The Evolution of Dynamic Capabilities in OM

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The dynamic capability view (DCV) has gained attraction in many areas of business administration. This article aims to analyze the evolution of the dynamic capability view (DCV) theory within the operations and supply chain field. In this article, we use author co-citation, term co-occurrence, and topic modeling techniques to uncover the evolution of DCV in operations and supply chain management areas. The analysis was performed on 166 peer-reviewed articles from the top four operations management (OM) journals. The study finds the prominent authors co-cited together along with the representative topics in these papers. Furthermore, newer topics, such as supply chain resilience and dynamic-based capabilities, such as data analytics capabilities, are gaining prominence. Finally, the future research agenda is discussed along with the limitations of the paper.

Keywords: author co-citation, term co-occurrence, topic modeling, dynamic capability view, data analytics capabilities

INTRODUCTION & LITERATURE REVIEW

Operations management and supply chain management are well-known management functions that add value through efficiency and effectiveness, thereby enhancing a firm's competitive advantage. The importance of operations and supply chain management was amplified and shown in the most recent COVID-19 pandemic, where rampant supply chain disruptions created huge complications and chaos in modern-day society (Moosavi et al., 2022).

Operations management is a field that borrows concepts from other disciplines, such as strategic management and information systems. Researchers commonly use theories from strategic management to explain their hypotheses. One commonly used strategic management theory is the dynamic capabilities

view (DCV), which explains how firms can achieve sustained competitive advantage in dynamic business environments.

Achieving and sustaining competitive advantage is key to survival in today's fast and dynamic business environment. One of the widely cited theories towards this direction in the early 90's was the firm's resource-based view (RBV) (Barney, 1991). RBV explains that firms achieve sustained competitive advantage by virtue of possessing capabilities and resources that are valuable, rare, inimitable, and non-substitutable. Since then, numerous scholars have utilized RBV to explain variability in firm performances (Singh et al., 2018). Though RBV provides a good framework for firms on how to get sustained competitive advantage, it also suffers from a few limitations (Priem & Butler, 2001). Some of these include the low probability of a firm possessing resources that meet all criteria specified in RBV, and the fact that acquiring these firm-specific resources and maintaining these resources and capabilities over time should be considered (Helfat et al., 2003). Furthermore, acquiring firm specific assets that aid in maintaining a competitive edge over time might not be applicable in dynamic business environments.

The dynamic capabilities view of the firm was introduced to address the limitations of RBV and introduce a new theory to address more dynamic business environments. Teece et al. (1997) defined dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments." Dynamic capabilities consider the dynamic aspect of business environments and the capabilities aspect that lead the organization to sustained competitive advantage by strategically aligning organizational goals. One of the earlier papers that helped explain DCV was Eisenhardt & Martin (2000), where the authors explained certain processes as dynamic capabilities and distinguished the dynamic capabilities required for moderately dynamic to high-velocity markets.

Since the development of DCV, academic research scholars have written a variety of articles exploring, defining, and distinguishing dynamic capabilities from other forms of capabilities (Wang & Ahmed, 2007). DCV has also been widely applied in strategic management empirical studies with firm performance (market-based or financial performance) as the leading outcome variable. Laaksonen & Peltoniemi (2018) argued that dynamic capabilities cannot explain performance but can rather explain changes in performance.

Within operations & supply chain management, the RBV has primarily been utilized in capabilities-based research (Wu et al., 2010). The literature mentions some research articles that review the DCV and make recommendations, such as the study by Bititci et al. (2011) that help understand the managerial processes that develop dynamic capabilities. Empirical studies such as the one by Cepeda & Vera (2007) examined the relationship between dynamic and operational capabilities.

Singh et al (2018) examined the use of DCV in operations & supply chain management in 2 leading journals, Journal of Operations Management and Management Science using a qualitative methodology. The authors identified 3 research disciplines and topics within the articles studied: Operations Management, Supply Chain Methodology, and Strategic Management. Some of the research topics identified included Enterprise resource planning (ERP), Quality management, Supply chain capabilities, Supply chain integration capability, and macro and micro dynamic capabilities. The authors also highlighted some future high-potential research areas, such as distinguishing between operational dynamic capabilities, the lack of longitudinal studies, and including more DCV-based studies in the service sector.

