
Dynamic capabilities deconstructed[‡]: a bibliographic investigation into the origins, development, and future directions of the research domain

Giada Di Stefano*, Margaret Peteraf** and Gianmario Verona†

This article uses co-citation analysis to explore the structure of the Dynamic Capabilities research domain, to better understand its origins, current state of development, and future directions. Co-citation analysis reveals the field's 'invisible colleges' and research directions. We find evidence of commonalities as well as polarizing differences among understandings across this research domain, suggesting opportunities and challenges for future research.

1. Introduction

Since the publication of Teece *et al.*'s (1997) seminal work on dynamic capabilities, the topic has become one of the most active research areas in the field of strategic management. In recent years, there has been a sharp rise in working papers, workshops, and conference sessions throughout the world on this topic. Special issues focused on dynamic capabilities, such as this, are beginning to appear in scholarly journals (e.g. Easterby-Smith *et al.*, 2009). Since 2006, articles concerning dynamic

*Giada Di Stefano, Bocconi University, Via Roentgen 1, 20136 Milan, Italy.
e-mail: giada.distefano@unibocconi.it

**Margaret Peteraf, Tuck School of Business at Dartmouth, 100 Tuck Hall, Hanover,
NH 03755, USA. e-mail: margaret.a.peteraf@tuck.dartmouth.edu

†Gianmario Verona, Bocconi University, Via Roentgen 1, 20136 Milan, Italy.
e-mail: gianmario.verona@unibocconi.it

[‡]We use the word 'deconstruct' in its simplest etymological sense, and not in terms of its usage in literary criticism.

capabilities have been published in business and management journals at a rate of more than 100 per year.¹

From the intensity of this research effort and evident interest in the topic, one might surmise that there exists a common understanding of dynamic capabilities. This is far from the case. The construct remains open to a variety of conceptualizations and interpretations concerning even its most basic aspects, including how dynamic capabilities are defined. This lack of accord may seem surprising in light of the definitive nature and strong influence of Teece *et al.*'s (1997) article (with over 1,900 citations by December 2009).

While the variation in understandings has contributed to the richness and vibrancy of the research on dynamic capabilities, it has also created confusion over the meaning and utility of the construct. This has led some to doubt even the existence of dynamic capabilities as more than a fanciful concept, as remarked by Winter (2003). At some point, these issues must be resolved for research in this area to advance further. A lack of clarity concerning basic understandings can limit fruitful conversation, impede progress on the theoretical front, and prevent empirical work from cumulating.

These issues may resolve themselves in time as this research domain evolves. Publication success rates will vary across competing lenses and points of view. Authors whose work is selected more often for inclusion in higher impact journals will be more widely read. Articles that are selected by more authors for citation will have a greater influence over how unresolved questions are settled. The pattern of selection may reveal the outline of the debates in sharper form and the underlying bases for the different positions. Over time, it may indicate the emergence of a consensus and which of the competing lenses and viewpoints is gaining sway. Alternatively, it may suggest that the domain is beginning to split into distinct branches, as researchers develop different aspects of the domain and as lines of thought become more distinctive.

For those striving to make sense of the confusion, it would be useful to apprehend this pattern as it surfaces, since it provides form to an otherwise elusive research frontier. It serves as an indicator of the direction in which the frontier is moving and as a signal of the types of research garnering the most attention. Early notice of how the research domain is taking shape can help researchers cut through the confusion and allocate their efforts towards those that will add the most value and prove most fruitful. Seeing the underlying issues in sharper relief can help them choose a position, refine the arguments, or find opportunities to reconcile differing positions.

Discerning this selection pattern as it emerges, however, poses a challenge. Patterns can be hard to detect and even harder to decipher when a research

¹According to preliminary analysis we performed on the ISI Web of Knowledge database.

domain is in its early stages of development, when the domain is complex, and when it is rapidly changing. For research on dynamic capabilities, its relative immaturity as a field of inquiry, the complexity of the research questions, the breadth of the research community and the frenetic pace at which the research is accumulating all exacerbate the challenge.

In this article, we take on this challenge by employing bibliometric techniques to explore the way in which the scholarly literature on dynamic capabilities has been evolving and taking shape. Bibliometric methods, such as co-citation analysis, bring a level of objectivity and quantifiability to the task that reduces the level of bias inherent in alternative approaches, such as surveys of experts or more traditional literature reviews (Nerur *et al.*, 2008). They help expose the underlying pattern of intellectual activity that gives shape, structure, and direction to the research domain as it develops and evolves.

In the following section, we provide an overview of the method that we employ in our analysis. The section after that is dedicated to a more detailed presentation of our methods and findings. We conclude by commenting on both the limitations of and the insights gained from our investigations, and by identifying the implications of our study for future research.

2. Co-citation analysis: overview of the method

Bibliometrics refers to “the collection, the handling, and the analysis of quantitative bibliographic data, derived from scientific publications” (Veerbek *et al.*, 2002: 181). One of the most common bibliometric techniques is co-citation analysis, a method used to examine relationships among articles or authors contributing to the development of a research field. In recent years, this method has been applied increasingly across a variety of research fields for the purpose of uncovering and articulating their underlying structure. Examples range from a broad examination of the management field (e.g. Ramos-Rodríguez and Ruíz-Navarro, 2004), to the identification of the main trends within particular theoretical perspectives (e.g. Acedo *et al.*, 2006), to the pinpointing of communities of interest within specific topical areas (e.g. Gartner *et al.*, 2006). As these applications suggest, the technique can be employed to discern patterns within a field of endeavor as they emerge, and before they are widely recognized and readily observable otherwise.

