below.

4.1 Types of ambidexterity

Based on the mechanisms used to achieve ambidexterity, the extant literature identifies structural, contextual and temporal as the major types of ambidexterity (Zimmermann & Birkinshaw, 2016). Most well-cited works in the field deal with these three types and their related nuances (Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008; Tushman & O’Reilly, 1996). However, observations from our base set paint a slightly different picture. Figure 3 depicts the different types of ambidexterity explored in the 504 papers analyzed (only typologies with more than one studies are analyzed). Out of the 504 papers, 109 studies explicitly mentioned the type of ambidexterity in their titles and abstracts. The data in Figure 3 suggest that contextual ambidexterity (28 papers) has received the highest share of attention compared to structural (6 papers) and temporal/punctuated equilibrium (4 papers).

Further, there have been other types of ambidexterity discussed in the literature such as innovation (Dunlap *et al.*, 2016), strategic (Judge and Blocker, 2008), learning (Kang and Snell, 2009) and cognitive (Karhu, Ritala and Loredana, 2016). These different characterizations might

lead to ambiguity on the various forms ambidexterity can take. One possible way to resolve this ambiguity could be to categorize the existing types of ambidexterity based on mechanisms, domains and processes. While structural, contextual and temporal/punctuated equilibrium are basic mechanisms through which ambidexterity can be achieved, ambidexterity can also be studied in certain domains (strategic, brand, alliance or international) or in basic processes affecting organizational activities (innovation, cognitive and learning). To illustrate the point, innovation ambidexterity is defined as organizational practices that ‘facilitates knowledge transfer and learning...’ leading to the ‘...simultaneous achievement of incremental and radical innovation’ (Lin and McDonough, 2014) while brand ambidexterity deals with how firms balance exploitation and exploration in their brands (Nguyen *et al.*, 2016). While the first definition focuses on the process of innovation, the second definition deals with how ambidexterity is achieved in a particular domain of organizational activity (brands). Some of these typologies are relatively nascent and hence more future work on these fields will better identify how they are different and how they interact with other types of ambidexterity.

Insert Figure 3 about here

4.2 Levels of Analysis

Ambidexterity has largely been studied at the organizational/business unit level. (Raisch & Birkinshaw, 2008; Tushfman & O’Reilly, 1999). This trend is also confirmed while analyzing the 504 abstracts accessed for this study. A large majority of the papers (427) handle ambidexterity at the organizational, strategic business unit or the business unit level. However, a

large number of constructs enabling organizational ambidexterity have been studied at the team, individual and psychological level. For example, leadership traits of top management individuals have been found to be critical enablers of organizational ambidexterity (Carmeli and Halevi, 2009).

Apart from the sizeable domination of the organizational level of analysis in ambidexterity studies, a growing subset considers other levels of analysis for studying ambidexterity. A summary of such papers (count >1) have been presented in Table 3.

Insert Table 3 about here

The breakup of such papers over the years is presented in Figure 4. It is interesting to note that the attention on other levels of analyses in ambidexterity studies is a recent trend. For example, individual ambidexterity, although being explored at least since 2007, has received significant academic interest in the last three years. Birkinshaw & Gupta (2013) and Simsek (2009) argue for the development of a multi-level perspective in ambidexterity research. In accordance with the suggestion, multi-level works have also increased in the last 3 years. However, as a field, ambidexterity is just beginning to build a more composite picture of ambidexterity across levels. It will be important to note the future development of such alternative levels of analyses and whether the primary focus of ambidexterity studies will shift from the organizational level.

Insert Figure 4 about here

4.3 New product development (NPD)

The field of ambidexterity focuses on balancing both exploration and exploitation within firms. It seems intuitive that the concept of ambidexterity would find good interest in studies exploring new product development by firms. Out of the base set of 504 papers, a total of 45 papers addressed ambidexterity and new product development/performance explicitly. The year-wise distribution of the 45 studies are presented in Figure 5. Most of the NPD studies in ambidexterity are clustered in the last decade with consistent attention paid to the topic in the period 2009-2016.

The studies on NPD and ambidexterity tackle various concepts like the role of organizational culture (Karhu, Ritala and Loredana, 2016) in promoting ambidexterity and NPD, ambidextrous idea generation (Gurtner and Reinhardt, 2016) and the effects of various organizational learning modes on ambidexterity leading to NPD (Hoang and Rothaermel, 2010). The influence of organizational learning and knowledge based view literature seems to have a significant theoretical anchor for a portion of NPD and ambidexterity studies.

Insert Figure 5 about here

Further, the studies on NPD and ambidexterity display an interesting trend. Figure 6 presents the various methodologies adopted in the papers explicitly exploring NPD and ambidexterity. A large majority of the papers (31 out of 45 papers) employ a multi-firm survey based method (de Visser *et al.*, 2010; Pavlou *et al.*, 2010). In contrast, single firm in-depth inductive studies are relatively few in number (Fengbin and Hong, 2009). Focus on extricating key insights from

detailed case studies of new product development activities of individual firms might be a good research topic in the future.

Insert Figure 6 about here

4.4 Orientations

The extant literature on strategic management, organizational theory and marketing highlight the roles of many strategic orientations in enabling enhanced organizational performance (Grinstein, 2008). Various authors have contributed to the typologies of strategic orientations over time. Prominent among the many conceptualizations are market orientation (Kohli and Jaworski, 1990), entrepreneurial orientation (Lumpkin and Dess, 1996) and learning orientation (Sinkula, 1994).

Figure 7 below presents the counts of papers in our base set which tackle various types of orientations within ambidexterity research. As can be seen in the figure 7, ambidexterity research consists of a blend of works including almost all major orientations like market, learning, entrepreneurial and innovation. The studies combining orientations and ambidexterity have not been limited to the organizational/strategic level (Plambeck and Weber, 2010), but have been explored at the team (Dasí-Rodríguez and Pardo-del-Val, 2015) and employee/manager levels (Van Der Borgh and Schepers, 2014) as well.

It is interesting to note that the largest sub-group in such works deal with market orientation and ambidexterity (number of papers: 12). Further, a set of papers within this classification deal with

the balance (ambidexterity) within two types of market orientations (proactive and reactive) and its impact on firm performance (Dutta, 2013; Herhausen, 2016). Another large group (number of papers: 10) in the base set considers ambidexterity itself as an orientation (Hill and Birkinshaw, 2014) or a balance between two conflicting orientations like exploration/innovation and exploitation/efficiency (Cao, Gedajlovic and Zhang, 2009). Such studies visualize ambidexterity as an attempt to simultaneously manage more than one orientations and its implications on firm performance.

Entrepreneurial orientation (number of papers: 6) and innovation orientation (number of papers: 3) also are studied with relation to ambidexterity, while a set of papers (number of papers: 6) deal with various forms of strategic orientations (Number of papers: 6) in the same work. Given the vast works on entrepreneurial orientation as an academic field, its links with ambidexterity might warrant more studies in the future.