The operations & supply chain management literature has been analyzed using qualitative and quantitative methodologies. In recent years, the literature on OM was analyzed by Pilkington & Meredith (2009) utilizing a citation/co-citation study on a basket of 3 leading OM journals from 1980 to 2006. The paper identified 12 primary knowledge groups in the field and their evolution over the years. Some of the knowledge groups Pilkington & Meredith (2009) identified include Resource-based view and manufacturing strategy. More recently, Kurian (2019) utilized Author Co-Citation Analysis along with topic modeling to explain the evolution of OM over the time period of 1997 to 2017. Some of the research topics Kurian (2019) identified include Strategy and cognition, Sustainable Operations, Healthcare Analytics, Psychology and behavioral Operations, and Health Analytics. This paper showcased how newer research topics were introduced in the field of OM over the years. Seyedghorban et al (2022) employed a document co-citation analysis utilizing research papers from 31 journals to highlight the past and future directions in

operations & supply chain management. In the study by Seyedghorban et al (2022), strategy research represented 9% of all co-citations. Within the strategy research, 63% accounted for Resource-Based View (RBV), Knowledge-Based View (KBV), and Dynamic Capabilities View (DCV). Furthermore, a search on DCV in Google Scholar yielded more than 5 million results, highlighting the significance and popularity of the theory. These results motivated us to pursue the exploration of DCV in OM & SCM further.

Our study employs Author Co-Citation Analysis, Term Co-Occurrence maps, and Topic Modelling to provide deeper insights by:

- Generating clusters of related (commonly co-cited) authors that are useful in deciphering central research themes/disciplines.
- Identifying highly influential authors.
- Developing the network of important authors and corresponding relationships.
- Generating the keywords inferred from the corpus and their co-occurrence relationships.
- Developing important latent topics along with their associated terms from the text corpus and showcase how these topics evolve over time.

A quantitative analysis was chosen as these techniques together incorporate the actual data and generate topics. ACA coupled with textual analytic techniques gives a unique outlook of the prominent research topics and how these have evolved over time.

METHODOLOGY

Journal Selection

Journal selection is a key step in the methodology as narrowing down the list of journals relevant to a study is essential in obtaining results that can be generalized and applied in future research. As a starting point, only journals in supply chain & operations management listed "A" or higher according to the Australian Business Deans Council Journal Quality List (*ABDC List*, 2023) were considered for this study. Journal of Operations Management, Production & Operations Management, and International Journal of Operations & Production Management were included as traditional OM journals (Kurian, 2019) with a rich history of publishing strategic management-related articles, including those utilizing DCV as a theoretical framework. Management science was also added to this list as it is a leading journal in the field of management science, including operations & Supply chain management (Singh et al., 2018). The final basket of journals is comprised of *Journal of Operations Management (JOM), Management Science (MS), Production and Operations Management (POM), and International Journal of Operations & Production Management (IJPM).* The journal selection process and the final basket of four journals were also validated by three academic experts in the field of operations & supply chain management, thus providing credence to the journal selection process. The database Web of Science was used to collect the data required for the analyses. Web of Science is a database that provides abstracts, titles, cited references, etc. for research papers, and is widely used by researchers for bibliometric analyses. The keywords used were "Dynamic Capability" (OR) "Dynamic Capabilities." The list of keywords was selected to encompass all papers that utilize the dynamic capabilities framework. The keywords list was further validated by consulting three academic experts in operations and supply chain management. The database yielded 100354 articles with the selected keywords.

Utilizing a keyword strategy leads to a high raw data count as the database collects all articles having any part of the keyword used (Kapoor et al., 2017). Further filtering and refining of the raw data are required to get the final dataset specific to each research project. As part of further refining, published articles filtered the dataset, bringing the article count down to 70726 articles. Furthermore, the data was filtered down to the basket of 4 selected journals and the years 2000-2022, bringing the article count to 168 articles. 2 empty abstracts were removed, resulting in the final dataset of 166 articles. Finally, all the authors reviewed the selected articles to ensure that all these utilize DCV. The 166 articles with all relevant fields, including abstract and cited references, form the text corpus.