In this article, we focus on those contributions to the dynamic capabilities literature recognized as being the most influential, and use co-citation analysis to trace the linkages among them, search for broad research fronts or subfields, and determine the relationships, if any, among the subfields. With multivariate techniques, we expose the “invisible colleges” within the research domain, and map the intellectual structure graphically. Depicting the structure graphically allows us to visualize more

clearly the directions in which the field has been moving, as well as the distances between different pockets of intellectual activity.

2.1 Identifying the core

A critical first step in uncovering the underlying structure of a field is the identification of its intellectual core (McCain, 1990). While this can be based on either contributing authors or published works, we use published articles on dynamic capabilities as our unit of analysis, since the same author may have published in different fields (Acedo *et al.*, 2006). We use citation analysis to identify the intellectual core of research on dynamic capabilities on the assumption that citation counts are a valid measure of prominence and influence. This is a standard assumption for bibliometric analyses (Ramos-Rodríguez and Ruíz-Navarro, 2004).

We based our analysis on the Social Science Citation Index (SSCI) of Thomson-ISI Web of Science over a time span from 1990 to 2007. This database provides bibliographic information for over 1,700 leading scholarly social sciences journals in more than 50 disciplines. Since ISI may take some months to complete data entry at the end of each calendar year, the analysis was performed after the month of April 2008, consistent with previous literature (e.g. Podsakoff *et al.*, 2005).

We began by retrieving all papers that were published in the Business and Management categories of the ISI Web of Science database, with titles, abstracts, or keywords containing the expressions “dynamic capability” or “dynamic capabilities.”² This yielded a set of 371 contributions, all published between 1995 and 2007, 281 of which had at least one citation.³ These were published in a variety of journal categories, indicating that the dynamic capabilities perspective is beginning to diffuse from the strategic management area into fields such as information systems (22 articles, 8.9% of citations), marketing (22 articles, 2.1% of citations) and operations (12 articles, 0.8% of citations).⁴ Within the management area, the journals that ranked highest in terms of number of papers published on the topic are: *Strategic Management Journal* (46 papers with 2,742 citations in total), *Journal of Management Studies* (21 papers with 169 cites), *Academy of Management Review* (15 papers with 397 cites), *Industrial and Corporate Change* (13 papers with 100 cites), and *Organization Science* (12 papers with 313 cites).

²For journals without keywords, Thomson ISI uses KeyWords Plus[®], which are index terms created by Thomson Reuters from significant, frequently occurring words in the titles of an article's cited references.

³While chapters such as Teece and Pisano (1994) and working papers on dynamic capabilities existed before 1995, no journals included in the ISI database published articles on this topic prior to this date.

⁴Indeed, we found an additional 53 articles on dynamic capabilities that were not classified under the Business or Management categories in the Thomson ISI Web of Science database.

To identify the intellectual core of dynamic capability research, we restricted our analysis to the 225 papers published in the field of management, where the concept originated. To this end, we ordered this panel of papers according to the number of times that they have been cited by any type of publication in the ISI database. Previous studies have used subjective criteria to determine a threshold of citation counts for inclusion in the core, such as the 100 most highly cited papers or papers with at least 50 citations (e.g. Ramos-Rodríguez and Ruíz-Navarro, 2004; Acedo *et al.*, 2006). We chose to establish a more objective threshold by including only articles that received a number of citations greater than the average number of citations within our panel (20 citations). This lower threshold (relative to past practices) also counteracts a tendency for citation counts to underweight the impact of newer publications (Brown and Gardner, 1985). Applying this threshold led to the identification of a core set of the 40 most influential contributions, published in 14 different journals. These account for 68.4% of the total number of citations garnered by the entire set of the 371 journal articles published on dynamic capabilities through 2007. The complete list of this “Intellectual Core of Dynamic Capabilities Research” is shown in Table 1.⁵

2.2 Analyzing the structure

Co-citation analysis of documents is used to reveal a field’s underlying structure, in terms of varying degrees of relatedness among the articles defining its intellectual core. It is a method for ascertaining the subject similarity between articles, based on the assumption that if two articles are often cited together, they are related by the broad questions they address, even if they are not in agreement (White and Griffith, 1981). The more often they are cited together, the stronger the relationship and the more likely they belong to the same research front, sometimes referred to as an “invisible college” (Crane, 1972).

The method begins with the retrieval of co-citation frequencies for the set of core articles, and the compilation of these into a raw co-citation matrix. This is a square matrix, with rows and columns representing the articles in the set and cells representing the number of times each pair of documents has been cited together.⁶ The raw co-citation matrix is then converted into a matrix of Pearson’s correlation coefficients. Correlation coefficients represent a measure of similarity between two works. They are preferable to co-citation frequencies, since they make it possible to standardize the data and reduce the number of zeros, thus providing a better basis for subsequent statistical analyses (Rowlands, 1999). The last steps of co-citation

⁵Note that this list omits influential books, monographs, and book chapters, since these types of publications are not readily extracted from the ISI Web of Science database.

⁶We treat the cells of the main diagonal (i.e. the number of times a paper has been cited together with itself) as missing values (White and McCain, 1998).