Insert Figure 7 about here

4.5 Dynamic Capability

Zimmermann & Birkinshaw (2016) suggest that dynamic capability (DC) and ambidexterity are similar concepts. However, the authors suggest that there are distinctions between the two and advise against merging the two concepts. The concept of DC has received significant attention in ambidexterity literature and hence, emerged as a prominent theme under the study. Out of 504 papers identified in the base set, 33 papers (i.e. 7.0%) have discussed the theme ‘dynamic capability’ explicitly. In Figure 8, three major sub-themes are identified under this theme and

they are: 1) ambidexterity as a DC; 2) conceptual integration of ambidexterity and DC perspectives; and 3) DCs to achieve organizational ambidexterity.

Insert Figure 8 about here

Most of the papers have considered ambidexterity (capability) as a dynamic capability (O'Reilly and Tushman, 2008; Teece, 2014) contrary to the view of Zimmerman and Birkinshaw (2016). Under this consideration, some recent works (20 %) have also highlighted ambidextrous supply chain as a source of dynamic capability (Arlbjørn and Mikkelsen, 2014; Lee and Rha, 2016). The last three years have seen conceptual works on the integration of both ambidexterity and DC perspectives (Birkinshaw, Zimmermann and Riasch, 2016; Ricciardi, Zardini and Rossignoli, 2016). Researchers of the field have also emphasized the need of DCs to achieve organizational ambidexterity (Judge and Blocker, 2008; Bessant, Stamm and Moeslein, 2011). Lastly, some of the papers highlighted the works on network responsiveness (Kleinbaum and Stuart, 2014), different work and participation practices during organizational renewal (de Biazzini, 2012) as antecedents to DC, rather than singularly focusing on the impact on ambidexterity. It will be interesting to see how the two concepts: dynamic capabilities and ambidexterity are reconciled going forward.

4.6 Business Models

The study of business models in the context of ambidexterity has been less emphasized by the researchers of the field. Out of 504 papers identified in the field of ambidexterity, only 18 papers (i.e. 3.6%) have discussed the theme 'business model' explicitly. In such papers, the relationship

between business model innovation and ambidexterity appear to be a dominant focus of researchers. The focus on exploring the relationship between business models and ambidexterity has appeared only in the last decade. Markides (2013) calls for adoption of ambidexterity as the conceptual lens for analyzing business model innovations. Many works have answered Markides' call in using ambidexterity as a theoretical foundation of business model changes. This line of inquiry presents a strong potential for future studies under ambidexterity literature. Further, our analysis identified four major sub-themes presented in Figure 9 and they are: 1) ambidexterity as a theoretical foundation for business model innovation (BMI); 2) ambidextrous processes and activities as an enabler to BMI; 3) BMI as a source of ambidexterity; and 4) elements within existing business models aiding ambidexterity.

Insert Figure 9 about here

A group of papers employ ambidexterity as a theoretical foundation for studying business model innovation (Markides, 2013; Ricciardi, Zardini and Rossignoli, 2016). The works in this group attempt to apply findings from ambidexterity literature to the act of balancing and managing business models (Frederick, 2015). Further, another group of researchers consider ambidextrous processes and activities as an enabler to BMI (Bøe-Lillegraven, 2014). Some papers delving into business models consider BMI as a source of ambidexterity (Reficco and Gutiérrez, 2016), while a distinct set of papers emphasize organizational elements within existing business models which aid ambidexterity (Voelpel, Leibold and Tekie, 2006).

Although the integration of business model and ambidexterity research is underdeveloped, the current works emphasize more on instances of innovations in business models, rather than elements present within existing business models that lead to organizational ambidexterity. Future researchers working at the intersections of business models and ambidexterity might be able to shed new light in this direction.

4.7 Leadership

Extant research on ambidexterity evidences emphasis on studies pertaining to leadership (Figure 10). The major direction in ambidexterity and leadership research has been on studying the effects of leadership and its different styles in achieving organizational ambidexterity (Lin and McDonough, 2014; Kauppila and Tempelaar, 2016). A second prominent direction has been studies relating to ambidextrous leadership, which specifies two complementary sets of leadership behavior that foster exploration and exploitation in individuals and teams - opening and closing leader behaviors, respectively (Rosing, Frese and Bausch, 2011). The course of examination in ambidextrous leadership relates to innovation performance of the firms (Rosing, Frese and Bausch, 2011). A third interesting and novel stream is the cognitive ambidexterity phenomena, which is the use of prediction and creation logic by leaders (Onyemah and Pesquera, 2015). Additionally, few other streams of research also emerge which include achieving cost leadership or market leadership through ambidexterity.

Research in ambidexterity and leadership consists of studies ranging from qualitative case studies to quantitative survey based research, from emerging economies to developed economies as well as in conjunction with a variety of theoretical streams like social cognitive theory, contingency theory and economic theories. One of the major sub themes in this domain has been understanding the styles of leadership that are most appropriate in effecting ambidexterity

(Baškarada, Watson and Cromarty, 2016). However, a closer observation reveals that only transformational leadership styles have been studied at length with a few studies also considering transactional leadership style. However, other forms of leaderships like strategic leadership, supportive leadership or paradoxical leadership have been hardly studied and thus emerge as potential areas for further research. The levels of analysis have majorly been employees or teams (Carmeli and Halevi, 2009). However, only a few studies pertained to Top Management Teams, making this topic a potential area for future scholarship. As is common with ambidexterity research, a majority of the studies pertained to understanding innovation (Tushman & O'Reilly, 1999). While technological innovation has received comparatively sufficient attention, other domains of innovation like process innovation or business model innovation warrant further examination.

Insert Figure 10 about here

4.8 Networks

Studies in ambidexterity have collaborated with research in networks in a variety of ways. While examining ambidexterity at the network level of analysis has been a major sub theme (as shown in Figure 11) in this division of research, the most prominent theme has been to study the effects that network emphasizes in effecting ambidexterity. The reverse causality, that is, effects of ambidexterity on networks has also received some attention in extant literature. Additionally, a few studies have also investigated the phenomena of network ambidexterity or ambidextrous networks.

Ambidexterity at the network level of analysis majorly involves analysis of ambidexterity, its approach and capacity at the network layer and its concern with innovation and R&D performance (Gieske, van Buuren and Bekkers, 2016). Studies pertaining to open source innovation networks, though present, has been inadequate and thus can be a future research avenue. A second prominent stream of research has been integration of internal versus external and formal versus informal knowledge search and transfer mechanisms (Patriotta, Castellano and Wright, 2013). However, understanding of the learning processes driven by ambidexterity has not been studied in extant literature and may be an interesting avenue for future research. Ambidexterity as new models of business in networked economies has been studied thinly and emerges as another area of future research (Herciu, 2015).