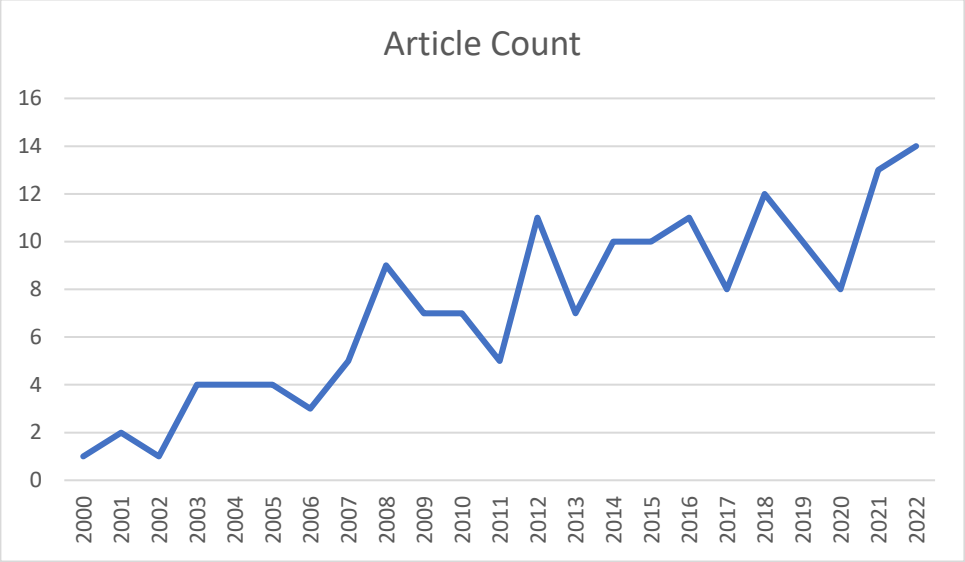
Even though the dynamic capabilities framework was introduced in 1997, the year 2000 was used as the starting point of the time series because it takes a few years for a theory to mature and gain prominence

(Singh et al., 2018). As the data was collected in mid-2023, the ending point was kept as 2022 to get the full set of articles for each year and maintain consistency in data. The filtering and refining of research articles were based on the systematic review guidelines that Page et al (2021) recommended. The column "CR" comprising cited references was utilized in Author Co-Citation Analysis, and the column "AB" comprising abstracts was utilized in term co-occurrence map and topic modeling.

Descriptive Analysis

A time-series chart was plotted to showcase the number of selected articles against the years of publication (2000-2022).

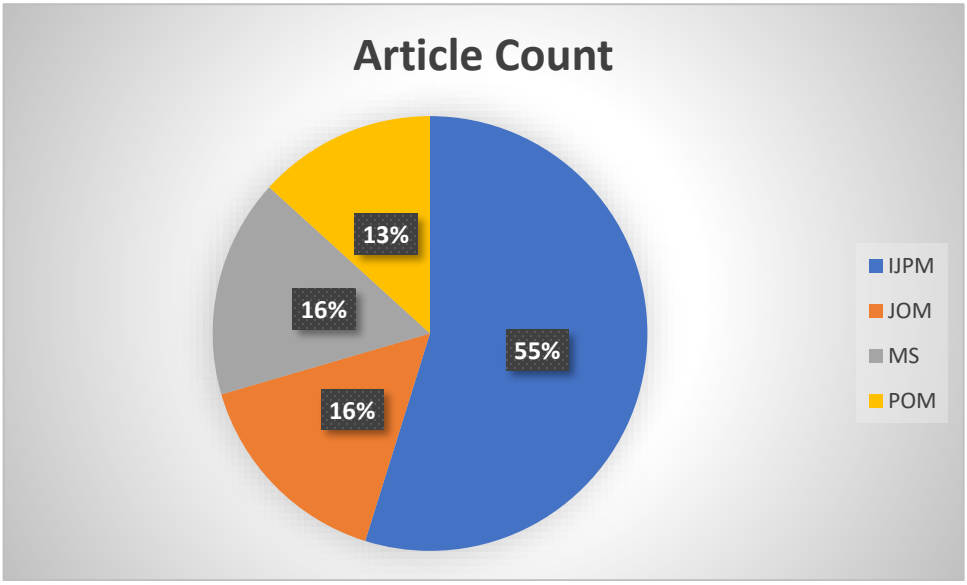
FIGURE 1
TIME-SERIES CHART, ARTICLE COUNT VS YEAR



The chart (Figure 1) depicted a cyclical pattern with a steep increase in the number of articles utilizing the DCV published in the 2020's.

A pie chart (Figure 2) was plotted to show the distribution of the selected articles among the 4 journals. Out of the 166 papers, 91 (55%) were published in IJPM, followed by 27 articles in MS (16%), 26 articles (16%) in JOM and 22 articles (13%) in POM. This indicates that most of the dynamic capability-based papers during the 23-year period were published in IJPM.