Table 1 The intellectual core of dynamic capabilities research^a

References	Times cited
Teece, Pisano and Shuen, <i>Strategic Management Journal</i> , 1997, 18(7)	1193
Eisenhardt and Martin, <i>Strategic Management Journal</i> , 2000, 21(11)	470
Zahra and George, <i>Academy of Management Review</i> , 2002, 27(2)	218
Zollo and Winter, <i>Organization Science</i> , 2002, 13(3)	206
Amit and Zott, <i>Strategic Management Journal</i> , 2001, 22(7)	119
Makadok, <i>Strategic Management Journal</i> , 2001, 22(5)	103
Helfat, <i>Strategic Management Journal</i> , 1997, 18(5)	93
Winter, <i>Strategic Management Journal</i> , 2003, 33(2)	82
Mahoney, <i>Journal of Business Research</i> , 1995, 24(10)	81
Benner and Tushman, <i>Academy of Management Review</i> , 2003, 28(2)	81
Helfat and Peteraf, <i>Strategic Management Journal</i> , 2003, 24(10)	76
Wright, Dunford and Snell, <i>Journal of Management</i> , 2001, 27(6)	75
Danneels, <i>Strategic Management Journal</i> , 2002, 23(12)	59
Rindova and Kotha, <i>Academy of Management Journal</i> , 2001, 44(6)	50
Knight and Cavusgil, <i>Journal of International Business Studies</i> , 2004, 35(2)	49
Dutton, Ashford, O'Neill, Hayes and Wierba, <i>Strategic Management Journal</i> , 1997, 18(5)	48
Teece, <i>Long Range Planning</i> , 2000, 33(1)	48
Galunic and Eisenhardt, <i>Academy of Management Journal</i> , 2001, 44(6)	47
Carpenter, Sanders and Gregersen, <i>Academy of Management Journal</i> , 2001, 44(3)	47
Hitt, Ireland, Camp and Sexton, <i>Strategic Management Journal</i> , 2001, 22(7)	44
Helfat, <i>Strategic Management Journal</i> , 2000, 21(11)	38
Madhok, <i>Strategic Management Journal</i> , 2002, 23(6)	38
King and Tucci, <i>Management Science</i> , 2002, 48(2)	38
Aragon-Correa and Sharma, <i>Academy of Management Review</i> , 2003, 28(1)	38
Uhlenbruck, Meyer and Hitt, <i>Journal of Management Studies</i> , 2003, 40(2)	34
Zott, <i>Strategic Management Journal</i> , 2003, 24(2)	31
Jarzabkowski, <i>Organization Studies</i> , 2004, 25(4)	31
Vohora, Wright and Lockett, <i>Research Policy</i> , 2004, 33(1)	31
Rosenbloom, <i>Strategic Management Journal</i> , 2000, 21(11)	29
Miller, <i>Strategic Management Journal</i> , 2003, 24(10)	29
Becker, <i>Industrial and Corporate Change</i> , 2004, 13(4)	27
Jacobides and Winter, <i>Strategic Management Journal</i> , 2005, 26(5)	27
Agarwal, Echambadi, Franco and Sarkar, <i>Academy of Management Journal</i> , 2004, 47(4)	26
Rugman and Verbeke, <i>Strategic Management Journal</i> , 2002, 23(8)	25
Ireland, Hitt and Sirmon, <i>Journal of Management</i> , 2003, 29(6)	24
Zollo and Singh, <i>Strategic Management Journal</i> , 2004, 25(13)	24
Adner and Helfat, <i>Strategic Management Journal</i> , 2003, 24(10)	23
Deeds, DeCarolis and Coombs, <i>Journal of Business Venturing</i> , 2000, 15(3)	22
Luo, <i>Organization Science</i> , 2002, 13(1)	22
Mahoney, <i>Journal of Management</i> , 2001, 27(6)	21

^aIncludes only articles published in Management journals prior to 2008, available in the Thomson-ISI Web of Science database.

analysis involve applying various multivariate techniques to analyze the data, and interpreting the findings.

3. Findings

In this study, we used three techniques often employed in co-citation analyses to assess the structure of a field of research: factor analysis, cluster analysis, and multi-dimensional scaling (MDS) (McCain, 1990).

3.1 *The findings from factor analysis*

Factor analysis is a data reduction method that we use here to classify the core articles into related sets, called factors, by detecting structure on the basis of varying degrees of relatedness among the articles. The factors comprise relatively homogenous groupings of articles that may represent a subfield, research front, or community of interest. Since the results from cluster analysis were quite consistent with those we obtained from factor analysis, we report only the latter here.

We used principal components analysis as the extraction method,⁷ varimax rotation of the extracted factors to interpret the results,⁸ and Kaiser's criterion along with a scree test to determine the number of extracted factors. As shown in Table 2, the analysis resulted in four factors, explaining 94.1% of the variance. The factor loadings represent the correlation between a given article and the factor, or the degree to which the article belongs to that set. Consistent with prior studies (McCain, 1990), we include only factor loadings higher than 0.4, with loadings of 0.7 or greater indicating very high correlation. Loadings of the same article on more than one factor indicate that it is related secondarily to additional factors.

To characterize the factors, we examined the set of contributions loading on each factor for common themes and similarities in subject matter or approach, since this

⁷Principal Component Analysis is based on seeking a linear combination of variables such that the maximum variance is extracted from the variables. It is by far the most common form of factor analysis and it is generally preferred for purposes of data reduction (translating variable space into optimal factor space). Other methods (such as unweighted least squares, generalized least squares, maximum likelihood, principal axis factoring, alpha factoring and image factoring) are less used, except for principal axis factoring which is better suited for causal modeling.

⁸In the choice for rotation methods, orthogonal solutions such as varimax (as used in Acedo *et al.*, 2006) should be preferred when one expects factors to be theoretically independent, whereas oblique rotations such as oblimin (as used in Nerur *et al.*, 2008) should be preferred in the opposite case. We chose the varimax method because we did not want to make an assumption of theoretical dependence. Second, this choice had no impact on the results, which were consistent in terms of factor loading regardless of which types of analysis we employed. However, the component correlation matrix displayed with oblimin rotation showed poor correlation among the four factors, providing further support for our choice of the varimax method.