The prominent direction of research in networks affecting ambidexterity has been studying the effects of network and networking in improving ambidexterity or the ambidexterity-performance relationship (Schemeil, 2013; Soetanto and Jack, 2016). More specifically, networks of top managers or CEOs have been studied (Cao, Simsek and Zhang, 2010). What remains understudied is the effect of networks in ambidextrous learning capabilities. Another area of future research remains studying open innovation systems as well as non-profit contexts.

The reverse causality of ambidexterity in organizations influencing networks has majorly been studied in the form of ambidexterity affecting networks by acting as governance mechanisms like allowing flexibility or defining guidelines (Du, Pan and Zuo, 2013). However, the other two prime characteristics of network, structure and content have not been studied through an ambidexterity lens, and this provides another direction for future research. Again, the context of extant studies has been communities of practice and innovation networks (Riccaboni and

Moliterni, 2009), but open innovation systems might provide interesting future grounds for extending research in effects of ambidexterity on networks.

Finally, the network ambidexterity theme is a rather new and interesting stream of research with the major thrust on alliance ambidexterity (Tiwana, 2008). Again, innovation networks have been the major context of research here. Other types of networks like knowledge networks, supply networks, etc. thus remain fertile grounds for future research.

Insert Figure 11 about here

5. Discussion

The objective of the current study is to capture the essence and scope of the growing field of ambidexterity. In doing so, the study identifies eight distinct themes, within the field, that have emerged over the last two decades. Further, sub-themes within the identified major themes are presented. This helps in understanding the current state of ambidexterity research and gauging the future potential of the field. The authors believe that this work should help future researchers in their endeavors.

Over the years, ambidexterity has largely been studied at organizational level. However, the current study findings suggest a recent spate of works approaching ambidexterity at the individual level. The impressive increase in the studies focused on individual ambidexterity make this sub-area hard to ignore. This trend suggests that future works could still uncover and combine a host of levels in their analyses.

Although some authors in the field of ambidexterity have suggested an impending further consolidation/focus in the field, this study reveals an increasing proliferation of the concept of ambidexterity across various management disciplines. Also, the number of publications continues to see an unabated increase, especially in the past five years. This study also calls for further consolidation in the field in terms of identifying the connections between the various applications of the construct. However, there are certain areas where this study encourages new insights and possible disruptions in the current understanding of the construct. Some of these areas deal with very important gaps in the academic understanding of ambidexterity.

The study presents the various types of ambidexterity encountered in the literature. We suggest the grouping of various types of ambidexterity based on mechanisms, domains and processes. Such grouping will help us make sense of the various typologies used in ambidexterity research. Further, the relationship between mechanism-based ambidexterity types (structural, contextual, temporal) with domain and process based types like innovation, brand and cognitive ambidexterity needs to be clarified and consolidated. Further, the relationship between types and levels of ambidexterity also need further consolidation. For example, the relationship between structural, contextual and temporal types and individual and leadership ambidexterity has remained largely untouched.

Apart from the aim of consolidation, the field of ambidexterity also consists of gaps that need new insights. One such gap is the current inadequacy of the field to explain ambidexterity across levels of analysis. Many scholars have pointed to this gap in ambidexterity research (Simsek, 2009; Birkinshaw and Gupta, 2013). Studies addressing this gap have recently started to trickle in (for example, see Stokes *et al.*, 2015; Zimmermann, Raisch and Birkinshaw, 2015; Snehvrat and Dutta, 2017). We still do not know whether, and to what extent, ambidexterity at different

organizational levels are additive or multi-dimensional in nature. New insights in this aspect of ambidexterity research should provide robust tools to understand the nuanced issues of how organizations build ambidexterity. The generation of new insights in this sub-area might require an inductive, qualitative approach to study how ambidexterity is/can be produced in organizations.

Another gap stems from two important papers published in the last decade focusing on the relationship between exploration and exploitation. Katila & Ahuja (2002) study the presences of *search scope* and *search depth* as two different dimensions of search efforts in new product introductions of robotic firms. They refer to *search depth* as "...how deeply a firm reuses its existing knowledge" (Katila and Ahuja, 2002, p. 1183). Further, they state that "...increase in the depth of search can positively affect product innovation" (Katila and Ahuja, 2002, p. 1184). Further, Gupta et al. (2006) suggest that the relationship between exploration and exploitation could be linear or orthogonal depending upon the scarcity of implied resources. Also, the assumption about the relationship between exploration and exploitation would significantly impact the research design and analysis. Although a sizeable group of ambidexterity studies focused on innovation ambidexterity have addressed the relationships between exploitative and exploratory innovation by measuring the balance and combined effects of the two (Dunlap *et al.*, 2016), studies have not largely focused on whether and how exploitative use of existing knowledge can also lead to disruptive product-market changes (Rangan, 2005; Gupta, Smith and Shalley, 2006, p. 696). This line of thinking goes contrary to the conceptualization of March (1991) that exploration and exploitation are conflicting activities vying for scarce resources within the firm. Insights in this field could possibly reveal new understandings of how the constructs of exploration and exploitation interact.

Some key debates also exist on the relationship of the field of ambidexterity with other fields. Such debates need to be reconciled for the field to have a focused contribution to academic literature. These debates include the debate on whether ambidexterity is a dynamic capability and whether ambidexterity can be used as a conceptual lens to study business model innovation. Dynamic capability has received significant attention in the extant ambidexterity literature. However, the studies are split in conceptualizing the relationship between ambidexterity and dynamic capabilities. On the other hand, following Markides' (2013) work, a set of studies have approached business model innovation through the lens of ambidexterity. However, this approach is still in its infancy. More work is required to justify and extend the contribution of the concept of ambidexterity to business model research. Reconciliation of these debates will add to the power and bring clarity of the field of ambidexterity in the future.

The above discussion summarizes the key themes that set the current boundary of the field of ambidexterity. Some of themes like business models, networks and some orientations (example, entrepreneurial orientation) within ambidexterity are emerging areas of interest that could see significant academic attention in the future.

6. Conclusion and Implications for future research

Although there have been attempts to review the field of ambidexterity, most of these reviews have not followed a systematic and scientific approach to extricate the key themes emerging within. The motivation of the current study is to inductively derive major themes helping to set the current boundary of the field. This study follows a systematic approach from document search till text aggregation followed by a scientific approach of text mining to reveal the implicit themes of the field. The study identifies a set of eight distinct themes which are analyzed in-depth to identify sub-themes and trends. Further, the analysis highlights key potential areas and

current debates requiring future academic attention. The analysis brings out some key aspects regarding the state of ambidexterity research. Firstly, the field of ambidexterity is receiving heightened academic interest coupled with dynamic proliferation across a host of related management fields. Additionally, we are currently witnessing growth in the various ways of understanding ambidexterity. Although, these varied approaches pose the risk of an eventual splintering of the field, these insights are opening newer ways to visualize ambidexterity. Secondly, apart from required consolidation, the field also needs new insights to enhance its explanatory power. The above mentioned aspects are discussed in detail in the paper. This exercise should prove valuable for ambidexterity scholars looking for clarity on the various aspects of ambidexterity research and helps pave the way for fueling a renewed focus on future research avenues in the field.