FIGURE 2
PIE CHART. ARTICLE COUNT (%) BY JOURNAL



Author Co-Citation Analysis (ACA)

Co-citation can be best explained as a measure of the relationship between two documents (Small, 1973). It is a bibliographic coupling measure that can use documents or authors as the unit of analysis. In simple terms, co-citation occurs when 2 papers are commonly cited by other papers. The higher the number of papers co-cited by other papers, the higher the co-citation strength between them.

Author Co-Citation Analysis (ACA) uses the first author as the unit of analysis. Similar to document co-citation, when other authors commonly cite the first authors of papers, co-citation occurs. The higher the number of first authors co-cited by other authors, the higher their co-citation strength. When other authors commonly cite authors, there is a higher probability that the authors who commonly cite the same paper will be working on the same or similar research themes. For example, when 2 authors cite the seminal newsvendor authors Schweitzer & Cachon (2000) in behavioral operations management, the chances are high that the 2 citing authors are based in the field of behavioral operations management. On checking the bibliography of research papers that publish articles in the same/similar fields, we notice the pattern of authors commonly citing other authors, and this is the central concept in ACA that facilitates identifying common research themes.

Citation/Co-Citation studies have been widely used in the past few decades to unravel conceptual themes and the interrelationships between these in various disciplines (Kurian, 2019). ACA was used to study the intellectual evolution of strategic management by identifying influential authors and how their influence changed over time (Nerur et al., 2008). ACA was also utilized in the field of information systems by Dwivedi & Nerur (2017) to unravel research themes in the thriving field of business analytics. In the field of operations management, citation/co-citation study was used by Pilkington & Meredith (2009) to study the growth of the field of operations management over the years 1980-2006, and ACA was used to study the evolution of the field of operations management over the period 1997-2017 to account for important changes that took place in the field of OM (Kurian, 2019).

More recently, co-citation analysis has been used in fields such as online learning (Park & Shea, 2020), digitalization capabilities (Annarelli et al., 2021), and Artificial Intelligence supported e-learning (Tang et al., 2023).

The input data utilized for ACA is the Author Co-Citation matrix (Table 1). This matrix shows the number of times a pair of authors are commonly cited by other authors. The co-citation matrix is in a format suitable for ACA clustering and pathfinder analysis.

TABLE 1
AUTHOR CO-CITATION MATRIX

	Author 1	Author 2
Author 1		20
Author 2	20	

ACA Clusters

The software VOSviewer (van Eck & Waltman, 2011) was utilized for ACA. The column "CR" showing the cited references of the 166 selected papers was utilized, and only the first authors were selected for ACA.

In ACA, highly cited and influential lead authors are selected, as they play a central role in the growth of the field. In VOSviewer, under Co-Citation, the unit of analysis was selected as Cited authors (first authors only). As co-citation studies typically focus on around 50 leading authors in the field, the minimum citation count was kept at 20, bringing the number of selected authors to 55 (Table 2).

TABLE 2
SELECTED AUTHORS FOR ACA

Author	Citations
adner, r	20
anand, g	21
anderson, jc	26
argote, l	30
armstrong, js	28
barney, j	44
barney, jb	26
benner, mj	25
boyer, kk	45
choi, ty	26
christopher,m	21
cohen, wm	28
dubey, r	21
dyer, jh	36
eisenhardt,km	94
flynn, bb	39
fornell, c	43
gebauer, h	26
gligor, dm	21
grant, rm	42
gulati, r	22
gunasekaran,a	21
hair, jf	26
hayes, rh	30
helfat, ce	69
hendricks, kb	31
hitt, ma	25
hult, gtm	21
ketchen, dj	20

kogut, b	32
lee, hl	36
march, jg	26
miller, d	31
narasimhan, r	32
nelson, rr	26
nonaka, i	25
penrose, e	21
podsakoff,pm	49
porter, me	46
prahalad, ck	20
rosenzweig,ed	28
roth, av	26
rothaermel, ft	23
shah, r	25
skinner, w	28
swink, m	24
teece, dj	168
tushman, ml	21
wamba, sf	22
ward, pt	30
wernerfelt, b	32
williamson,oe	31
winter, sg	35
zahra, sa	25
zollo, m	32

Utilizing the selected 55 authors and the resultant co-citation matrix as input, VOSviewer generated 4 distinct co-citation clusters (Figure 3). Authors who are commonly co-cited are clustered together. Within the clusters generated, authors with higher citations are represented in larger circles. VOSviewer utilizes a hierarchical classification and an optimization algorithm to generate these distinct co-citation clusters (Waltman & Jan Van Eck, 2012).