Table 2 Factor analysis^a

	Foundations and applications	Interrelationships with other theoretical perspectives	Issues of governance structure	Transformation processes and entrepreneurship
Benner and Tushman, 2003	0.953			
Zahra and George, 2002	0.949			
Galunic and Eisenhardt, 2001	0.949			
Danneels, 2002	0.943			
Rindova and Kotha, 2001	0.931			
Vohora <i>et al.</i> , 2004	0.929			
Rosenbloom, 2000	0.921			
Winter, 2003	0.919			
Zott, 2003	0.907			
Zollo and Winter, 2002	0.894			
Teece <i>et al.</i> , 1997	0.893			
King and Tucci, 2002	0.892			
Adner and Helfat, 2003	0.887			
Helfat, 1997	0.866			
Helfat and Peteraf, 2003	0.862			
Luo, 2002	0.856			
Knight and Cavusgil, 2004	0.843	0.485		
Helfat, 2000	0.831	0.491		
Eisenhardt and Martin, 2000	0.828			
Amit and Zott, 2001	0.827	0.523		
Aragon-Correa and Sharma, 2003	0.816	0.471		
Deeds <i>et al.</i> , 2000	0.812	0.474		
Makadok, 2001	0.795	0.539		
Becker, 2004	0.792			
Carpenter <i>et al.</i> , 2001	0.770	0.542		
Miller, 2003	0.746			
Teece, 2000	0.732	0.477		
Zollo and Singh, 2004	0.719		0.542	
Wright <i>et al.</i> , 2001	0.693	0.580		
Dutton <i>et al.</i> , 1997		0.874		
Rugman and Verbeke, 2002	0.434	0.855		
Mahoney, 2001	0.443	0.785		
Agarwal <i>et al.</i> , 2004		-0.776		
Jarzabkowski, 2004	0.608	0.657		
Hitt <i>et al.</i> , 2001	0.476	0.634		0.543
Mahoney, 1995	0.492	0.604		0.489
Jacobides and Winter, 2005			0.894	
Madhok, 2002	0.487	0.465	0.704	
Uhlenbruck <i>et al.</i> , 2003				0.942
Ireland <i>et al.</i> , 2003	-0.416	0.692		

^aExtraction method: principal component analysis with varimax rotation. Variance explained: 94.1%. Only factor loadings higher than 0.4 are reported.

is a key driver of co-citation frequencies. To lessen the problem of subjectivity, the three authors worked independently to characterize each of the factors and then worked together, iteratively, to find the most satisfactory characterizations. In this manner, we labeled the four factors as: (i) Foundations and Applications; (ii) Interrelationships with Other Theoretical Perspectives; (iii) Issues of Governance Structure; and (iv) Transformation Processes and Entrepreneurship.

Factor 1 (Foundations and Applications) comprises what appears to be the structural center of the dynamic capabilities domain. It contains the greatest number of papers in our panel (29 out of 40), and includes those papers most identified with the concept of dynamic capabilities, including Teece *et al.* (1997), Eisenhardt and Martin (2000), Zollo and Winter (2002), as well as Helfat (1997), Makadok (2001), and Winter (2003). It is weighted heavily towards the papers with the greatest number of citations, containing 17 of the 20 most cited papers and encompassing 90.6% of the citation total for the panel. This is indicative of the fact that these are truly foundational papers within the body of dynamic capabilities research.⁹ Papers loading on this factor are concerned largely with defining the construct, articulating the processes by which it evolves and is deployed, and exploring its application as well as its effects. The factor is revelatory of the key issues and concerns within the body of research on dynamic capabilities, including how they function and how they evolve (e.g. Helfat, 2000; Benner and Tushman, 2003; Helfat and Peteraf, 2003). It is suggestive of a pivotal role for managers, both in terms of their own such capabilities and in terms of enabling the creation, exercise, and maintenance of other types of dynamic capabilities (e.g. Carpenter *et al.*, 2001; Makadok, 2001; King and Tucci, 2002; Adner and Helfat, 2003).

Factor 2 (Interrelationships with Other Theoretical Perspectives) seems best characterized in terms of the connections between dynamic capabilities and a key set of other theoretical perspectives in management research. Among the papers loading on this factor, the relationship of dynamic capabilities to the Resource-Based View and its Penrosean roots is most strongly represented (e.g. Mahoney, 1995; Mahoney, 2001; Rugman and Verbeke, 2002). Other linking perspectives include Transaction Cost Economics (Mahoney, 2001), Learning Theory (Mahoney, 1995), Social Theory (Jarzabkowski, 2004), and Social Psychology (Dutton *et al.*, 1997).

This factor is also suggestive of the centrality of certain issues in dynamic capabilities research that are of particular concern to top managers. These include growth (Rugman and Verbeke, 2002), adaptation (Jarzabkowski, 2004), and change processes (Dutton *et al.*, 1997). Like factor 1, this factor highlights some key themes within dynamic capabilities research (e.g. Mahoney, 1995; Hitt *et al.*, 2001), including knowledge and learning (see for instance Romme *et al.*, 2010),

⁹They received 62% of the citations for all the 371 articles dealing with dynamic capabilities that were published prior to 2008 in any of the business and management journals included in the Thomson ISI Web of Science database.

management and decision making (see for instance Kay, 2010), corporate strategy, multinational and global strategy (see for instance Dunning and Lundan, 2010, as well as Pitelis and Teece, 2010).

Among papers loading on factor 2, Agarwal *et al.* (2004) displays a negative load, indicating that it has a reverse co-citation profile with respect to the other papers in the group. This means that it is unlikely to be cited along with other papers in this group, and as such is not really a part of this group. Indeed, results from hierarchical cluster analysis show this article, together with the contribution by Dutton *et al.* (1997), clustered together with the papers loading on factor 4 (Transformation Processes and Entrepreneurship), since they focus respectively on spin-outs (Agarwal *et al.*, 2004) and on issue-selling performed by middle managers and processes of strategic change (Dutton *et al.*, 1997).