The insights of the analysis will not only help researchers, but also offer practitioners a good view point about the myriad of paths (not restricted to contextual, structural and temporal) through which ambidexterity can be promoted in organizations. In addition, relatively recent ambidexterity research suggests that ambidexterity can not only be achieved at the organizational level, but across domains and employees. These insights are relevant for managers and organizations aiming at building ambidexterity in particular domains/sections of the organization. Further, the developing relationship between business model innovations and ambidexterity is also relevant for managers looking for new approaches and/or new markets for their businesses.

6.1 Limitations

This study highlights the major trends currently present in ambidexterity research. In spite of its various contributions, this paper does exhibit certain limitations. Firstly, the analysis considers

seventy-five distinctive lexicons, having high correlation (>0.50) with the root word ‘ambidext’, to identify major themes. This approach could potentially restrict the emergent themes discussed in the paper. Secondly, the study considers inductive derivation of the field through published works that contain the terms “ambidexterity” or “ambidextrous” in their abstracts and keywords from EBSCO Business Source Complete database. Although, the set of selected papers were compared across other databases, the study does not utilize an exhaustive list of published ambidexterity papers. Lastly, this study captures the current state of the field and acknowledges that the field is subject to significant underlying and dynamic trends. Hence, a replication of the same study in the future could generate new insights pertaining to the growth of the field.

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Figures and Tables

Figure 1: Number of papers on ambidexterity over the last two decades

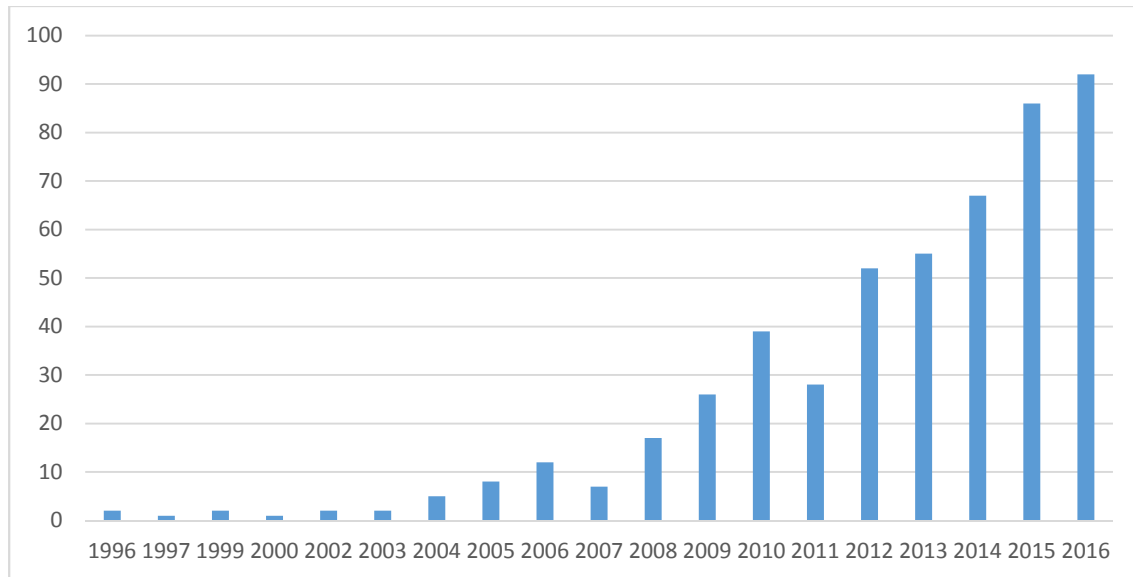


Figure 2: The proliferation of ambidexterity research across management fields

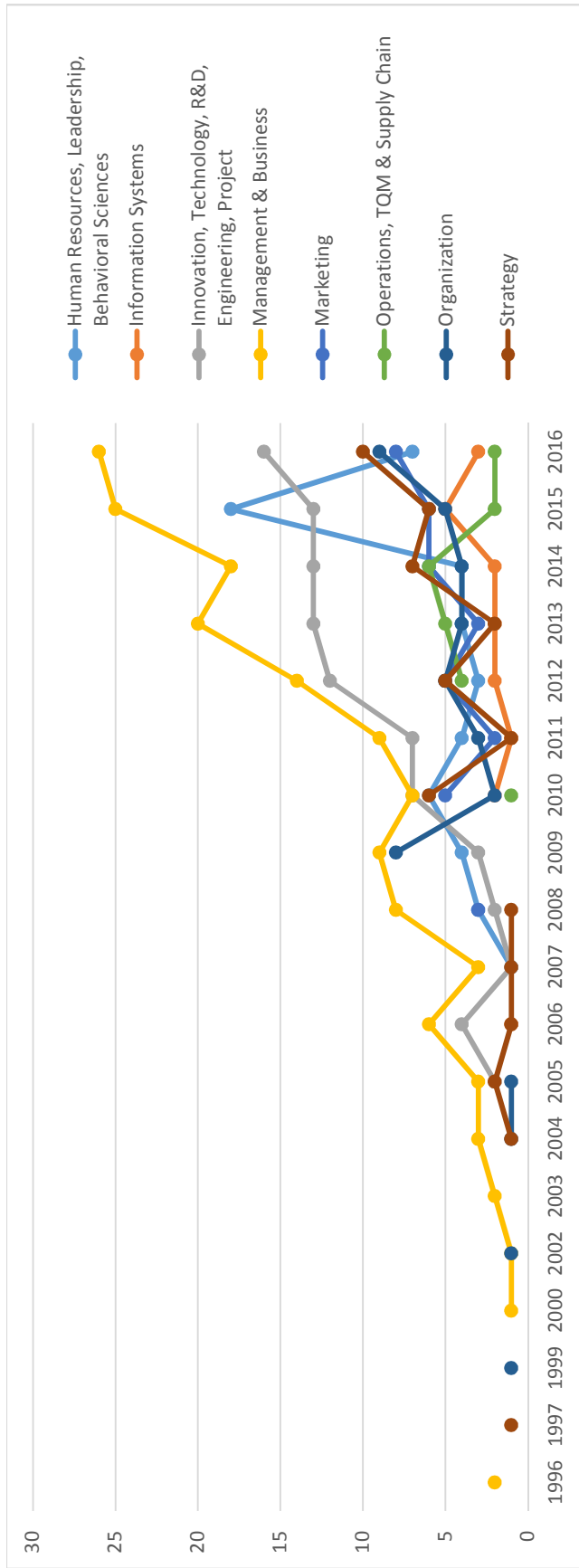


Figure 3: Types of ambidexterity (count > 1)

