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Revisiting James March (1991): Whither Exploration and Exploitation?

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ABSTRACT

James G. March has published his seminal work 'Exploration and Exploitation in Organizational Learning' in 1991. We revisit March's article and analyze the impact it has had on scholarly thinking, providing a comprehensive and structured review of the extensive and diverse research inspired by this publication. Unlike previous reviews on the topic, we combine bibliometric analysis and machine-based text mining to portray a picture of the evolving landscape of this article's influence. We show that although this influence has changed significantly over the years, there are still unexplored opportunities left by this seminal work. Our approach enables us to identify promising directions for future research that reinforce the themes anchored in March's (1991) article. In particular, we call for reconnecting current research to the behavioral roots of this article and uncovering the microfoundations of exploration and exploitation. Our analysis further identifies opportunities for integrating this framework with resource-based theories, and considering how exploration and exploitation can be sourced and integrated within and across organizational boundaries. Finally, our analysis reveals prospects for extending the notions of exploration and exploitation to new domains, but we caution that such domains should be clearly delineated. We conclude with a call for more research on the antecedents of exploration and exploitation and for studying their underexplored dimensions.

Revisiting James March (1991): Whither Exploration and Exploitation?

INTRODUCTION

In 1991, James March published his seminal article "Exploration and Exploitation in Organizational Learning" (March, 1991). Perceiving organizations as adaptive systems, he introduced the concepts of exploration and exploitation, and discussed the relationship and trade-offs between the processes and activities underlying them. Since then, "exploration" and "exploitation" have become core intellectual constituents of a range of business discourse, stretching from management and marketing to entrepreneurship and finance. In particular, they have become firmly embedded in academic thinking relating to innovation, organization design, organizational learning, competitive advantage, and organizational survival.

In this study, we revisit March's article and analyze the impact it has had on scholarly thinking using a comprehensive and structured review of the diverse research inspired by its publication. March (1991) accumulated around 6,000 Web of Science citations and more than 20,000 Google Scholar citations, implying that such an endeavor is worth pursuing to capture the extent and nature of that influence.

We depart from previous studies reviewing March (1991) (e.g., Fourné, Jansen, & Rosenbusch, 2016; Lavie, Stettner, & Tushman, 2010; Nosella, Cantarello, & Filippini, 2012; see Online Appendix A1) in several ways. From an empirical standpoint, we analyze a significantly broader set of articles that cite March's (1991) article without limiting our review to specific research domains or journals. This allows us to more holistically assess the influence of this article. Rather than pursuing a classic narrative review approach, which can be limiting and potentially biased with such a vast and diverse literature (Ramos-Rodriguez & Ruiz-Navarro, 2004), our approach combines two methods. Similar to some review studies, we use bibliometric analysis to identify the scope and structure of the impact March's article had by identifying the most relevant contributions and research clusters through bibliographic coupling. This enables us to identify research streams and "schools of thought" in the form of related publications based on the structure of their references. Unlike previous reviews, we then text-mine the abstracts of all citing articles to identify relevant concepts and dominant themes and their development over the years. We accomplish this by applying text mining to uncover the conceptual insights in the papers. This allows us to shift the level of analysis from publications and their citations to the actual content of each article. Consequently, we can unpack the constructs of exploration and exploitation to investigate

how the prevalence of the terms emerging from March's (1991) work on exploration (search, variation, risk-taking, experimentation, play, flexibility, discovery, innovation) and exploitation (refinement, choice, production, efficiency, selection, implementation, and execution) has changed over time. By using these methods in tandem, we can examine the breadth, scope, and evolution of March's (1991) influence, with less interference from our individual interpretation of his work.

Our approach enables us to identify promising directions for future research that reinforce the themes anchored in March's (1991) article. In particular, we call for reconnecting current research to the behavioral roots of March (1991) and uncovering the microfoundations of exploration and exploitation. Our analysis further identifies opportunities for integrating his framework with resource-based theories and elaborating research that considers how exploration and exploitation can be sourced and integrated within and across organizational boundaries. We conclude with a call for further research on the antecedents of exploration and exploitation and for studying their underexplored dimensions. Yet, we caution against attempts to draw generalizable conclusions when studying this phenomenon across different dimensions and contexts.

EMPIRICAL REVIEW

Citation trends and scope

We first analyzed the citation trends and scope.[1] We retrieved all journal articles that were published in the ISI Web of Science database and cited March (1991). As we are interested in the overall impact of this article, we did not constrain the list of journals to any specific research area. This procedure yielded a set of 3,949 citing articles published between 1991 and 2016.[2] Figure 1 shows that citing publications have steadily increased and come from an ever-widening number of research fields. Indeed, we see an increasing dispersion of influence. By 2016, the article's influence spread over more than eleven research areas, with no single field accounting for more than 20% of the citing articles.

Insert Figure 1 here

[1] Please see A2 for a detailed description of the data collection and methodology.
[2] Out of these 3,949 articles, the ISI Web of Science database provided the full abstracts of 3,684 articles.

Analysis of the intellectual structure of citing articles and their core themes

Next, we used bibliographic coupling (Kessler 1963) and network analysis to identify streams and clusters of related research. We used the shared references of the 500 most cited articles to calculate proximity scores for each pair of articles. The resulting network graph, including five distinct clusters, can be seen in Figure 2.

Insert Figure 2 here

In the next step, we applied a text mining approach using a Bayesian learning algorithm available in the Leximancer software package (Wilden, Akaka, Karpen, & Hohberger, 2017), to uncover the main themes and concepts discussed by the literature in each of the five clusters identified in the coupling analysis (Figure 1). This provides us with a relatively objective and unbiased representation of the most relevant constructs within each cluster. We show the key numeric results of the analysis together with the findings of the coupling analysis in Table 1. Overall, it is interesting that not only are the publications grouped in relatively distinct clusters within the network, but also that we can identify distinct combinations of themes between the clusters. This supports the conclusion that there are distinctive schools of thought building on March (1991).

Insert Table 1 here

Our analysis reveals five distinctive clusters of research. Cluster 1 is represented by studies focusing on organizational learning, which is somewhat diverse and includes two sub-groups. The first is a sub-cluster emphasizing co-evolutionary adaption (Baum & Ingram, 1998; Denrell & March, 2001; Lewin & Volberda, 1999) and features more marketing-oriented studies (Olson, Slater, & Hult, 2005; Slater & Narver, 1995). The second sub-cluster is centered on the work of Bowman and Hurry (1993) Miller (1993), and Ocasio (1997), with a focus on learning strategy, performance and change.

Cluster 2, which is the smallest cluster, includes papers oriented around international learning and collaboration. It, too, includes two sub-clusters. The first sub-cluster revolves around work on acquisitions and international learning (Barkema & Vermeulen, 1998; Chang & Rosenzweig, 2001; Vermeulen & Barkema, 2001), with the second sub-cluster focusing on research relating to learning in the context of alliances and inter-organizational collaborations (Barringer & Harrison, 2000; Grant & Baden-Fuller, 2004; Koza & Lewin, 1998). Cluster 3

is the largest and most central cluster. It also has the highest impact, with an average of 417 citations per paper and 10,851 citations overall. Perhaps because of its size, it is also the least homogenous cluster. It features popular research on dynamic capabilities and absorptive capacity (Teece, 2007; Zahra & George, 2002; Zollo & Winter, 2002), as well as work on knowledge management (Gold & Arvind Malhotra, 2001; Matusik & Hill, 1998; Nonaka, Von Krogh, & Voelpel, 2006). Cluster 4 is the most homogeneous cluster, with an emphasis on organizational exploration and exploitation, ambidexterity, and firm performance (Gupta, Smith, & Shalley, 2006; Jansen, Van Den Bosch, & Volberda, 2006; Raisch & Birkinshaw, 2008). Cluster 5 is largely based on studies of technology and innovation, including topics such as recombinant search, open innovation, evolutionary economics, and local search (Almeida, 1996; Katila & Ahuja, 2002; Rosenkopf & Nerkar, 2001), as well as work on social networks (Burt, 2000; Phelps, 2010) and technology, knowledge, and innovation.

It is interesting to investigate the evolution of the publications within the network and how the citation patterns and content of scholarly discussions change over time. Examining the number of key articles published within each cluster over time, we can see that research on learning and marketing (Cluster 4) and alliances and acquisitions (Cluster 1) tends to be 'older'. More recent research relating to March (1991) has been published in the areas of organizational structure, ambidexterity, and performance (Cluster 3) as well as technological search, innovation, and networks (Cluster 5). Research on capabilities, resources, and change (Cluster 2) and technological search and innovation was mainly published at the turn of the millennium.

Development of concepts and themes over time

We next looked at how authors have used words related to the concepts of exploration and exploitation. First, we text-mined all abstracts to identify how the use of the terms *exploration*, *exploitation*, and *ambidexterity* has evolved over the years (see Figures 3a and 3b).[3] We find that all three terms have been used increasingly in research over the years, with *exploration* being mentioned most frequently ahead of *exploitation* and *ambidexterity*. The frequencies of the terms *exploration* and *exploitation* are quite aligned, with these terms often used in tandem. In turn, *ambidexterity* has gained popularity mostly in the last decade. In terms of relative importance (that is, the frequency of term usage relative to the most

[3] We manually verified that each occurrence of the respective terms refers to the actual use in March's (1991) sense.

frequently used term), we find that with a few exceptions during the first decade, *exploration* has been relatively more important than the other two terms.