Factors 3 and 4 constitute only a minor part of the research on dynamic capabilities, each consisting of only two articles. Factor 3 (Issues of Governance Structure) forms a distinctive set, concerned with the determination of how economic activity is organized and with the location of firm boundaries. It echoes a theme found in factor 2, namely that dynamic capabilities links to both resource-based theory (Wernerfelt, 1984) and transaction cost economics (Williamson, 1975).

Factor 4 (Transformation Processes and Entrepreneurship) includes the contribution by Ireland *et al.*, (2003) dealing with strategic entrepreneurship, and the contribution by Uhlenbruck *et al.*, (2003) on organizational transformation—themes that are central to strategic management and to the notion of dynamic capabilities itself. These papers also highlight another theme of importance to the dynamic capabilities domain—that of seeking out and taking advantage of new opportunities. This is related to themes of exploration and capability exploitation found in some of the foundational papers (e.g. Luo, 2002; Benner and Tushman, 2003).

One of the advantages of factor analysis with respect to other multivariate techniques is that it allows the analyzed objects to load on more than one factor, thus providing an indication of the breadth of the considered contributions. Indeed, the papers having significant but minor loadings on other factors can be seen as bridging different perspectives or subfields within the main research domain (McCain, 1990). In this respect, it is evident that factors 1 and 2 are deeply intertwined: 9 out of the 29 papers loading on factor 1 display a significant secondary loading (greater than 0.4) on factor 2, while five out of the seven papers loading on factor 2 display a significant secondary loading on factor 1. This characteristic becomes even clearer in considering the results of the MDS analysis, discussed in the next section.

3.2 *The findings from MDS*

MDS provides a graphical representation of the similarity, or conceptual proximity, between the objects of our analysis—the panel of 40 papers analyzed (Kruskal

and Wish, 1978). Using Pearson's correlation coefficients, MDS generates a bi-dimensional map, shown in Figure 1, in which the position of each paper on the map depends on its relationship to the other papers in the panel, as perceived by the community of authors citing them.¹⁰ The closer papers appear on the map, the more likely they are to have similar intellectual content.

MDS shows co-citation links among all of the contributions in the panel. Accordingly, papers positioned close to the (0, 0) point have been cited together with a higher number of the 40 contributions than papers positioned near the border of the map. The heterogeneous citation profiles of papers near the center imply that they are linked to many different content areas, or schools of thought. Furthermore, the greater the proximity between papers within a group, the higher the internal consistency of the set of documents, i.e. the tendency to cite these documents together. In this respect, it is worth noticing that most of the papers in Figure 1 tend to be positioned close to the center, as well as close to one another. This indicates the presence of strong ties among the majority of the papers, suggesting that dynamic capabilities research is still in its infancy and has not developed sufficiently for distinct topical streams to have been constituted.

The lines on the map enclosing groups of papers show where the four factors identified earlier are positioned on the map. The position of factor 1 on the map is consistent with our interpretation of this factor as foundational, since it close to the center of the map. The majority of the papers in factor 1 are clustered very tightly together, indicating a similarity of co-citation profiles within the group. This suggests close links in terms of their underlying themes and central concerns. Moreover, there is an equally tight clustering between the majority of the papers loading on factor 2 and those of factor 1. The existence of close ties between these two factors was suggested by the prevalence of bidirectional secondary factor loadings found within these groups. The visual representation of this offered by MDS shows the tightness and significance of these connections. Their interpretation, however, requires a deeper and more fine-grained examination of these contributions.

The axes of the graph also require content-based interpretation. We used the position of the four factors on the map to help with this, but also examined the topical concerns of the papers at the poles of the axes. Our consensus-based interpretation is as follows.

The *x*-axis juxtaposes an internal perspective, focusing on matters inside the organization, with an external perspective, concerned more with markets and matters outside of the firm. This is illustrated on the left side of the map (External), by the position of Agarwal *et al.* (2004), which is on spin-outs, and of the factor 4 papers, both of which concern finding and seizing new opportunities. At the edge of the right

¹⁰The Kruskal's Stress test result of 0.10708 indicates good fit (McCain, 1990). This is confirmed by an R-squared (RSQ) value of 0.98623, where RSQ is the proportion of variance of the scaled data in the matrix that is accounted for by their corresponding distances.