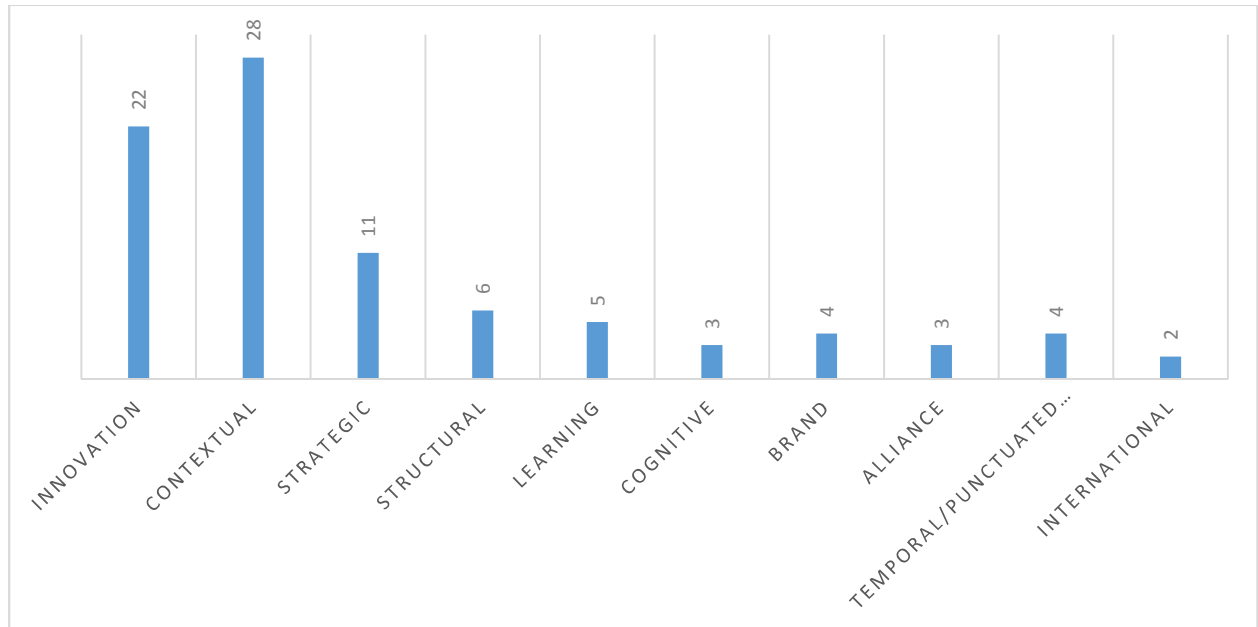


Figure 4: Level of Analyses apart from org./bus. unit levels (Count>1) over the years.