To further understand how authors use terms related to exploration and exploitation we studied the use of March's (1991) suggested keywords representing these activities.[4] Overall, we find that exploration-related terms have been used more frequently than exploitation-related terms (73% compared to 27%). In regard to the terms used for expressing exploration (Figure 4b), we see that *innovation* has been used most often, followed by *search* and *flexibility*, which are much less common. Overall, the terms *production*, *efficiency*, and *choice* represent the most frequently used exploitation-related terms, with a more recent focus on *efficiency*, *implementation*, and *choice*. In turn, the terms *variation*, *risk-taking*, *experimentation*, *play*, and *discovery* are rarely used in connection with exploration, whereas the terms *execution* and *selection* are infrequently used in connection with exploitation. All these tendencies crystalize over the years.

Insert Figures 3a, 3b, 4a and 4b here

When we examined the evolution of the key themes discussed in the abstracts of all the citing articles (see A5), we found that *management*, *processes* and *knowledge* have been reoccurring themes, with *processes* peaking in 2002. *Performance* has been a consistent theme, with its relevance increasing over time and especially in the past decade. Quite clearly, more research has evolved around *organizational* and *firm*-level issues rather than on the *individual* level of analysis. This is surprising because March (1991) reports simulation analyses that bridge the individual and organizational levels of analysis. *Learning* was an especially central theme between 2005 and 2011. *Change* did not feature as an important theme in many years, with the exception of a spurt in 2001 (41%). Interestingly, contextual factors such as *institutions*, *industry, competition*- and *market*-related topics do not show up

[4] For the purposes of this analysis, we only considered abstracts in which the concepts 'exploration' and/or 'exploitation' are explicitly mentioned. This reduced our sample to 1,587 abstracts. We used the following dictionaries for the respective keywords: Exploration: Search (search, searching); variation (variation, vary, varies), risk-taking (risk(-)taking); experimentation (experimentation, experimenting, experiment); play (play, playing, plays); flexibility (flexibility, flexible); discovery (discovery, discovering, discover); and innovation (innovation, innovations, innovate, innovating, innovative). For exploitation, we searched for: refinement (refinement, refining, refinements); choice (choice, choices, choosing); production (production, productivity, produce, producing); efficiency (efficiency, efficiently, efficient); selection (selection, select, selecting); implementation (implementation, implement, implementing, implements); and execution (execution, execute, executing). We then checked each identified occurrence in the Leximancer-generated results to verify that the word was used in a relevant sense and deleted non-relevant occurrences from our counts.

as central themes anytime over the past 25 years, nor do we find much work in line with the resource-based view (RBV). Despite the identified link to the RBV in the citation analysis, *resources* (one year) and *capabilities* (three years) only feature infrequently as central themes.

REFLECTIONS AND DIRECTIONS FOR FUTURE RESEARCH

Our comprehensive, albeit brief, analysis of the impact of March's (1991) seminal article reveals a number of important findings that point to interesting avenues for future research (see Table 2).

Insert Table 2 here

Reconnecting with the behavioral roots of March (1991)

Our analysis shows that the exploration-exploitation framework has evolved from a predominant focus on organizational behavior to the theme of innovation. March's work investigated exploration and exploitation from the perspective of a behavioral theory of the firm and positioned it in the context of organizational learning (Cyert & March, 1963). Interestingly, our results show that over time (see A5) March's ideas have been 'strategyfied'. That is, exploration and exploitation have mainly been applied in research aimed at explaining innovation and firm performance, moving away from his original focus on organizational behavior. In fact, with few exceptions (e.g., Posen & Levinthal, 2012), scholars have not extended the simulation model introduced by March, which was central to his original article. We believe that the emerging importance of "behavioral strategy" (e.g., Gavetti, Greve, Levinthal, & Ocasio, 2012; Powell, Lovallo, & Fox, 2011), with its emphasis on a closer integration of cognitive and social psychology and behavioral economics to strategic management theory, may provide a pathway back to some of March's original thinking.

March (1991) provides a joining point between classical work on the behavioral theory of the firm and mainstream strategic management research. Recent studies have worked toward developing a behavioral theory of strategy, explicitly building on March (1991) (e.g. Reitzig & Sorenson, 2013; Tuncdogan, Van Den Bosch, & Volberda, 2015). Nevertheless, there is room for further research on how behavioral tendencies of managers, such as the risk propensity of executives (e.g., Buckley, Chen, Clegg, & Voss, 2017) relate to a firm's ability to explore versus exploit. Moreover, in his article, March bridges the

individual, organizational, and environmental levels of analysis when discussing knowledge equilibrium. Future research may consider not only individual learning, but also extend his framework to environmental trends at the institution, industry, and country levels (e.g., Miller, Lavie, & Delios, 2016). Such research can potentially reveal how cultural and institutional differences across countries influence a firm's tendency to explore versus exploit. In particular, some cultures are more tolerant of failure and their institutions furnish support to entrepreneurs, which is likely to reinforce exploration.

The microfoundations of exploration and exploitation

Related to the previous recommendation of connecting back to March's behavioral roots, our analysis clearly shows a preference for research conducted at the organizational level (Levinthal & March, 1993; Rivkin & Siggelkow, 2003; Rosenkopf & Nerkar, 2001) and inter-organizational level (e.g., Lavie & Rosenkopf, 2006; Rothaermel & Deeds, 2004) (see Table 1). This is a particularly surprising finding given March's emphasis on individual learning within the organization and the "mutual learning of an organization and the individuals in it". The importance of how organizations "accumulate […] knowledge over time" and "learn[…] from their members" while at the same time "… individuals in an organization are socialized to organizational beliefs" implies that '[s]uch mutual learning has implications for understanding and managing the trade-off between exploration and exploitation in organizations (March, 1991: 73)." Our findings indicate, however, that prior research has relied on March (1991) to study various phenomena at the organizational level, such as innovation and diversification, without revisiting the critical questions he raised for organizations (see Figure 2 and Table 1). Future research may need to give more attention to enhancing understanding of the microfoundations of exploration and exploitation by linking such microfoundational lower-level processes back to existing research on meso- and macro-level aspects of exploration and exploitation. One example of this avenue is Oehmichen et al. (2017). Based on the premise that a board of directors and its members present an important micro-foundational antecedent of an organization's ability to pursue both exploration and exploitation (O'Reilly & Tushman, 2013), they find that the benefits of boards of directors' knowledge heterogeneity only outweigh the associated costs beyond a particular threshold, thus finding a U-shaped relationship between this individual level board heterogeneity and organizational ambidexterity. Further research along these lines can help solidify a first-principles logic seen in work on the microfoundations of strategy (Felin, Foss, & Ployhart, 2015). A rather unique approach to this is seen in Laureiro-Martínez, et al. (2015), who

utilize fMRI to examine how brain activity links to exploratory versus exploitative demands. Indeed, studying exploration and exploitation across levels can shed more light on the mechanisms by which organizations accumulate and apply knowledge.

Integrating March (1991) into resource-based thinking

Our coupling citation analysis indicates that the most influential research linking March's work to capabilities, resources, and change was published around the turn of the 21st century (see A4 and Figure 1), while the text mining results imply that themes around capabilities, resources, and change have not been at the center of research following March (1991) (see A5). However, in his article, March clearly refers to capabilities for change in the context of environmental turbulence. Most current research takes it for granted that firms can explore and exploit, focusing on the desirable balance between these activities and its performance implications. However, firms possess idiosyncratic capabilities for exploration and exploitation that constrain their tendencies to explore versus exploit, and shape the performance implications of these tendencies (Levinthal & March, 1993). Few studies have investigated exploration and exploitation capabilities. For example, in the context of marketing efforts, Vorhies et al. (2011) found positive relationships between exploration and exploitation capabilities and a firm's ability to enhance the organization's customer-focused marketing, but stress that organizations do not benefit from maximizing both capabilities simultaneously. Furthermore, future research may extend the focus on knowledge as the underlying resource that is shaped by exploration and exploitation, by considering various other resources that the firm can leverage and develop via exploration and exploitation. Finally, considering how exploration and exploitation yield knowledge that is valuable, rare, and difficult to imitate and substitute can offer new insights on the sources of resource-based sustainable competitive advantage (Barney, 1991).

Finally, future research may seek to isolate the particular capabilities needed to support exploration and exploitation, and study how these capabilities emerge and become embedded in organizational routines. For example, early research interpreted ambidexterity to be a dynamic capability (O'Reilly III & Tushman, 2008). However, Wilden et al. (2016) show that ambidexterity and dynamic capability research have evolved into separate, albeit related research streams. Thus, future research may investigate how exploration, exploitation, and dynamic capabilities relate. Although, both exploitative and exploratory learning may shape dynamic capabilities (Zollo & Winter, 2002), exploitative learning may weaken capability reconfigurations due to rigidities it may cause (Leonard-Barton, 1992). Similarly,

exploitative use of existing assets likely requires a different kind of sensing, seizing, and reconfiguring compared to exploration of latent market opportunities. Future research may benefit from studying whether and how processes concerning sensing, seizing, and reconfiguring differ for exploration versus exploitation.