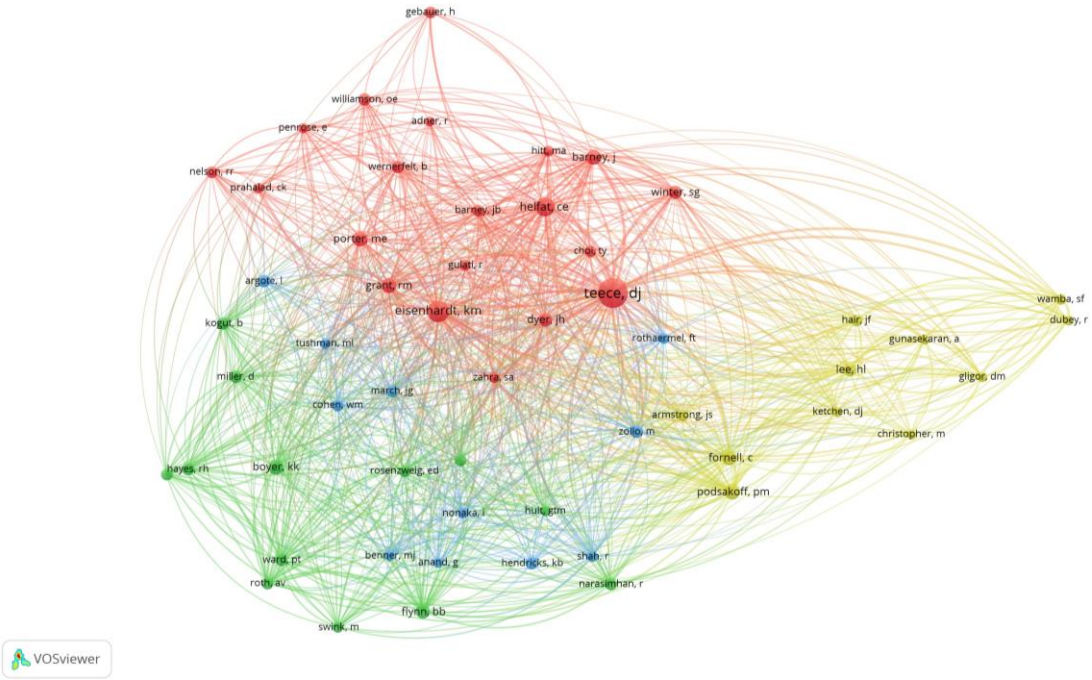
The clusters generated by VOSviewer can be interpreted as follows:

- Cluster 1 Strategic Management: Cluster 1 includes David J Teece, who wrote the seminal research article on dynamic capabilities (Teece et al., 1997). Other prominent authors include Kathleen M Eisenhardt whose research interests lie in the field of strategy and cognition; Michael Porter, who focuses on strategy, competition, and economic development, and Jay Barney who wrote the seminal research article on the resource-based view of the firm (Barney, 1991). Due to the authors' common interest in strategic management, Cluster 1 was named strategic management.
- Cluster 2 Operations & Supply Chain Strategy Cluster 2 includes authors such as Ken Boyer whose research interests are in operations strategy, supply chain management, Barbara Flynn who is involved in operations strategy, quality management, etc. Other prominent authors include Ram Narasimhan who works in the field of buyer-supplier relationships, operations strategy, etc. Based on the common research topics exhibited by the authors, Cluster 2 was named Operations & Supply Chain Strategy.
- Cluster 3 Operations Technology & Research Methods: Cluster 3 comprises authors such as Hau Lee who works in the field of Supply chain management, value chain innovations, and information technology, Angappa Gunasekaran who is in the field of Operations management

and technology management, Philip Podsakoff whose research interests are in the areas of organizational behavior and organizational research method, Claes Fornell who works in customer satisfaction and marketing. Due to the interdisciplinary nature of this cluster, Cluster 3 was labelled as Operations technology and Research Methods.

– Cluster 4 Operations & Economics: This cluster is difficult to interpret as it is intertwined with other clusters. Prominent authors in this cluster include authors such as Kevin Hendricks whose research interests are in the field of supply chain & operations management, operations strategy, and econometrics; Morris A. Cohen who works in the field of manufacturing/logistics, global operations strategy, and James G March whose research interests lies in the field of organizational learning and economics. Based on the diverse nature of the topics represented in cluster 4, the cluster was named Operations & Economics.