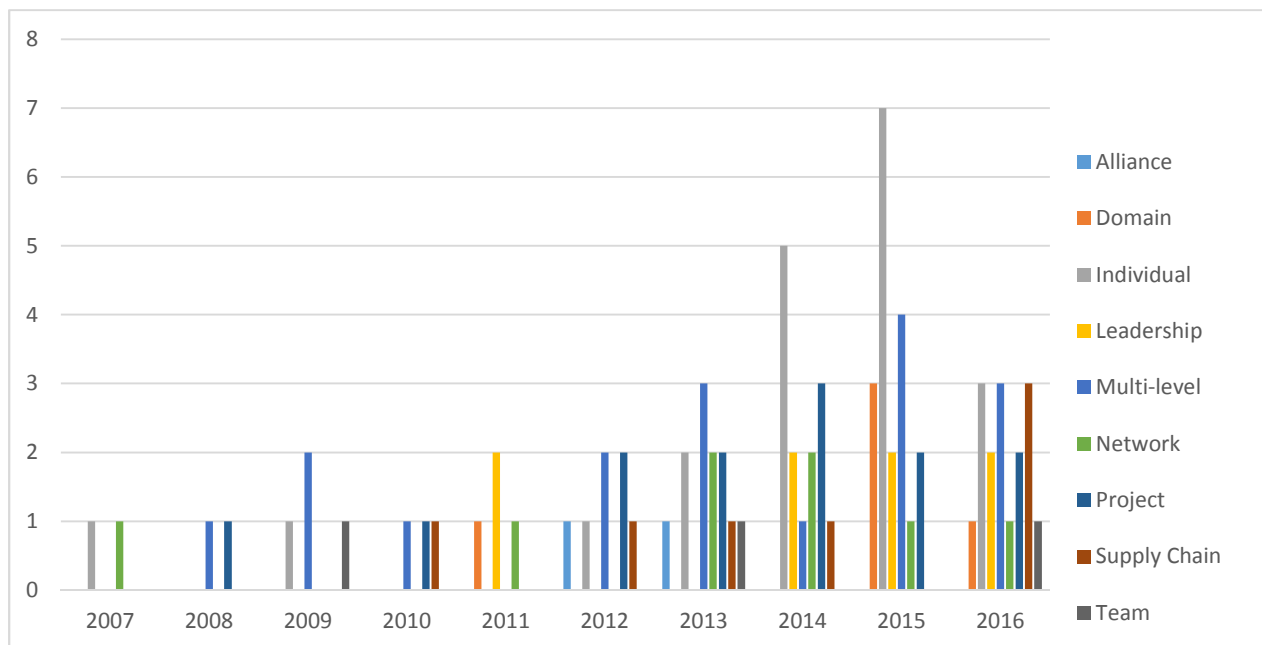


Figure 5: Year wise distribution of NPD studies in ambidexterity

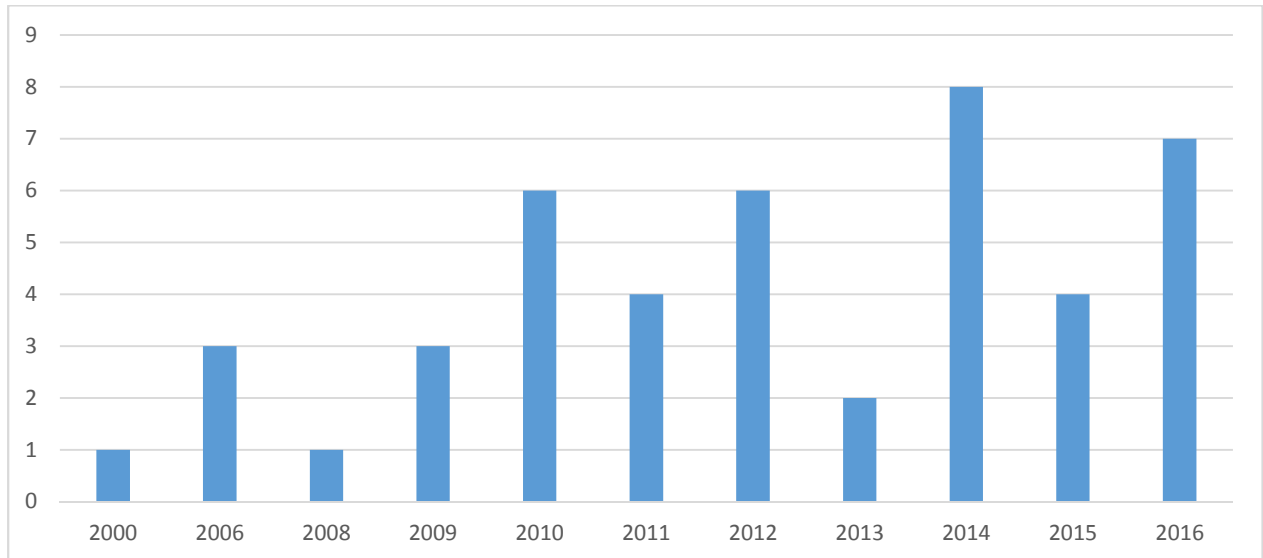