Exploration and exploitation across organizational boundaries

March (1991: 74) stresses that "[o]rganizations often compete with each other under conditions in which relative position matters. The mixed contribution of knowledge to competitive advantage in cases involving competition for primacy creates difficulties for defining and arranging an appropriate balance between exploration and exploitation in an organizational setting." This is echoed in Teece (2007: 1324), who notes that in "fast-paced environments, with a large percentage of new product introductions coming from external sources, search/exploration activity should not just be local". Previous reviews have often concluded with a set of contingency factors, underscoring managerial motivation, organizational structure, and environmental conditions such as uncertainty and competitive dynamics (e.g., Gupta et al., 2006; Lavie et al., 2010). However, we find that contextual factors – such as *institutions*, *industry, competition* and *market* – have not been a central theme in research building on March (1991) (see A5). Thus, we believe that more work is needed to consider the configuration of exploration and exploitation across organizational boundaries, studying, for instance, how firms leverage alliances and acquisitions besides their internal organization in order to optimize their configuration of exploration and exploitation endeavors (e.g., Stettner & Lavie, 2014).

The importance of the interaction between firms and individuals in the external environment is especially important given the trend of using March's work as it relates to innovation (e.g., Chesbrough, 2003; Grigoriou & Rothaermel, 2017; Hess & Rothaermel, 2011; West & Gallagher, 2006). Together with the fact that exploration and exploitation fundamentally deal with the question of value creation and capture in an organizational context, March's ideas become even more compelling when multiple organizations are involved. Thus, a promising avenue for future study involves investigating exploration and exploitation in the context of open innovation. Interestingly, both Chesbrough (open innovation) and Von Hippel (user innovation) do not show up in our citation analysis, although March (1991) represents a strong foundation for core open innovation articles (Randhawa, Wilden, & Hohberger, 2016); hinting at the broad question of how firms can structure exploration and exploitation activities in an open innovation context. To answer this

question, and owing to the fact that firm boundaries have become more amorphous, scholars may build on the rich research on alliances and acquisitions (see the subgroup in Cluster 1) that has followed March (1991).

Understanding the various dimensions of exploration and exploitation

Finally, a significant amount of research has studied exploration and exploitation in various contexts; e.g., diversification, internationalization, and knowledge development as manifestations of exploration (see Figures 4a and b). There is a risk in relying on March (1991) to describe distinct phenomena and drawing seemingly generalizable conclusions (Lavie et al., 2010). In fact, our analysis reveals that there is even greater potential for extending the notions of exploration and exploitation to new dimensions. In particular, the notion of exploration has been almost exclusively associated with innovation, even though March (1991) outlined a much broader conceptualization of this construct. Whereas scholars have relied on March's framework for studying innovation and search versus implementation and choice, future research may extend applications of the framework to variation, risk-taking, play, and discovery (dimensions of exploration) as well as to execution and selection (dimensions of exploitation), which have been underrepresented according to our analysis. Although such elaboration is likely to exacerbate the problem of generalizability, a remedy may involve a clear distinction between the dimensions in which exploration and exploitation are pursued. Once scholars clearly delineate these dimensions, they can identify unique boundary conditions and characterize the distinctive processes and performance implications ascribed to each dimension of exploration and exploitation. Additionally, since our findings reveal greater focus on exploration as opposed to exploitation, there is room for further research on the processes that support exploitation as well as on the means by which firms dislodge from path dependencies in exploitation (Levinthal & March, 1993). Because our analysis uncovers a strong emphasis on performance implications and consequences in connection with exploration and exploitation, there is a need for more work on the antecedents and drivers of exploration and exploitation. Specifically, although environmental and organizational predictors are consistently featured in prior research (Lavie et al., 2010), future research may seek to uncover unique antecedents such as possible interdependence in firms' exploration and exploitation tendencies. Such research can show, for instance how firms converge or diverge from the exploration tendencies exhibited by their alliance partners and competitors.

One of the reasons March (1991) has become influential in various research areas concerns its broad appeal and the fundamental principle of balance, which is applicable in various organizational domains and informs different disciplines. As scholars continue to build and apply his framework, it is essential to identify distinctive patterns and boundary conditions rather than advocate generalizable conclusions based on narrow conceptual and empirical settings (Aguinis, Boyd, Pierce, & Short, 2011). Research on ambidexterity and the balance between exploration and exploitation will continue to draw attention as it embodies a paradox and an essential dilemma that lacks a straightforward solution. Future research may seek to uncover the mechanisms that enable firms to adjust their levels of exploration and exploitation given environmental conditions and elucidate the dynamics by which exploration and exploitation levels are adjusted over time. This has been the essence of March's (1991) model, but it is yet to be fully leveraged in contemporary research on exploration and exploitation.

Figure 1: Number of articles citing March (1991) clustered by intellectual area 1991-2016

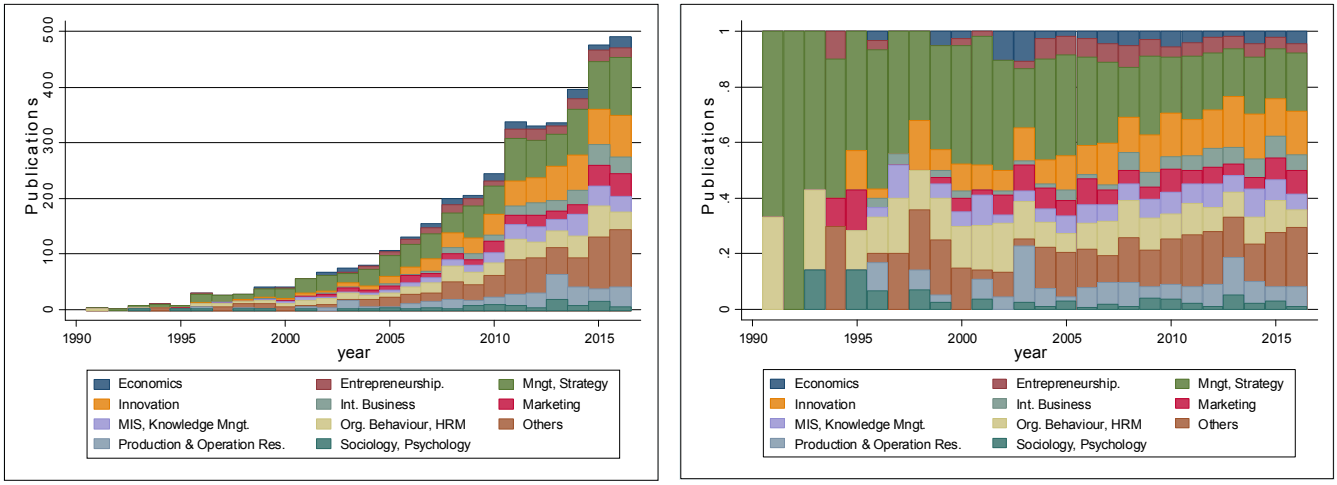
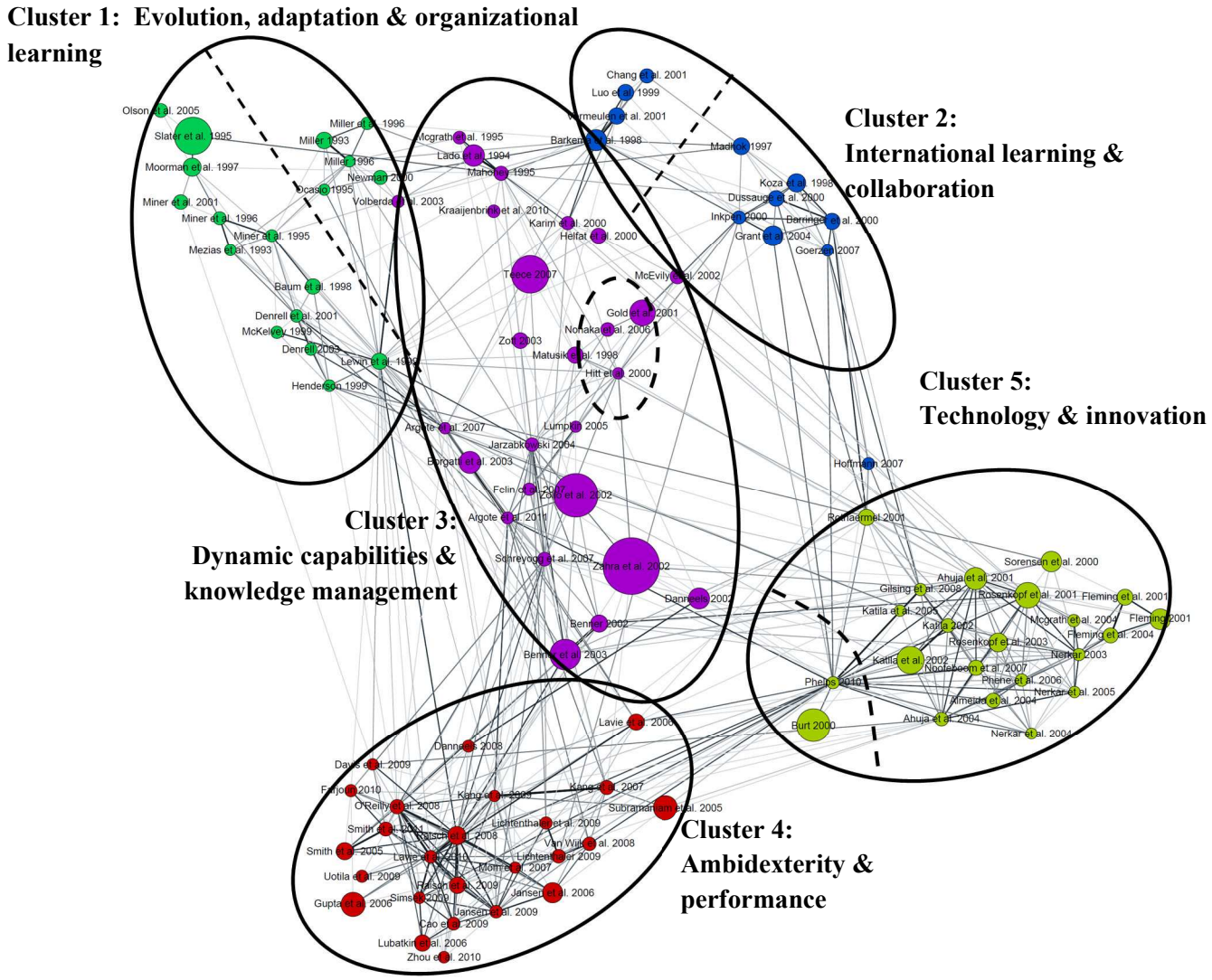