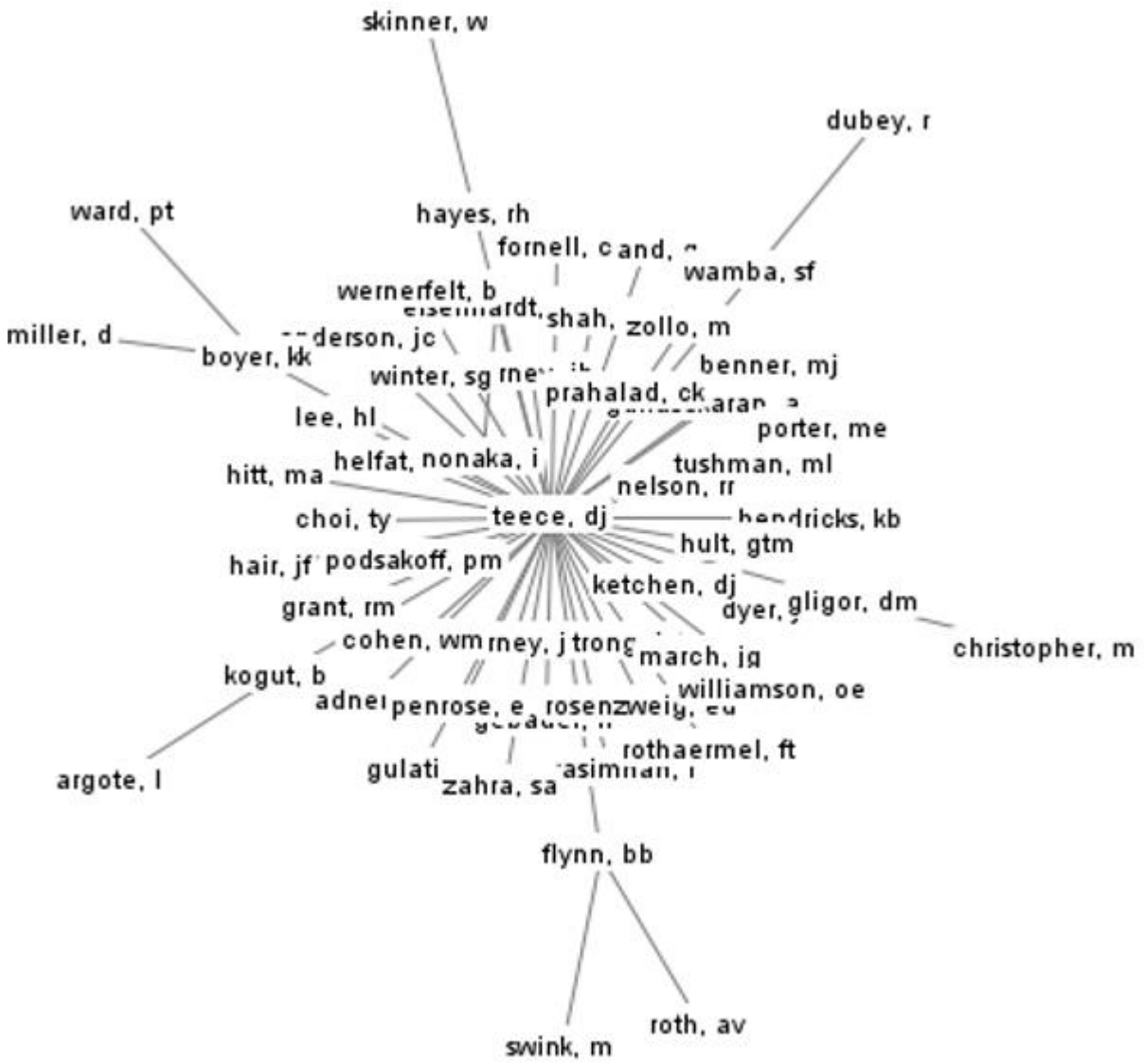
FIGURE 3
ACA CLUSTERS



Pathfinder Network

The Pathfinder network is usually used as a complement to the author co-citation network in citation/co-citation studies to highlight the central nodes of the authors and the resultant author inter-relationships (Sullivan et al., 2011). Using the author co-citation matrix as the input and the software JPathfinder the pathfinder network output PFNet chart was generated. From Figure 4, David J Teece, the author of DCV is the central node from which other author branches are formed. Teece is critical to the stability of the Pathfinder network due to its central location. Other related authors are branched out of the central node who are important in the field of operations & supply chain management, as they are commonly cited as well.