Figure 6: Various methodologies adopted in NPD and ambidexterity studies

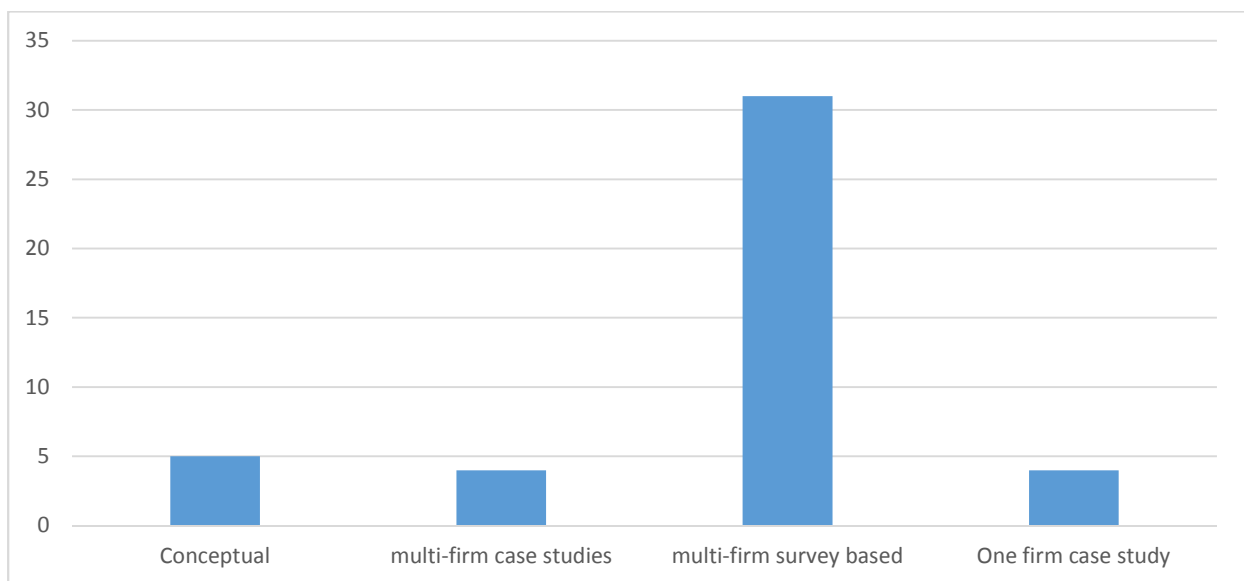
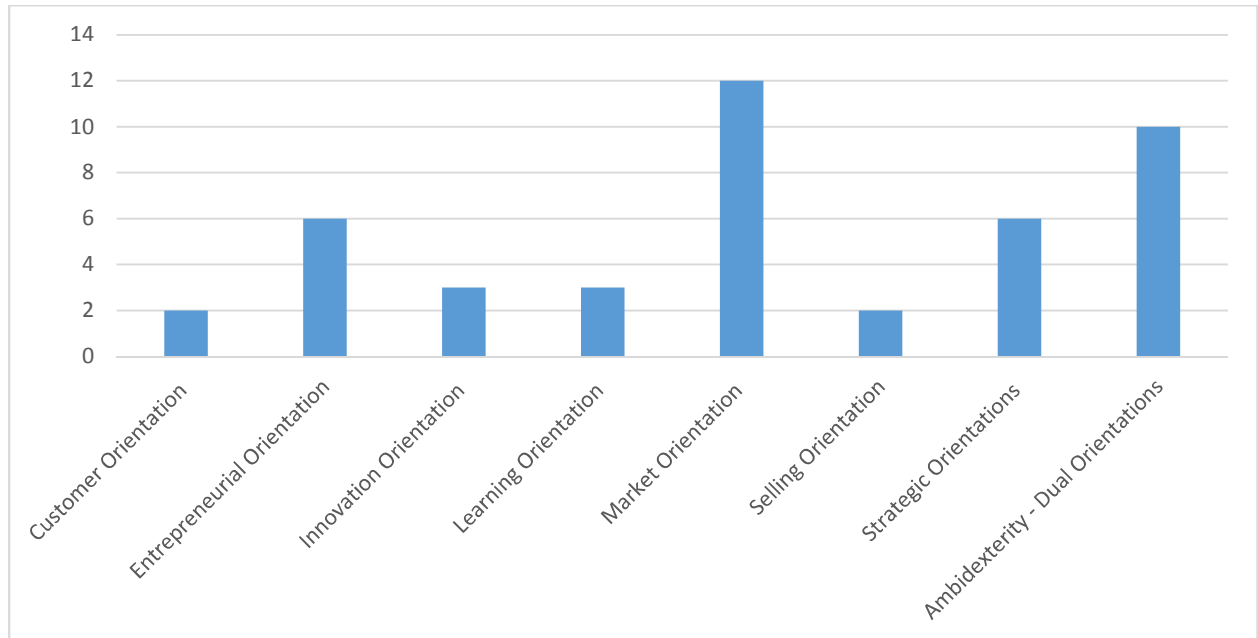
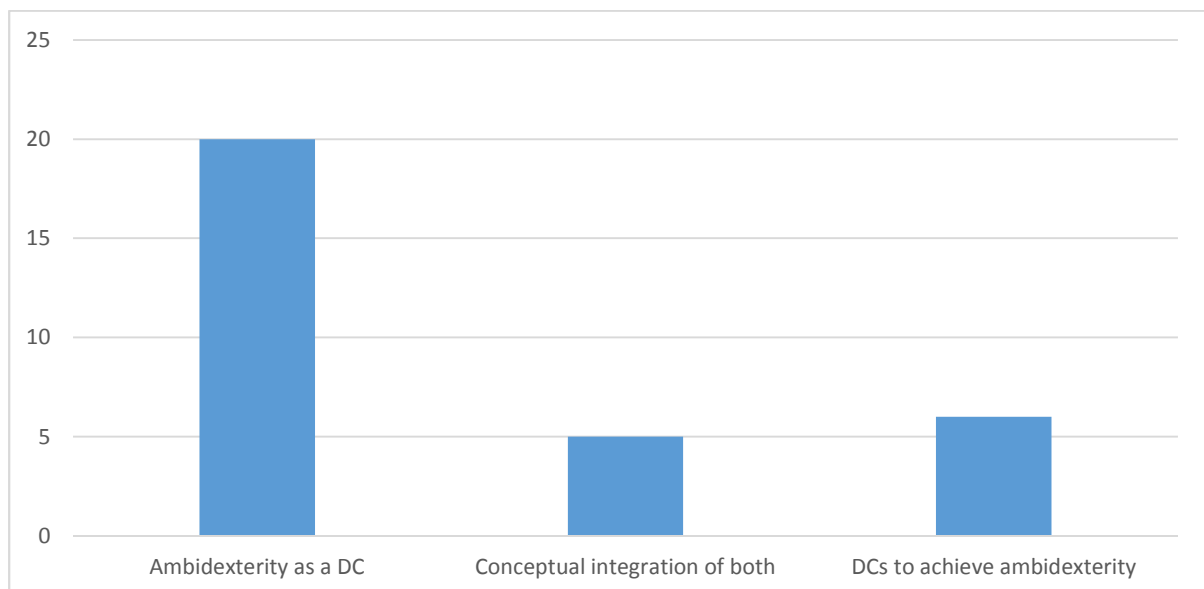