Figure 2: Coupling analysis of core articles citing March (1991)



The network graph is based on publications with a degree range > 4 and proximity scores > 12. Additionally, we weighted each publication with the number of citations they received from the sample of all publications (large nodes represent a more frequently cited publication).

Please note: The attached labels are indicative only.

Figure 3a: Evolution of concepts used in citing articles by absolute frequency

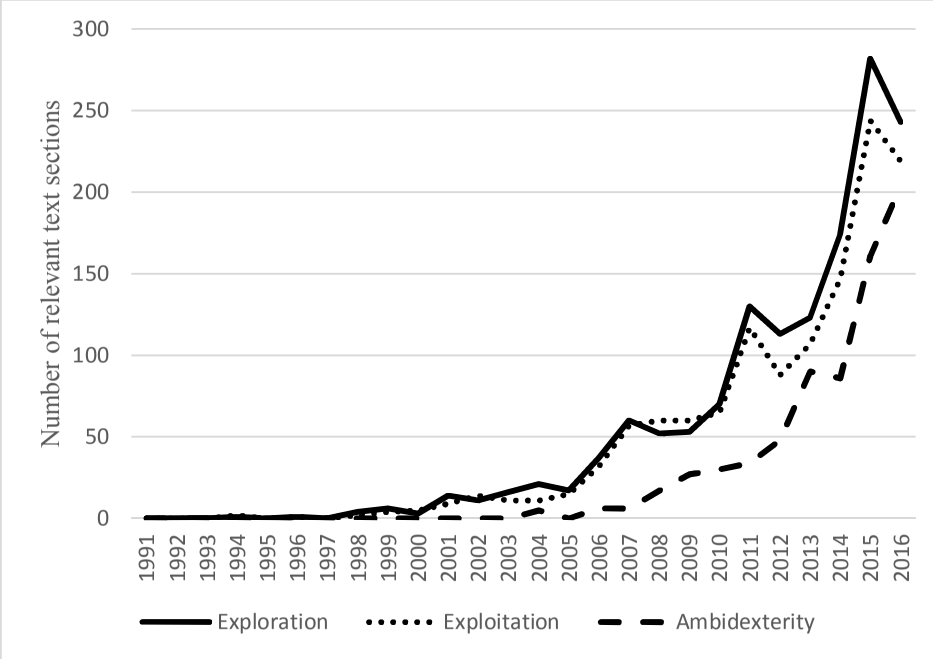


Figure 3b: Evolution of concepts used in citing articles by relative importance

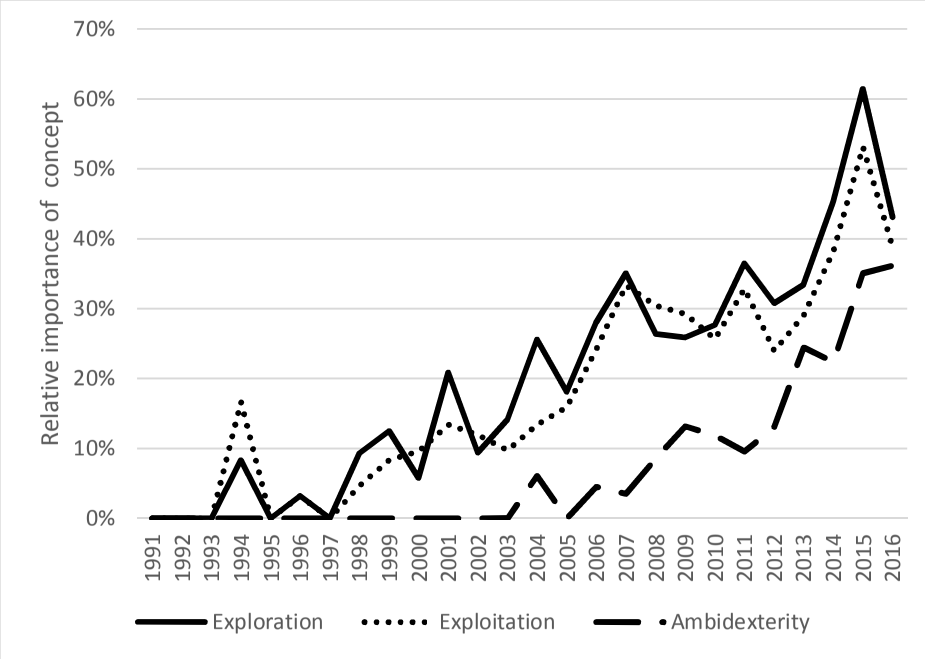


Figure 4a: Evolution of exploration-related concepts used in citing articles by absolute frequency

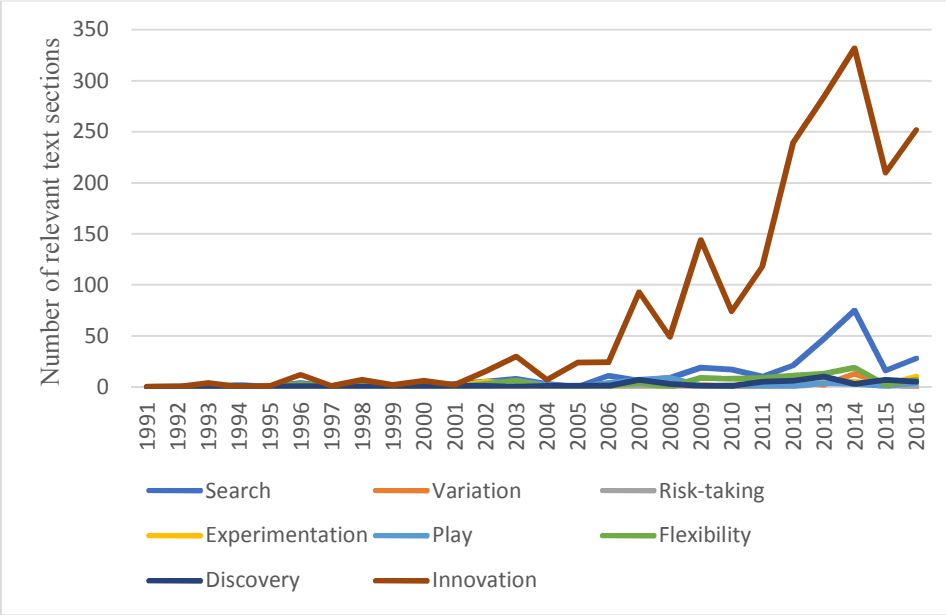


Figure 4b: Evolution of exploitation-related concepts used in citing articles by absolute frequency