FIGURE 4
PATHFINDER NETWORK PFNET



Term Co-Occurrence Map

The term co-occurrence map was generated in VOSviewer. The first step for generating the term co-occurrence map is to identify all terms existing in the abstract text field. This is done by part-of-speech tagging, which is the process that identifies verbs, and nouns. The Apache OpenNLP toolkit is used for this purpose. A linguistic filter is then utilized for noun phrase identification. Plural noun phrases are then converted into singular phrases utilized as the terms (Waltman & Jan Van Eck, 2012).

The second step is to collect terms from the abstracts belonging to a specific research field and assign term relevance scores for each term in the research field. The basic premise is that terms with superior relevance scores provide a good idea about a particular research theme (Waltman & Jan Van Eck, 2012). The final step is to select the most relevant terms for each research theme based on the relevance scores calculated in the earlier step.

The abstract text data from the column "AB" in the dataset was utilized and copyright statements were ignored. The minimum number of occurrences of a term was kept at 10. 140 words met the minimum

threshold. Of these 140 words, based on calculated relevance scores, 60% of 140 words, 84 words were utilized in the generation of the term co-occurrence map.

FIGURE 5
TERM CO-OCCURRENCE MAP WITH RESEARCH TOPICS & TERMS

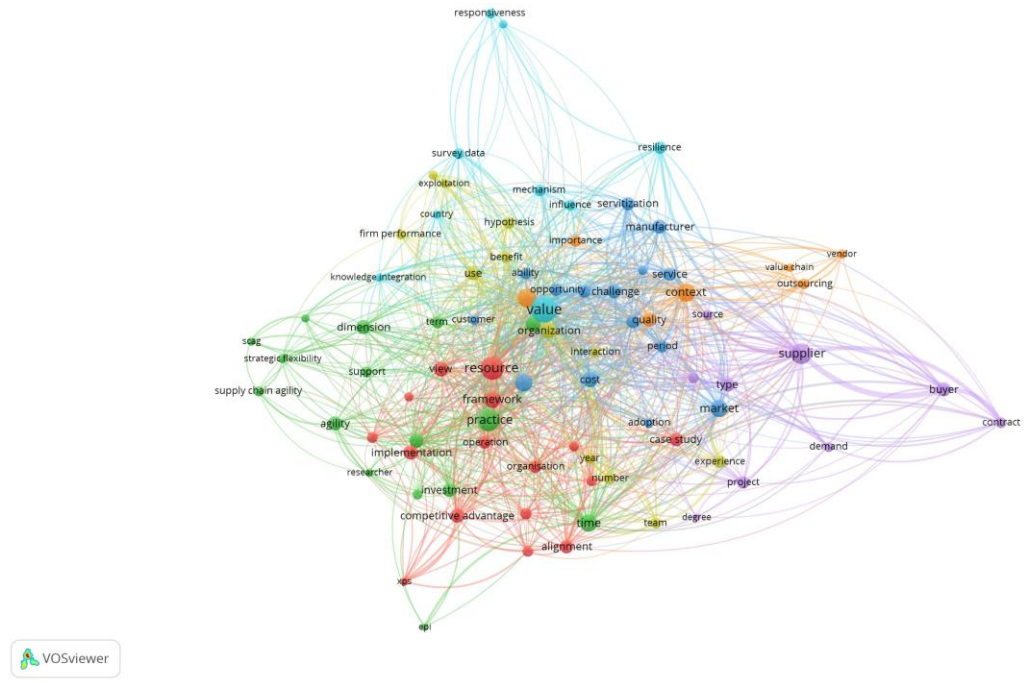
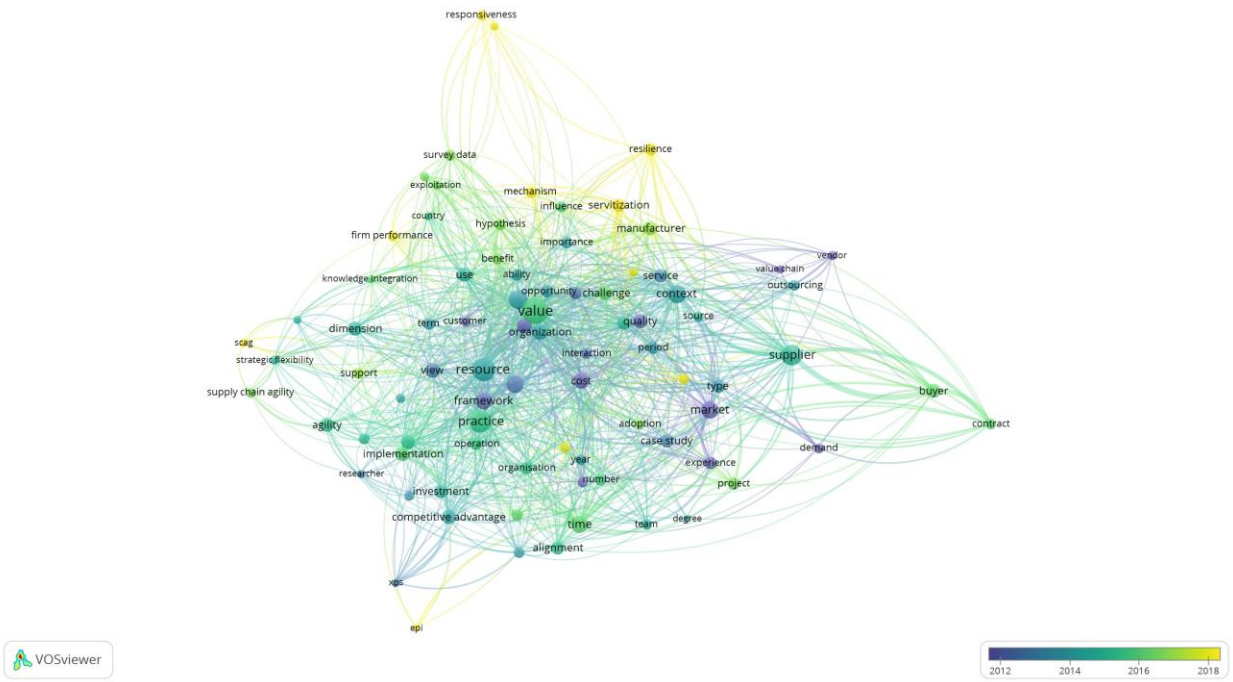