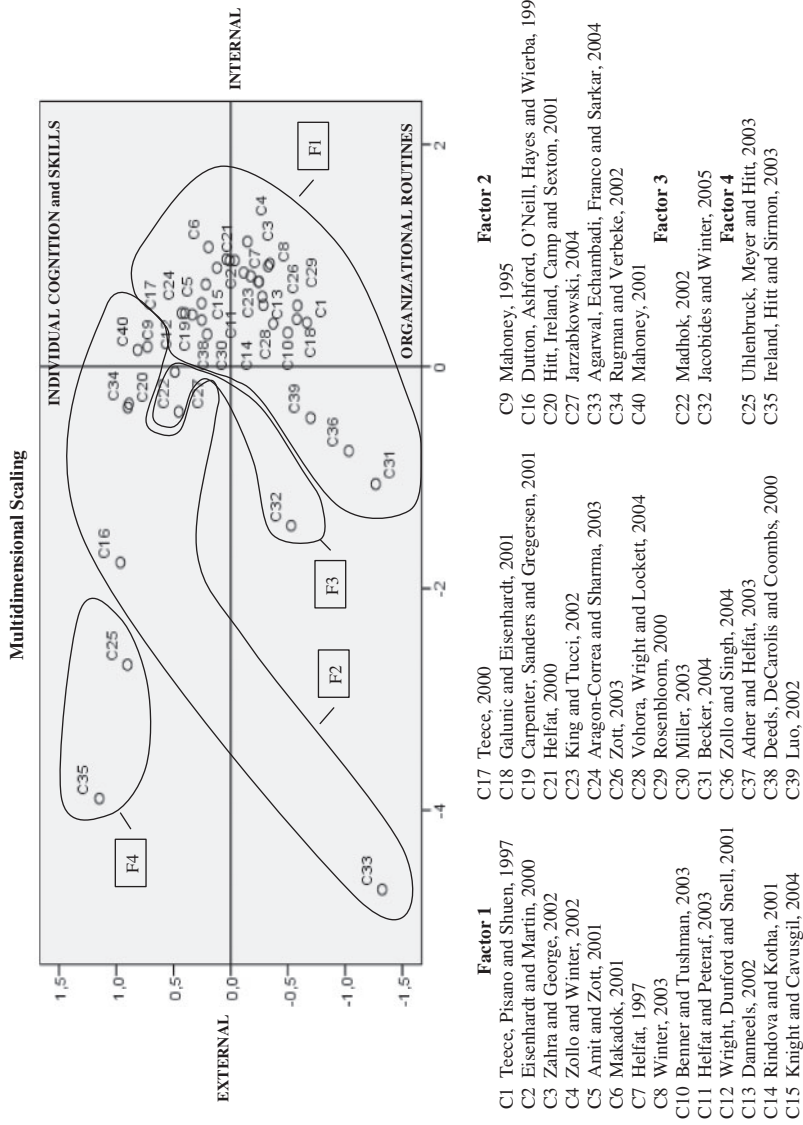


Figure 1 Multidimensional scaling. *Note:* The circles on the map were added by the authors to show where the four factors identified in Table 2 are positioned on the map.

side (Internal), we have papers on internal issues such as organizational learning (Zollo and Winter, 2002), absorptive capacity (Zahra and George, 2002), and rent creation mechanisms (Makadok, 2001). Fittingly, we find the majority of papers within the core of dynamic capabilities to be focused on internal matters. This is not unexpected, given the nature of dynamic capabilities and the need to understand the processes involved in creating, deploying, and maintaining them.

The y-axis represents a continuum going from individual cognition and skills, with a stronger focus on the role played by managers and entrepreneurs (e.g. Dutton *et al.*, 1997; Ireland *et al.*, 2003), to organizational routines, with more attention to the organization, its competences, and routinized activities (e.g. Becker, 2004; Zollo and Singh, 2004), as we move from the top to the bottom of the graph. A more far-reaching interpretation of this graph is that it may suggest a possible development path for dynamic capabilities, as it expands beyond the limiting boundaries of its current clusters. Teece's (2007) recent paper on the microfoundations of dynamic capabilities and his forthcoming special issue on a similar theme (Lovallo *et al.*, *Strategic Management Journal*, forthcoming) suggest some movement in the direction of the individual manager. The attention given to the topics of growth, markets, and alliances in Helfat *et al.*'s (2007) recent book on dynamic capabilities suggests a potential for more research on the external.

4. Conclusions

In this article, we have taken on the challenge of detecting and deciphering the pattern of evolution of the rapidly emerging domain of dynamic capabilities. In this respect, we have tried to shed light on some of the difficult yet crucial questions posed by 10 years of research on the topic. To this aim, we employed a combination of techniques that helped us make sense of how the literature in this area is developing and taking shape.

Our study is subject to the limitations of bibliometric analysis, which is typically conservative in nature, since citations of published articles are a lagging indicator of a contribution's influence (Brown and Gardner, 1985).¹¹ In addition, our method ignores the influence of book chapters and books (e.g. Fujimoto, 2000; Helfat *et al.*, 2007).

To address the first issue, we included papers with citation numbers that exceeded the average for articles on dynamic capabilities. Since this literature is relatively

¹¹Previous literature has thoroughly discussed other possible limitations related to the use of citations, such as perfunctory mentions, citations that are incorrectly employed, and citations aimed at pleasing potential reviewers (see, for instance, Baumgartner and Pieters, 2003). Still, if compared to alternative techniques (such as key informants' judgements), citations are less prone to systematic biases in providing an objective assessment of the influence of publications or authors (Baumgartner and Pieters, 2003).

young, this allowed the influence of newer publications to surface, while still providing sufficient time for evidence to accumulate.

By unveiling the patterns underlying dynamic capabilities research, we contribute to the future development of the construct in a number of ways. As a research domain still in its early stages of development, it remains tightly focused on foundational issues, as we have shown. Our research suggests some ways to expand beyond these issues. By mapping the network of topical connections and identifying content-oriented dimensions, we find potential avenues of expansion and enrichment. By uncovering central themes within the research, we find key areas of application. These provide some clues not only about where the concept is likely to have the greatest utility, but also about the kinds of settings where dynamic capabilities are most likely to be found. This type of knowledge is critical for empirical work, since investigating the existence and deployment of dynamic capabilities depends upon looking in the right places.

By exposing the underlying intellectual structure of the field, our findings may promote a greater understanding of differences, the resolution of conflict, the development of a clearer and more uniform conception of dynamic capabilities, and a research agenda capable of exploiting the complementarities available from a combination of perspectives.

References

- Acedo, F. J., C. Barroso and J. L. Galan (2006), 'The resource-based theory: dissemination and main trends,' *Strategic Management Journal*, **27**(7), 621–636.
- Adner, R. and C. E. Helfat (2003), 'Corporate effects and dynamic managerial capabilities,' *Strategic Management Journal*, **24**(10), 1011–1025.
- Agarwal, R., R. Echambadi, A. M. Franco and M. B. Sarkar (2004), 'Knowledge transfer through inheritance: spinout generation, development, and survival,' *Academy of Management Journal*, **47**(4), 501–522.
- Amit, R. and C. Zott (2001), 'Value creation in E-business,' *Strategic Management Journal*, **22**(7), 493–520.
- Aragon-Correa, J. A. and S. Sharma (2003), 'A contingent resource-based view of proactive corporate environmental strategy,' *Academy of Management Review*, **28**(1), 71–88.
- Baumgartner, H. and R. Pieters (2003), 'The structural influence of marketing journals: a citation analysis of the discipline and its sub areas over time,' *Journal of Marketing*, **67**, 123–139.
- Becker, M. C. (2004), 'Organizational routines: a review of the literature,' *Industrial and Corporate Change*, **13**(4), 643–677.
- Benner, M. J. and M. L. Tushman (2003), 'Exploitation, exploration, and process management: the productivity dilemma revisited,' *Academy of Management Review*, **28**(2), 238–256.