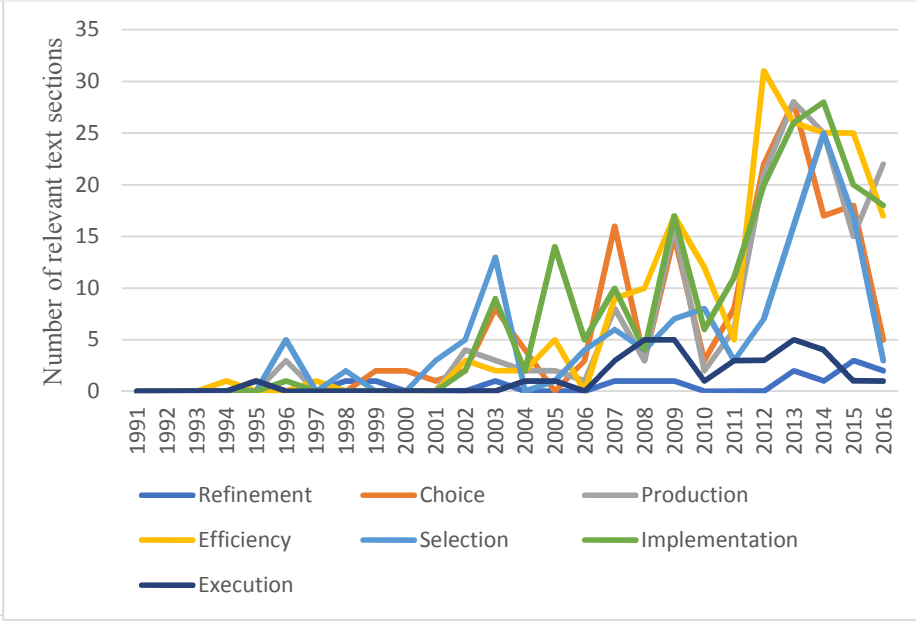


Table 1: Overview of cluster, size, impact, themes, representatives, and theories

#	Relative size (absolute)	Impact sum/average	Key concepts (Leximancer)	Main representatives	Reference theories & topics
Cluster 1: Evolution, adaptation & organizational learning					
1	16.7% (17)	4,166 245	51% learning 36% strategy 35% performance 35% change 34% product 26% processes 26% marketing 23% innovation 22% competitive 22% experience	Lewin et al 1999 Baum & Ingram 1998 Dennrell et al 2001	• Coevolution • Adaption
				Slater & Narver 1995 Moorman & Miner 1997 Minner et al 2001	• Improvisation & planning • Market orientation
				Newman 2000 Miller 1993 Miller et al 1996	• Organizational learning
Cluster 2: International learning & collaboration					
2	11.8% (12)	3,418 284	69% alliance 35% acquisition 29% entry 28% knowledge 26% market 24% relationships 24% partner 24% joint 22% endowment 21% experience	Barkema & Vermeulen 1998 Vermeulen & Barkema 2001 Luo & Peng 1999	• Acquisition • International expansion
				Grant et al. 2004 Koza et al 1998 Barringer et al 2000	• Learning in alliances and inter-organizational collaborations
Cluster 3: Dynamic capabilities & knowledge management					
3	25.5 (26)	10,851 417	90% knowledge 58% process 56% capabilities 48% product 46% learning 42% dynamic 40% resources 36% innovation 35% change 32% technological	Zahra & George 2002 Zollo & Winter 2002 Benner et al 2003 Teece 2007	• Capabilities & resources • Dynamic capabilities • Absorptive capacity
				Gold et al 2001 Nonaka et al 2006 Matusik et al 1998	• Knowledge Management • Knowledge creation
Cluster 4: Ambidexterity & performance					
4	24.5% (25)	5,790 231	87% exploitation 73% exploration 53% knowledge 42% innovation 33% performance 33% structure 28% learning 27% processes 26% strategic 26% ambidexterity	Gupta et al 2006 Raisch et al 2008 Jansen et al.,2006 Smith et al 2005	• Organizational exploration and exploitation • Ambidexterity • Organizational performance
Cluster 5: Technology & innovation					
5	21.6% (22)	6,858 311	66% technological 65% knowledge 58% patents 58% innovation 49% networks 40% effect 31% search 24% organization 23% industry 22% exploration	Burt, 2000 Katila & Ahuja 2002 Rosenkopf & Nerkar 2001 Ahuja & Lampert 2001 Fleming 2001	• Search • Open innovation • Path dependency & local search • Social network analysis

Note: The results show for each cluster: (1) the absolute and relative size of the group based on number of publications; (2) the impact, measured as overall number of citations and average citations per paper; (3) the key themes derived from text mining, (4) the main representative articles related to each of those themes; and (5) each theme's main underlying theories or phenomena.

Table 2: Future research suggestions based on our findings

	Research Gap	Potential Research Questions	Applicable theories
1	Reconnecting with the behavioral roots of March (1991)	How do behavioral tendencies of managers, such as the risk propensity of executives, relate to a firm's ability to explore versus exploit? How do individual tendencies to explore versus exploit interact with environmental trends at the institution, industry, and country levels?	Upper echelons theory (e.g., Hambrick & Mason, 1984; Oehmichen et al., 2017) Behavioral strategy (e.g., Gavetti et al., 2012; Powell et al., 2011)
2	The microfoundations of exploration and exploitation	How do microfoundational lower-level processes interact with meso- and macro-level aspects of exploration and exploitation? How does the board of directors support firms in accumulating knowledge necessary for exploration and exploitation?	Cognitive/Behavioral management (Laureiro-Martínez, Brusoni, Canessa, & Zollo, 2015; Powell et al., 2011) Upper echelons theory (e.g., Hambrick & Mason, 1984) Microfoundations of strategy (e.g., Aguinis & Molina-Azorín, 2015; Felin et al., 2015)
3	Integrating March (1991) into resource-based thinking	How do capabilities that support exploration and exploitation emerge and become embedded in organizational routines? Are there differences in the dynamic capabilities required for executing exploration versus exploitation? Which dynamic capabilities are required to overcome path dependencies in exploitation?	Dynamic capabilities (e.g., Eisenhardt & Martin, 2000; Teece, 2007) Dynamic managerial capabilities (e.g., Helfat & Martin, 2015; Kor & Mesko, 2013)
4	Exploration and exploitation across organizational boundaries	How can firms leverage alliances and acquisitions in order to optimize their configuration of exploration and exploitation endeavors? How can collaborative knowledge creation processes be managed across open innovation networks? How can organizations best structure exploration and exploitation activities in an open innovation context?	Interorganizational learning (e.g., Powell et al.,1996; Ahuja, 2000) Alliance portfolio configuration (e.g., Lavie and Rosenkopf, 2006; Stettner and Lavie, 2014) Social network theory (e.g., Burt, 1993; Uzzi, 1997) Alliance-portfolio management (e.g., Aggarwal & Hsu, 2009; Wang & Rajagopalan, 2015) Open innovation (e.g., Chesbrough, 2003; Gassmann & Enkel, 2004)
5	Understanding the various dimensions of exploration and exploitation	What are the unique boundary conditions that characterize the distinctive processes and performance implications ascribed to each dimension of exploration and exploitation? Which organizational and individual-level processes support the various dimensions of exploration and exploitation? Do organizations converge or diverge from the specific exploration processes exhibited by their alliance partners and competitors?	Boundary conditions (e.g., Aguinis et al., 2011; Rosenkopf & Nerkar, 2001) Cognitive/Behavioral management (e.g., Laureiro-Martínez et al., 2015; Powell et al., 2011) Sociological institutionalism (e.g., Beckert, 2010)

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Online Appendix A1: Overview of recent literature reviews

Authors	Summary	Methodology
Raisch & Birkenshaw (2008)	• Focus on ambidexterity research. • Develop a comprehensive framework that covers research on the antecedents (structure, context, leadership), moderators (dynamism, competitive dynamics, market orientation, resource endowment, firm scope), and performance outcomes (accounting, market, growth) of organizational ambidexterity. • Future research recommendations include the need to clearly identify the level of analysis is identified; research the interrelationships between the various antecedents; investigate several performance dimensions; and study the evolution of ambidextrous organizations.	Qualitative review
Simsek (2008)	• Develop a multi-level model of ambidexterity. • Levels include: organization level (antecedent and moderator); interfirm level (antecedent); and environmental level (moderators).	Qualitative review
Lavie et al. (2010)	• Develop a framework comprising the antecedents (dynamism, shocks, competitive intensity, absorptive capacity, slack resources, organizational structure, culture, age, and size, as well as managerial inclinations) and consequences of exploration and exploitation and their balance. • Conceptual and empirical gaps, such as empirical evidence on the benefits of balance between exploration and exploitation, are identified, and directions for future research are provided.	Qualitative review
Nosella et al. (2012)	• Focus on ambidexterity research. • Previous research classified into (1) Foundations: Structural solution, (2) Contextual solution, (3) Antecedents and consequences of ambidexterity, and (4) Cross-boundary perspectives. • Findings suggest that organizational ambidexterity research has evolved from the original definition of the construct as a capability for resolving tensions. • Most previous research has focused on macro-level aspects.	Factor analysis of 55 articles
Mueller et al. (2013)	• Focus on exploratory and exploitative innovation. • Impact of institutional conditions differs between exploratory and exploitative innovation.	Meta-analysis of 46 studies.
Turner et al. (2013)	• Focus on ambidexterity research. • Develop a framework integrating intellectual capital resources (organizational, social and human capital) across various levels of analysis (organization, group and individual).	Qualitative review of 119 articles