Figure 7: Types of orientations in ambidexterity studies (count > 1)**Figure 8: Dynamic capabilities and ambidexterity****Figure 9: Business models and ambidexterity**

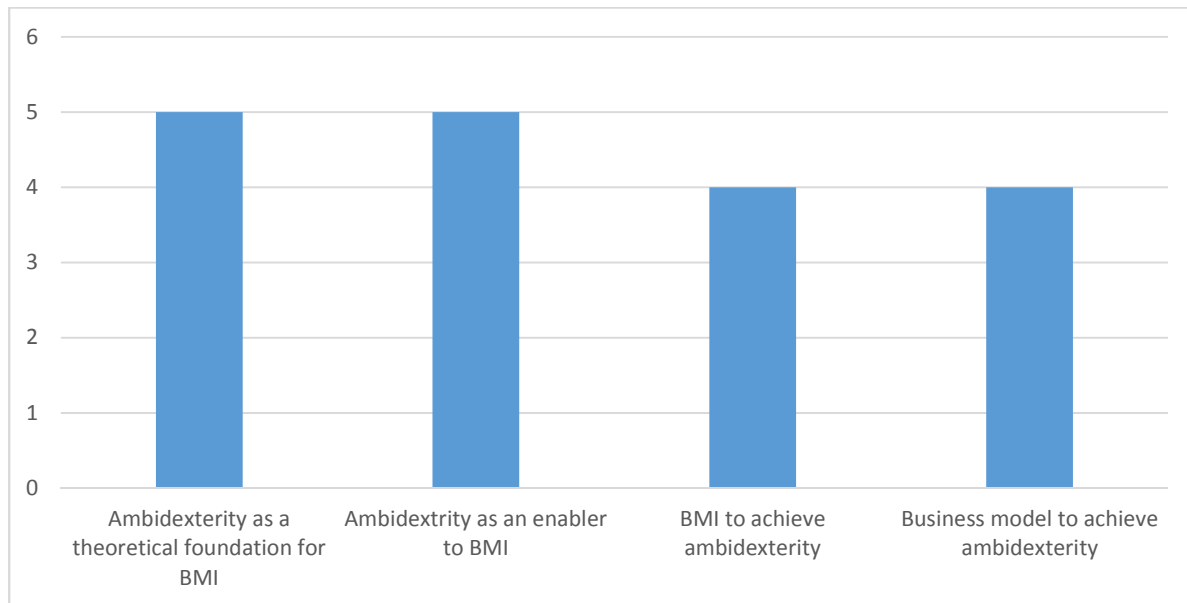


Figure 10: Leadership and ambidexterity

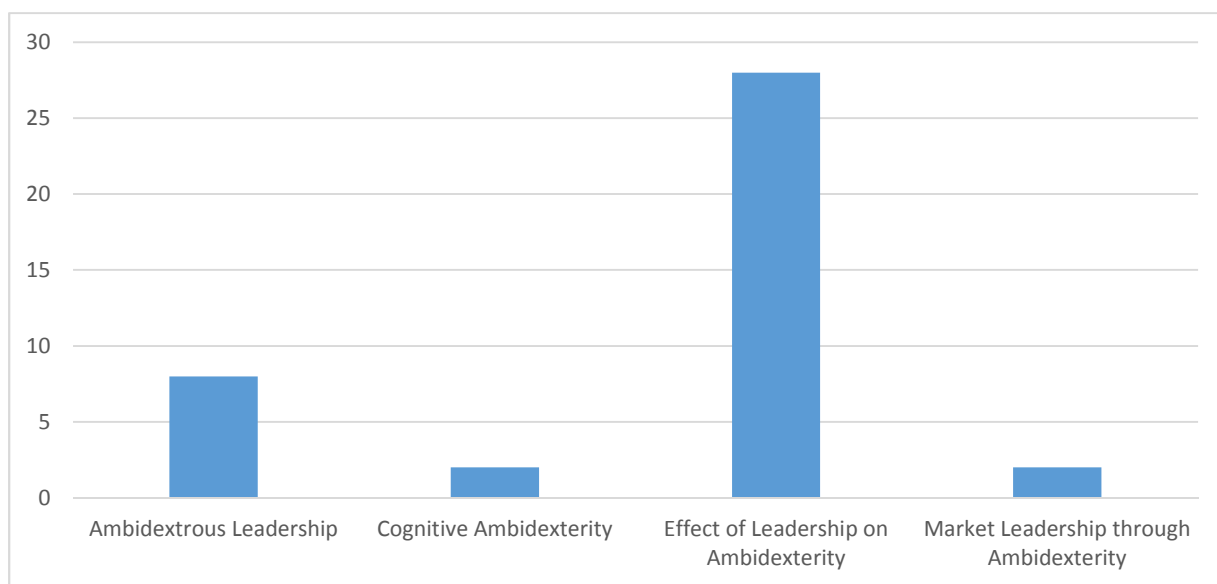


Figure 11: Network and ambidexterity

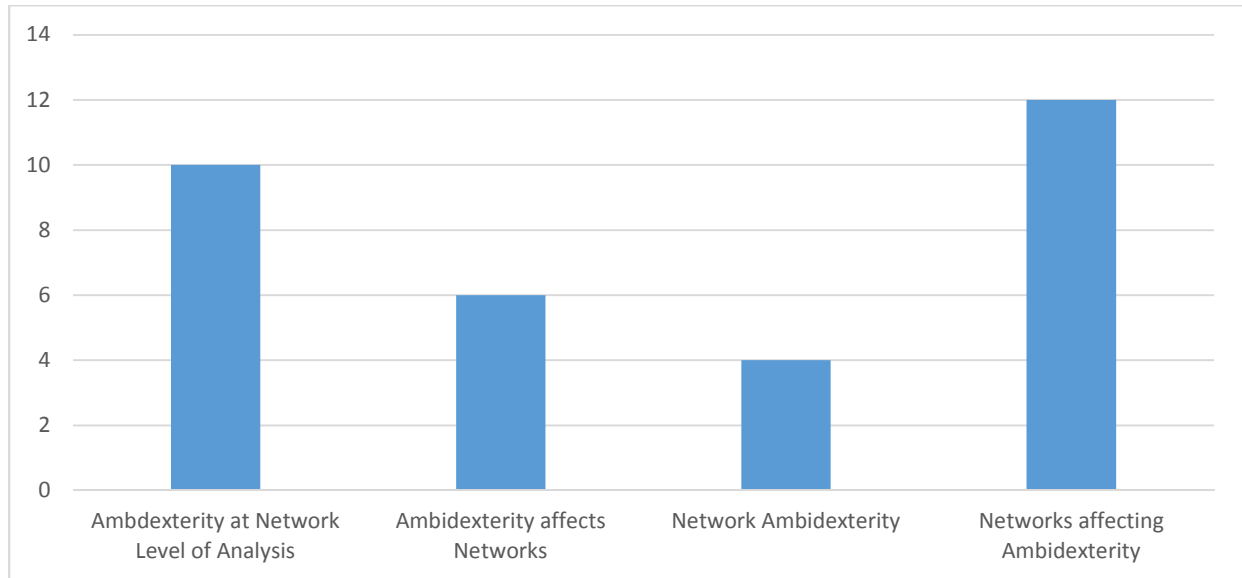


Table 1: Detailed search process

Steps	Search Options	Descriptions
01.	Search Modes and Expanders	Searching: ambidexterity OR ambidextrous Database: EBSCO Business Source Complete. Select a Field: AB Abstract Search Mode: Boolean/Phrase The Boolean/Phrase for Business Source Complete: (AB ambidexterity) OR (AB ambidextrous)
02.	Special limiters for Business Source Complete	Publication Type: Academic Journal (excluding proceedings, trade publications, magazines and books) Language: English
03.	Limiters	Scholarly Journals: Peer Reviewed Published Date: 1997-2016

TABLE 2: The distinctive lexicon of the field ambidexterity

Distinctive words ^a ^a with sparsity removal < 10		Distinctive words ^a (rearranging into groups)		Identified Major Themes
ambidext		ambidext		
firm	0.78	use	0.69	The studies of Ambidexterity include...
innov	0.75	case	0.61	
organiz	0.75	model (1)	0.60	
exploit	0.74	two	0.60	
manag	0.74	examin	0.58	
explor	0.73	high	0.58	
perform	0.71	find	0.57	
organ	0.69	suggest	0.56	
use	0.69	approach	0.56	
market	0.68	data	0.56	
busi	0.66	exist	0.55	
develop	0.66	test	0.54	
effect	0.66	import	0.54	
process	0.66	within	0.54	
capabl	0.65	posit	0.53	
knowledg	0.63	focus	0.52	
new	0.63	support	0.52	
relationship	0.63	perspect	0.52	
base	0.62	identifi	0.51	
orient	0.62	studi	0.51	
product	0.62	theori	0.51	

case	0.61	result	0.51	
design	0.61	innov (1)	0.75	(I)...Types of Ambidexterity
level	0.61	structur	0.56	
strategi	0.61	contextu	0.53	
technolog	0.61	context	0.52	
model	0.60	firm	0.78	(II)... Levels of Analysis
two	0.60	organiz	0.75	
project	0.59	perform	0.71	
strateg	0.59	organ	0.69	
dynam	0.58	busi (1)	0.66	
examin	0.58	level	0.61	
high	0.58	project	0.59	
find	0.57	success	0.56	
approach	0.56	team	0.55	
data	0.56	industri	0.55	
integr	0.56	compani	0.52	
practic	0.56	organis	0.53	
relat	0.56	unit	0.52	
structur	0.56	develop	0.66	(III)...New product development
success	0.56	new	0.63	
suggest	0.56	product	0.62	
exist	0.55	design	0.61	
industri	0.55	technolog	0.61	
network	0.55	build	0.52	
team	0.55	system	0.51	
differ	0.54	exploit	0.74	(IV)...Orientations
import	0.54	explor	0.73	
role	0.54	market	0.68	
test	0.54	orient	0.62	
within	0.54	strategi	0.61	
activ	0.53	strateg	0.59	
contextu	0.53	differ	0.54	
learn	0.53	adapt	0.52	
organis	0.53	simultan	0.51	
posit	0.53	balanc	0.50	
adapt	0.52	process	0.66	(V)...Dynamic Capability
build	0.52	capabl	0.65	
combin	0.52	knowledg	0.63	
compani	0.52	base	0.62	
context	0.52	practic	0.56	
focus	0.52	integr	0.56	
leadership	0.52	activ	0.53	

perspect	0.52	learn	0.53	
support	0.52	combin	0.52	
unit	0.52	resourc	0.51	
identifi	0.51	chang	0.50	
resourc	0.51	innov (2)	0.75	(VI)...Business Models
result	0.51	busi (2)	0.66	
simultan	0.51	model (2)	0.60	
studi	0.51	manag	0.74	(VII)...Leadership
system	0.51	effect	0.66	
theori	0.51	role	0.54	
balanc	0.50	leadership	0.52	
chang	0.50	relationship	0.63	(VIII)...Networks
		network	0.55	
		relat	0.56	

Note: Numbers indicate the correlation coefficients between the distinctive words and the root word 'ambidext'.

Table 3: Levels of Analysis apart from org./bus. unit levels (count > 1)

Level of Analysis	Count
Alliance	2
Domain	5
Individual	20
Leadership	8
Multi-level	17
Network	8
Project	13
Supply Chain	7
Team	3
Total	83