- Brown, L. D. and J. C. Gardner (1985), 'Using citation analysis to assess the impact of journals and articles on contemporary accounting research (CAR),' *Journal of Accounting Research*, **23**, 84–109.
- Carpenter, M. A., W. G. Sanders and H. B. Gregersen (2001), 'Bundling human capital with organizational context: the impact of international assignment experience on multinational firm performance and CEO pay,' *Academy of Management Journal*, **44**(3), 493–511.
- Crane, D. (1972), *Invisible Colleges: Diffusion of Knowledge in Scientific Communities*. University of Chicago Press: Chicago, IL.
- Danneels, E. (2002), 'The dynamics of product innovation and firm competences,' *Strategic Management Journal*, **23**(12), 1095–1121.
- Deeds, D. L., D. DeCarolis and J. Coombs (2000), 'Dynamic capabilities and new product development in high technology ventures: an empirical analysis of new biotechnology firms,' *Journal of Business Venturing*, **15**(3), 211–229.
- Dunning, J. H. and S. M. Lundan (2010), 'The institutional origins of dynamic capabilities in multinational enterprises,' *Industrial and Corporate Change*, **19**(4), 1225–1246.
- Dutton, J. E., S. J. Ashford, R. M. O'Neill, E. Hayes and E. E. Wierba (1997), 'Reading the wind: how middle managers assess the context for selling issues to top managers,' *Strategic Management Journal*, **18**(5), 407–423.
- Easterby-Smith, M., M. Lyles and M. Peteraf (eds), (2009), 'The practice of dynamic capabilities,' *British Journal of Management Special Issue*, **20**(Supplement 1), s1–s8.
- Eisenhardt, K. M. and J. Martin (2000), 'Dynamic capabilities: what are they?' *Strategic Management Journal*, **21**(10–11), 1105–1121.
- Fujimoto, T. (2000), 'Evolution of manufacturing systems and ex post dynamic capabilities: A case of Toyota's final assembly operations,' in G. Dosi, R. Nelson and S. G. Winter (eds), *The Nature and Dynamics of Organizational Capabilities*. Oxford University Press: Oxford, UK, pp. 244–280.
- Galunic, D. and K. M. Eisenhardt (2001), 'Architectural innovation and modular corporate forms,' *Academy of Management Journal*, **44**(6), 1229–1249.
- Gartner, W. B., P. Davidsson and S. A. Zahra (2006), 'Are you talking to me? The nature of community in entrepreneurship scholarship,' *Entrepreneurship Theory and Practice*, **30**(3), 321–331.
- Helfat, C. E. (1997), 'Know-how and asset complementarity and dynamic capability accumulation,' *Strategic Management Journal*, **18**(5), 339–360.
- Helfat, C. E. (2000), 'Guest editor's introduction to the special issue: the evolution of firm capabilities,' *Strategic Management Journal*, **21**(10–11), 955–960.
- Helfat, C. E., S. Finkelstein, W. Mitchell, M. A. Peteraf, H. Singh and S. G. Winter (2007), *Dynamic Capabilities: Understanding Strategic Change in Organizations*. Blackwell Publishing Malden: MA.
- Helfat, C. E. and M. A. Peteraf (2003), 'The dynamic resource-based view: capability lifecycles,' *Strategic Management Journal*, **24**(10), 997–1010.

- Hitt, M. A., R. D. Ireland, S. M. Camp and D. L. Sexton (2001), 'Guest editors' introduction to the special issue – strategic entrepreneurship: entrepreneurial strategies for wealth creation,' *Strategic Management Journal*, **22**(7), 479–491.
- Ireland, R. D., M. A. Hitt and D. G. Sirmon (2003), 'A model of strategic entrepreneurship: the construct and its dimensions,' *Journal of Management*, **29**(6), 963–989.
- Jacobides, M. G. and S. G. Winter (2005), 'The co-evolution of capabilities and transaction costs: explaining the institutional structure of production,' *Strategic Management Journal*, **26**(5), 395–413.
- Jarzabkowski, P. (2004), 'Strategy as practice: recursiveness, adaptation, and practices-in-use,' *Organization Studies*, **25**(4), 529–560.
- Kay, N (2010), 'Dynamic capabilities as context: the role of decision, system and structure,' *Industrial and Corporate Change*, **19**(4), 1205–1223.
- King, A. A. and C. L. Tucci (2002), 'Incumbent entry into new market niches: the role of experience and managerial choice in the creation of dynamic capabilities,' *Management Science*, **48**(2), 171–186.
- Knight, G. A. and S. T. Cavusgil (2004), 'Innovation, organizational capabilities, and the born-global firm,' *Journal of International Business Studies*, **35**(2), 124–141.
- Kruskal, J. B. and M. Wish (1978), *Multidimensional Scaling*. Sage: Beverly Hills.
- Lovullo, D., T. C. Powell, C. R. Fox and D. J. Teece, 'Psychological foundations of strategic management,' *Strategic Management Journal Special Issue*. forthcoming.
- Luo, Y. D. (2002), 'Capability exploitation and building in a foreign market: Implications for multinational enterprises,' *Organization Science*, **13**(1), 48–63.
- Madhok, A. (2002), 'Reassessing the fundamentals and beyond: Ronald Coase, the transaction cost and resource-based theories of the firm and the institutional structure of production,' *Strategic Management Journal*, **23**(6), 535–550.
- Mahoney, J. T. (1995), 'The management of resources and the resources of management,' *Journal of Business Research*, **33**(2), 91–101.
- Mahoney, J. T. (2001), 'A resource-based theory of sustainable rents,' *Journal of Management*, **27**(6), 651–660.
- Makadok, R. (2001), 'Toward a synthesis of the resource-based and dynamic-capability views of rent creation,' *Strategic Management Journal*, **22**(5), 387–401.
- McCain, K. W. (1990), 'Mapping authors in intellectual space: a technical overview,' *Journal of the American Society for Information Science*, **41**(6), 433–443.
- Miller, D. (2003), 'An asymmetry-based view of advantage: towards an attainable sustainability,' *Strategic Management Journal*, **24**(10), 961–976.
- Nerur, S. P., A. A. Rasheed and V. Natarajan (2008), 'The intellectual structure of the strategic management field: an author co-citation analysis,' *Strategic Management Journal*, **29**, 319–336.