Junni et al. (2013)	• Focus on ambidexterity research. • Ambidexterity has positive performance implications especially in non-manufacturing organizations and at higher levels of analysis. • Performance effects are dependent on the measurement of ambidexterity and applied research design. • Identified moderator: environmental conditions.	Meta-analysis of 69 papers with 135 samples
Almahendra & Ambos (2015)	• Identifying citation patterns. • Five intellectual foundations identified (absorptive capacity, behavioral theory of the firm, evolutionary theory, resource-based view, knowledge-based view). • Turning points (i.e., seminal articles) are identified and discussed.	Bibliometric analysis of the references of 145 articles
Fourne et al. (2016)	• Find a positive and heterogeneous relationship between exploration and exploitation. • Identify organizational size, inter- and intrafirm modes of operation, and environmental factors (industry and technological intensity) as important factors.	Meta-analysis of 108 primary studies with 117 effect sizes

Online Appendix A2: Method description

Bibliographic coupling

Bibliographic coupling is one of main quantitative methods for mapping the structure and development of scientific fields and disciplines (Zupic & Čater, 2015). Even though it has been traditionally less popular than co-citation analysis in the field of Business and Management, it is a very powerful tool with multiple attractive features for studies, and it has been becoming more popular within the past years (e.g. Devinney & Hohberger, 2016; Nosella, Cantarello, & Filippini, 2012; Vogel & Güttel, 2012). The main point of distinction is that bibliographic coupling uses the shared number of references between two publications to measures the proximity between these two publications (Kessler, 1963). This is different from co-citations analysis, were the proximity between two publications is measured by the number of shared citations by other publications (Small, 1973). It is important to note that bibliographic coupling is a static approach as the number of shared references between two publications remains constant over time (Zupic & Čater, 2015). Therefore, it is well suited for analyzing trends in current research, even if they have not been cited yet (Vogel & Güttel, 2012; Zupic & Čater, 2015). Co-citation analysis, on the other hand, is a dynamic approach, because by the number of shared citations by other publications can increase with each number of articles that cites both publications (Vogel & Güttel, 2012; Zupic & Čater, 2015). As a consequence, older publications can accumulate more citations than newer publications and thus, co-citation results can be biased towards the more recent publications. Furthermore, bibliographic coupling and co-citation analysis operate at different levels of analysis (Vogel & Güttel, 2012). Co-citation analysis uses cited publications (references) to measures the similarity between two publications, while bibliographic coupling use references to measures the proximity of two citing publications. We are particularly interested in the academic structure within the publications citing March (1991) (and not his references), thus, we applied bibliographic coupling. However, we also have conducted co-citation analysis and the results can be requested by the authors.

In applying bibliographic coupling we followed previous research, in particular, Zupic and Čater (2015) and Randhawa et al. (2016). First we calculated the coupling based proximity scores use the BibExcel software package (Persson, Danell, & Schneider, 2009). We then use the proximity scores to analyze and visualize the relationship between the publications using network and network community analysis. Within bibliometric studies, network approaches have become increasingly popular (e.g. Nosella et al., 2012; Randhawa

et al., 2016; Vogel & Güttel, 2012; Zupic & Čater, 2015), as they provide an accurate, effective, and readable visualization of a larger number of documents in a meaning full ways (Randhawa et al., 2016; Vogel & Güttel, 2012; Zupic & Čater, 2015). Whereas other analysis and visualization techniques (e.g., exploratory factor analysis and multi-dimensional scaling) frequently benefit from a normalization of the proximity scores, this is not always the case for network-based approach (Wallace, Gingras, & Duhon, 2009; Zupic & Čater, 2015). In our case, the results did not improve (or even worsened), by normalizing with the Salton's cosine (Salton & McGill, 1986), thus, we use the raw scores. To visualize the network, we apply the 'Force Atlas 3D" network algorithm implemented in the Gephi software package (Bastian, Heymann, & Jacomy, 2009). In a second step we used the "Louvain" modularity optimization method to identify research clusters (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008). Thereby, the number of cluster is based on the resolution coefficient (Lambiotte, Delvenne, & Barahona, 2008). Starting from the default value of 1.0, we experimented with various resolution coefficients in an iterative interactive fashion to find the sound clustering. The quality of the solutions was judged with a modularity parameter (minimum of 0.4) (Blondel et al., 2008) and by a qualitative assessment of the results.

Leximancer

Leximancer has been used in previous literature reviews (Biesenthal & Wilden, 2014; Liesch, Håkanson, McGaughey, Middleton, & Cretchley, 2011; Randhawa et al., 2016; Wilden, Devinney, & Dowling, 2016) to investigate what authors are actually writing about. The software conducts both conceptual (thematic) and relational (semantic) analysis of textual data (Rooney, 2005), thus allowing researchers to analyze concepts (common text elements) and themes (groupings of revealed concepts). The algorithm automatically selects the most appropriate number of themes depending on the identified concepts and allows overlapping of clusters. Leximancer is appropriate for our exploratory research as it delivers high reproducibility and reliability of concept identifications and clustering, reducing biases typically underlying manually coded text analyses (Dann, 2010; Smith & Humphreys, 2006). Furthermore, Leximancer has high face validity as its algorithms are profoundly rooted in recognized practice such as Bayesian decision theory and computational linguistics. Finally, Leximancer exhibits high correlative validity as it has been found to reveal patterns that correlate with other modes of pattern identification such as human coding (see, e.g., Grech, Horberry, & Smith, 2002; Wilden, Akaka, Karpen, & Hohberger, 2017).

After downloading the relevant articles, we cleaned and prepared the textual data, converted the files into machine-readable format and deleted the references (Netzer, Feldman, Goldenberg, & Fresko, 2012). This phase includes typical procedures, such as name and term preservation, tokenization, and using a stop list (Grech et al., 2002). We merged word variants (e.g., "explore" and "exploration") and applied Leximancer's default stop word list (e.g., "and," "always," "just"), supplemented by terms without specific meaning in our textual data (e.g., "et", "al.," "table," "figure"). Next, Leximancer generates concept seeds "automatically using a ranking algorithm for finding seed words which reflect the themes present in the data. This process looks for words near the center of local maxima in the lexical co-occurrence network" (Smith, 2003: 23). The aim of this phase was to uncover word clusters, which, when combined as a concept, maximize the relevancy of all the other words in the data. The learning algorithm starts with a partial concept definition (seeds) and extends the definition to find additional words (e.g., modifiers, synonyms) that convey the equivalent meaning. Leximancer weighs the seeds with the frequency with which they occur in sentences, including the concept, compared to how frequently the seeds appear in other parts of the textual data. This categorization of words is driven by the software algorithm and thus minimizes researcher bias. Additionally, predefined dictionaries may "restrict the exploration of material to a limited scope, and limit the possibility of having new concepts emerge from the material" (Indulska, Hovorka, & Recker, 2012: 49). The concepts (dots in the figures) are word clusters conveying related meanings. The Leximancer default settings were used for the total number of concepts, learning threshold, etc.; however, we opted to exclude name-like concepts (i.e., words starting with a capital letter).

This process resulted in the automatically created dictionary comprising relevant concepts. We reviewed this initial concept list created by Leximancer through a Bayesian algorithm and deleted concepts that often occur in academic writing (e.g., "respondent," "literature," "significant"). Next, using the developed thesaurus, the data were marked with the identified concepts to a two-sentence resolution. The software algorithm considers a concept to appear in a sentence block if enough accrued evidence (the sum of the weights of the keywords) is found.

Subsequently, the concepts were mapped in a semantic network by applying an asymmetric scaling algorithm and ranking the concepts by their connectedness, based on the co-occurrence frequencies. Consequently, the algorithm extends beyond simply looking at concepts occurrences, and evaluates the proximity between concepts depending on how often they co-appear in the text. In these maps of meaning, "entity concepts are clustered according

to weight and relationship, to create a concept cluster map" (Grech et al., 2002: 1719). Then, the concepts are grouped them into themes. Finally, we inspected the resulting maps of meaning and their statistical information, investigated the maps stability by rerunning the algorithm several times and decided on the best number of themes by using the default setting. Thus, the final Leximancer outputs discussed in this paper are the result of the research team's reading of the conceivable structure of the data.

Online Appendix A3: Publication coupling Figure 1

Cluster	Publication	Citation	Year
1	Slater, SF; Narver, JC 1995	1115	1995
1	Moorman, C; Miner, AS 1997	367	1997
1	Miller, D 1993	302	1993
1	Lewin, AY; Volberda, HW 1999	292	1999
1	Baum, JAC; Ingram, P 1998	258	1998
1	Miner, AS; Bassoff, P; Moorman, C 2001	229	2001
1	Newman, KL 2000	209	2000
1	Olson, EM; Slater, SF; Hult, GTM 2005	199	2005
1	Miner, AS; Mezias, SJ 1996	169	1996
1	Denrell, J; March, JG 2001	150	2001
1	Miller, D; Chen, MJ 1996	147	1996
1	Denrell, J 2003	138	2003
1	McKelvey, B 1999	138	1999
1	Miner, AS; Haunschild, PR 1995	136	1995
1	Henderson, AD 1999	113	1999
1	Mezias, SJ; Glynn, MA 1993	102	1993
1	Miller, D 1996	102	1996
2	Barkema, HG; Vermeulen, F 1998	482	1998
2	Grant, RM; Baden-Fuller, C 2004	445	2004
2	Koza, MP; Lewin, AY 1998	375	1998
2	Madhok, A 1997	320	1997
2	Vermeulen, F; Barkema, H 2001	298	2001
2	Luo, YD; Peng, MW 1999	295	1999
2	Barringer, BR; Harrison, JS 2000	294	2000
2	Dussauge, P; Garrette, B; Mitchell, W 2000	274	2000
2	Chang, SJ; Rosenzweig, PM 2001	216	2001
2	Inkpen, AC 2000	177	2000
2	Hoffmann, WH 2007	133	2007
2	Goerzen, A 2007	109	2007
3	Zahra, SA; George, G 2002	1866	2002
3	Zollo, M; Winter, SG 2002	1385	2002
3	Teece, DJ 2007	1124	2007
3	Benner, MJ; Tushman, ML 2003	855	2003
3	Gold, AH; Malhotra, A; Segars, AH 2001	664	2001
3	Borgatti, SP; Cross, R 2003	515	2003
3	Lado, AA; Wilson, MC 1994	501	1994
3	Danneels, E 2002	480	2002
3	Benner, MJ 2002	330	2002
3	Matusik, SF; Hill, CWL 1998	292	1998
3	Zott, C 2003	273	2003
3	Helfat, CE; Raubitschek, RS 2000	265	2000
3	McEvily, SK; Chakravarthy, B 2002	236	2002
3	Mahoney, JT 1995	218	1995
3	Schreyogg, G; Kliesch-Eberl, M 2007	198	2007
3	Nonaka, I; von Krogh, G; Voelpel, S 2006	194	2006
3	Jarzabkowski, P 2004	183	2004
3	Karim, S; Mitchell, W 2000	178	2000

Cluster	Publication	Citation	Year
3	Felin, T; Hesterly, WS 2007	175	2007
3	McGrath, RG; MacMillan, IC; Venkataraman, S 1995	162	1995
3	Kraaijenbrink, J; Spender, JC; Groen, AJ 2010	158	2010
3	Volberda, HW; Lewin, AY 2003	146	2003
3	Argote, L; Miron-Spektor, E 2011	133	2011
3	Argote, L; Greve, HR 2007	112	2007
3	Hitt, MA; Ireland, RD; Lee, HU 2000	107	2000
3	Lumpkin, GT 2005	101	2005
4	Gupta, AK; Smith, KG; Shalley, CE 2006	600	2006
4	Subramaniam, M; Youndt, MA 2005	591	2005
4	Jansen, JJP; Van den Bosch, FAJ; Volberda, HW 2006	447	2006
4	Raisch, S; Birkinshaw, J 2008	363	2008
4	Smith, WK; Tushman, ML 2005	329	2005
4	Raisch, S; Birkinshaw, J; Probst, G; Tushman, ML 2009	300	2009
4	Lubatkin, MH; Simsek, Z; Ling, Y; Veiga, JF 2006	296	2006
4	Lavie, D; Rosenkopf, L 2006	294	2006
4	O'Reilly, CA; Tushman, ML 2008	219	2008
4	Kang, SC; Morris, SS; Snell, SA 2007	212	2007
4	Smith, WK; Lewis, MW 2011	205	2011
4	Lichtenthaler, U 2009	193	2009
4	van Wijk, R; Jansen, JJP; Lyles, MA 2008	185	2008
4	Cao, Q; Gedajlovic, E; Zhang, HP 2009	165	2009
4	Jansen, JJP; Tempelaar, MP; van den Bosch, FAJ; Volberda, HW 2009	156	2009
4	Lavie, D; Stettner, U; Tushman, ML 2010	151	2010
4	Lichtenthaler, U; Lichtenthaler, E 2009	139	2009
4	Farjoun, M 2010	137	2010
4	Uotila, J; Maula, M; Keil, T; Zahra, SA 2009	135	2009
4	Danneels, E 2008	130	2008
4	Zhou, KZ; Wu, F 2010	115	2010
4	Simsek, Z 2009	112	2009
4	Davis, JP; Eisenhardt, KM; Bingham, CB 2009	109	2009
4	Mom, TJM; Van den Bosch, FAJ; Volberda, HW 2007	104	2007
4	Kang, SC; Snell, SA 2009	103	2009
5	Burt, RS 2000	960	2000
5	Katila, R; Ahuja, G 2002	725	2002
5	Rosenkopf, L; Nerkar, A 2001	657	2001
5	Ahuja, G; Lampert, CM 2001	524	2001
5	Fleming, L 2001	463	2001
5	Sorensen, JB; Stuart, TE 2000	456	2000
5	Rosenkopf, L; Almeida, P 2003	390	2003
5	Rothaermel, FT 2001	287	2001
5	Fleming, L; Sorenson, O 2001	281	2001
5	Nooteboom, B; Van Haverbeke, W; Duysters, G; Gilsing, V; van den Oord, A 2007	253	2007
5	Fleming, L; Sorenson, O 2004	245	2004
5	Almeida, P; Phene, A 2004	221	2004
5	Katila, R 2002	194	2002
5	Ahuja, G; Katila, R 2004	188	2004

Cluster	Publication	Citation	Year
5	Phene, A; Fladmoe-Lindquist, K; Marsh, L 2006	146	2006
5	McGrath, RG; Nerkar, A 2004	142	2004
5	Gilsing, V; Nooteboom, B; Vanhaverbeke, W; Duysters, G; van den Oord, A 2008	140	2008
5	Phelps, CC 2010	136	2010
5	Nerkar, A 2003	135	2003
5	Nerkar, A; Roberts, PW 2004	107	2004
5	Nerkar, A; Paruchuri, S 2005	105	2005
5	Katila, R; Shane, S 2005	103	2005

Online Appendix A4: Coupling analysis

The following figures show the coupling analysis using network analysis and community detection (Blondel et al. 2008) for three broad time periods. As in the earlier networks, the nodes represent individual publications and the edges represent the connection between articles based on the proximity scores (shared references). To ease the interpretation and to focus on the most relevant publications, the network graph is based on publications with a degree range > 2 and proximity scores > 0.1. Additionally, the size associated with each of the publications is weighted with the number of citations a publication received.