- Pitelis, C. and D. J. Teece (2010), 'Cross-border market co-creation, dynamic capabilities and the entrepreneurial theory of the multinational enterprise,' *Industrial and Corporate Change*, **19**(4), 1247–1270.
- Podsakoff, P. M., S. B. MacKenzie, D. G. Bachrach and N. P. Podsakoff (2005), 'The influence of management journals in the 1980s and 1990s,' *Strategic Management Journal*, **26**(5), 473–488.
- Ramos-Rodríguez, A. R. and J. Ruíz-Navarro (2004), 'Changes in the intellectual structure of strategic management research: a bibliometric study of the Strategic Management Journal, 1980–2000,' *Strategic Management Journal*, **25**(10), 981–1004.
- Rindova, V. P. and S. Kotha (2001), 'Continuous “morphing”: competing through dynamic capabilities, form, and function,' *Academy of Management Journal*, **44**(6), 1263–1280.
- Romme, A. G. L., M. Zollo and P. Berends (2010), 'Dynamic capabilities, deliberate learning and environmental dynamism: a simulation model,' *Industrial and Corporate Change*, **19**(4), 1271–1299.
- Rosenbloom, R. S. (2000), 'Leadership, capabilities, and technological change: the transformation of NCR in the electronic era,' *Strategic Management Journal*, **21**(11), 1083–1103.
- Rowlands, I. (1999), 'Patterns of author co-citation in information policy: evidence of social, collaborative and cognitive structure,' *Scientometrics*, **44**(3), 533–546.
- Rugman, A. M. and A. Verbeke (2002), 'Edith Penrose's contribution to the resource-based view of strategic management,' *Strategic Management Journal*, **23**(8), 769–780.
- Teece, D. J. (2000), 'Strategies for managing knowledge assets: the role of firm structure and industrial context,' *Long Range Planning*, **33**(1), 35–54.
- Teece, D. J. (2007), 'Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance,' *Strategic Management Journal*, **28**(13), 1319–1350.
- Teece, D. J. and G. Pisano (1994), 'The dynamic capabilities of firms: an introduction,' *Industrial and Corporate Change*, **3**(3), 537–556.
- Teece, D. J., G. Pisano and A. Shuen (1997), 'Dynamic capabilities and strategic management,' *Strategic Management Journal*, **18**(7), 509–533.
- Uhlenbruck, K., K. E. Meyer and M. A. Hitt (2003), 'Organizational transformation in transition economies: resource-based and organizational learning perspectives,' *Journal of Management Studies*, **40**(2), 257–282.
- Veebek, A., K. Debackere, M. Luwel and E. Zimmerman (2002), 'Measuring progress and evolution in science and technology – I: the multiple uses of bibliometric indicators,' *International Journal of Management Reviews*, **4**(2), 179–211.
- Vohora, A., M. Wright and A. Lockett (2004), 'Critical junctures in the development of university high-tech spinout companies,' *Research Policy*, **33**(1), 147–175.
- Wernerfelt, B. (1984), 'A resource-based view of the firm,' *Strategic Management Journal*, **5**(2), 171–180.
- White, H. D. and B. C. Griffith (1981), 'Author co-citation: a literature measure of intellectual structure,' *Journal of the American Society for Information Science*, **32**, 163–171.

- White, H. D. and K. W. McCain (1998), 'Visualizing a discipline: an author co-citation analysis in information science, 1992-1995,' *Journal of the American Society for Information Science*, **49**, 326–356.
- Williamson, O. E. (1975), *Markets and Hierarchies*. Free Press: New York, NY.
- Winter, S. G. (2003), 'Understanding dynamic capabilities,' *Strategic Management Journal*, **33**(2), 91–101.
- Wright, P. M., B. B. Dunford and S. A. Snell (2001), 'Human resources and the resource based view of the firm,' *Journal of Management*, **27**(6), 701–721.
- Zahra, S. A. and G. George (2002), 'Absorptive capacity: a review, reconceptualization and extension,' *Academy of Management Review*, **27**(2), 185–203.
- Zollo, M. and S. G. Winter (2002), 'Deliberate learning and the evolution of dynamic capabilities,' *Organization Science*, **13**, 339–351.
- Zollo, M. and H. Singh (2004), 'Deliberate learning in corporate acquisitions: post-acquisition strategies and integration capability in US bank mergers,' *Strategic Management Journal*, **25**(13), 1233–1256.
- Zott, C. (2003), 'Dynamic capabilities and the emergence of intra industry differential firm performance: insights from a simulation study,' *Strategic Management Journal*, **24**(2), 97–125.