Figure A4-1: Coupling 1991-2000

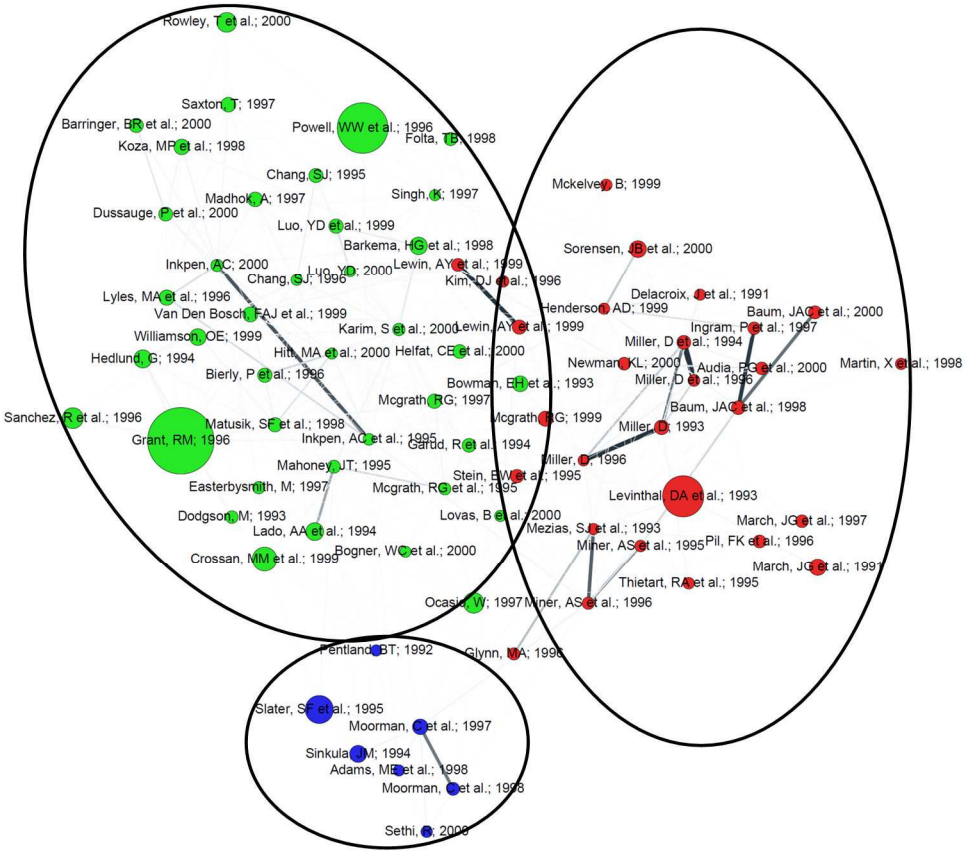


Figure A4-2: Coupling 2001-2010

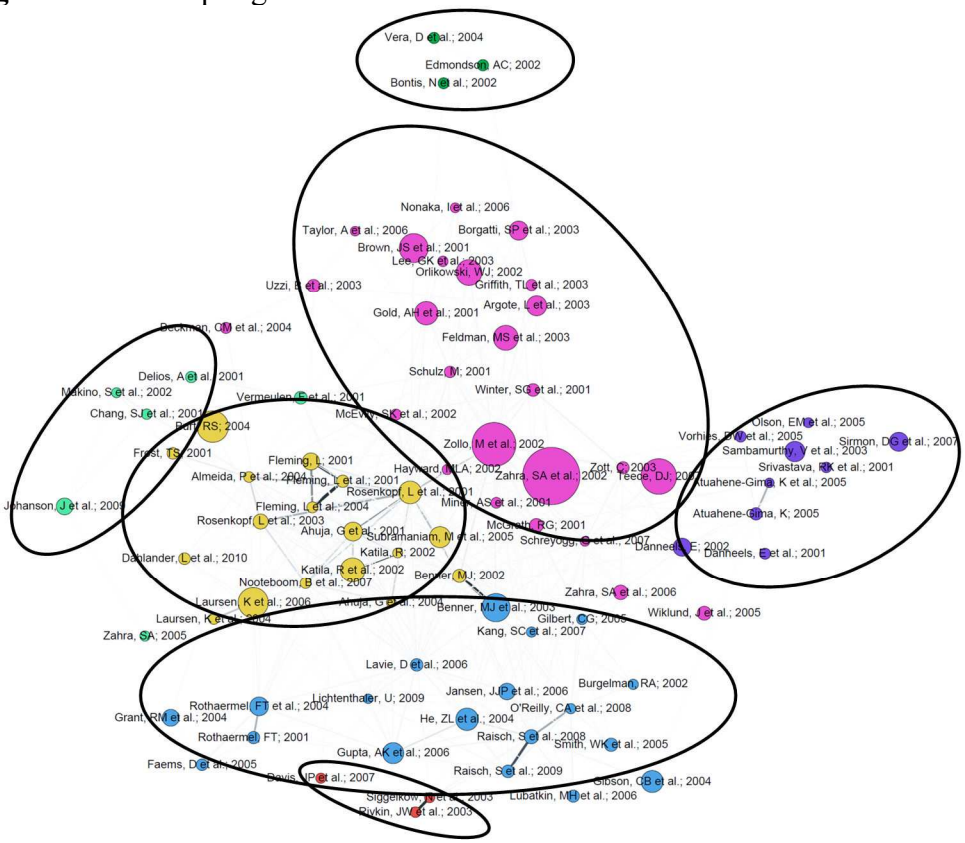
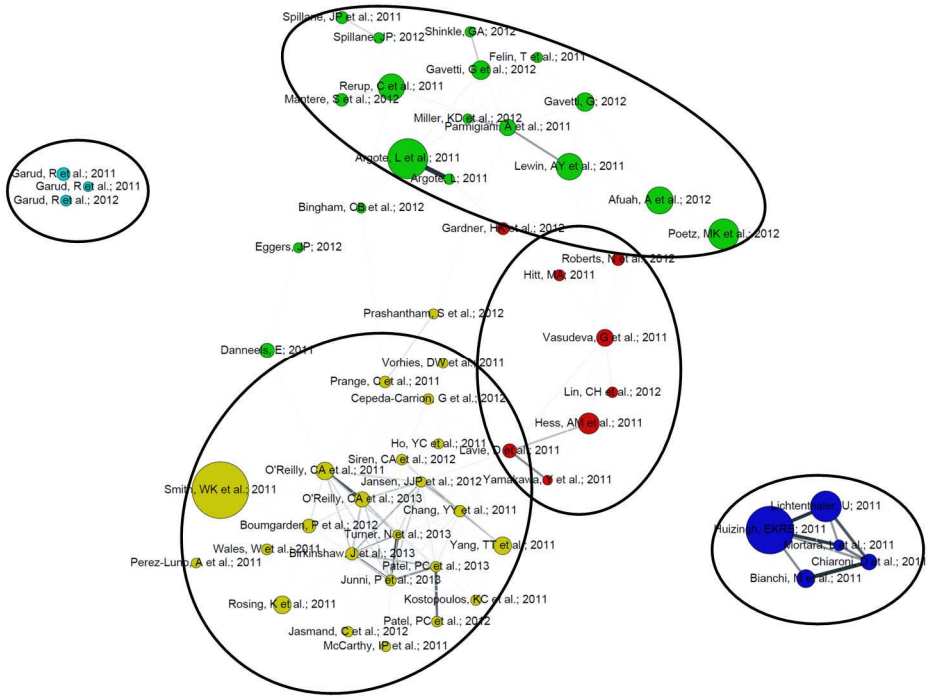


Figure A4-3: Coupling 2011-2016



Online Appendix A5: Central themes in evolution of research citing March (1991)

2017		2016		2015		2014		2013		2012	
Theme	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**
firms	100%	firms	100%	firms	100%	innovation	100%	firms	100%	firms	100%
performance	82%	knowledge	83%	exploration	78%	organization	91%	performance	76%	development	70%
exploration	64%	development	79%	innovation	73%	develop	81%	organization	47%	exploration	58%
relationship	47%	exploration	68%	organization	70%	exploration	81%	management	45%	performance	51%
strategic	25%	management	58%	knowledge	54%	firm	71%	strategic	38%	knowledge	50%
market	23%	innovation	50%	development	52%	knowledge	61%	knowledge	31%	management	46%
technological	19%	organization	46%	managers	50%	performance	56%	relationship	27%	process	43%
development	19%	learning	34%	process	40%	strategic	51%	context	12%	organization	27%
ambidexterity	10%	value	27%	strategic	28%	management	47%	external	8%	technological	19%
product	8%	design	22%	network	11%	technology	43%	network	8%	market	15%
levels	8%	dynamic	14%			social	31%	social	6%	business	11%
network	8%	industry	12%			network	16%			context	10%
social	6%	change	11%			value	13%			change	9%
		r&d	8%			change	12%			ambidexterity	8%

2011		2010		2009		2008		2007		2006	
Theme	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**
firms	100%	firms	100%	firms	100%	innovation	100%	firms	100%	firms	100%
organization	45%	innovation	65%	management	64%	development	96%	performance	54%	organization	71%
management	40%	organization	48%	exploration	64%	organization	85%	exploration	53%	performance	55%
exploration	39%	knowledge	45%	strategic	46%	firms	70%	technological	50%	exploration	46%
learning	22%	exploration	36%	innovation	44%	performance	62%	knowledge	45%	management	37%
development	19%	learning	24%	organization	40%	knowledge	49%	learning	40%	knowledge	32%
relationship	14%	role	21%	performance	38%	capabilities	47%	organization	36%	learning	32%
market	14%	management	19%	learning	37%	learning	27%	management	20%	systems	19%
network	9%	business	17%	knowledge	27%	technological	19%	capabilities	20%	relationship	15%
change	5%	value	14%	activities	13%	information	16%	business	18%	exploitation	15%
		market	13%	resources	8%	business	10%	industry	13%	industry	11%
		network	9%	ambidexterity	4%			social	7%	value	11%
		change	9%							social	5%

2005		2004		2003		2002		2001		2000	
Theme	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**
management	100%	organization	100%	organization	100%	organization	100%	organization	100%	organization	100%
organization	97%	firms	74%	firms	72%	management	80%	firms	97%	firms	73%
firms	87%	development	65%	strategic	40%	processes	69%	technological	61%	development	63%
strategic	62%	exploration	59%	technology	40%	firms	51%	strategy	55%	product	51%
performance	52%	technological	49%	exploration	16%	experience	21%	product	47%	competitive	32%
development	51%	strategic	16%	performance	12%	performance	19%	change	41%	context	29%
learning	44%	process	15%	market	12%	practice	12%	exploration	34%	performance	17%
exploration	26%	social	9%	information	11%	capabilities	10%	learning	25%	business	11%
business	12%	future	5%	change	8%	quality	6%	projects	14%	transformation	11%
industry	9%			individual	7%	role	5%	activities	14%	exploration	10%
social	8%			exploitation	5%	strategy	5%	experience	10%	network	6%
				role	5%			exploitation	10%		

1999		1998		1997		1996		1995		1994	
Theme	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**	**Theme**	**Connect.**
organization	100%	knowledge	100%	organization	100%	firms	100%	literature	100%	time	100%
firms	76%	organization	87%	behavior	57%	organization	59%	sequential	14%	firm	91%
process	57%	development	50%	process	39%	technological	45%	process	4%	market	89%
knowledge	38%	management	50%	performance	22%	performance	28%			knowledge	89%
complexity	28%	problem	45%	change	19%	change	14%			organization	60%
performance	27%	processes	40%	insights	9%	innovation	14%			understanding	57%
strategy	25%	mechanisms	38%	rate	4%	competitive	7%			performance	49%
failure	21%	learning	38%	exploration	4%					exploration	45%
management	18%	control	37%							learning	28%
change	13%	technology	18%							product	23%
information	8%	market	14%							attributes	13%
		exploration	10%							exploitation	9%

1993		1992	1991	
Theme	**Connect.**	*insufficient data*	**Theme**	**Connect.**
innovation	100%		exploration	100%
organization	59%		event-history	100%
used	50%		organization	75%
successful	41%		history	75%
rules	38%			
allocation	9%			

Note: Connect. (connectivity) indicates the importance of the respective theme relative to the most central theme.

Note: 2017 data only includes articles published by September.

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