TABLE 3
TOPIC LABELS DECIPHERED FROM TERM CO-OCCURRENCE MAP & ASSOCIATED TERMS

Topic	Terms
Organizational Quality	Organization, Quality, Cost
Supply Chain Contracts	Supplier, Buyer, Contract, Demand
Service Value Chain	Value Chain, Outsourcing, Vendor
Case Study	Case Study, Market, Experience
Organizational Alignment	Organization, Alignment, Competitive Advantage.
Supply chain Agility	Supply chain Agility, Strategic Flexibility, Agility
Resilience	Responsiveness, Resilience, Mechanism

Figure 5 showcases some research topics and the corresponding terms inferred from the co-occurrence map. The term co-occurrence map showcases various topics such as supply chain contracts, supply chain agility, resilience, etc.

FIGURE 6
TERM CO-OCCURRENCE MAP TIME OVERLAY



The term co-occurrence map with time overlay (Figure 6) was generated as it shows the research topics along with the top terms associated and how these topics have evolved over time.

Figure 6 does an excellent job of showcasing how the generated research topics have evolved over time. Terms such as organization, quality, market, and experience were more relevant in the early 2010s. As we move towards mid-2010 we notice a shift towards other research topics such as Supply Chain Contracts (terms such as Supplier, Buyer, Contract), Organizational Alignment (Terms such as Organization, Alignment, and Competitive Advantage). Since 2016, topics such as Supply chain Agility (Supply chain Agility, Strategic Flexibility, Agility), and Resilience (Responsiveness, Resilience) have been gaining traction. The shift towards agility and resilience can be attributed to recent socio-political changes, economic policies, natural disasters such as COVID-19, etc. and the global nature of the supply chain.

Figure 6 also exemplifies how the concept of dynamic capabilities is still significant after a period of 26 years and contributes a lot to a wide variety of research topics such as strategy, supply chain contracts, agility & and resilience in the field of operations and supply chain management.

Topic Modeling

Researchers widely use topic modeling to identify the latent topics in a large corpus of text data. For studies involving a smaller sample of papers such as 15 or 20, it is easier for the authors to review these papers and decipher topics. For deciphering topics within a larger sample, topic modeling makes it easier to identify latent themes.

Topics refer to themes present within the corpus comprising related words that are highly likely to belong to that topic. For generating these topics, topic modeling utilizes statistical analysis along with an algorithm to generate the topics (Blei, 2012).

There are various topic modeling routines available such as LDA (Latent Dirichlet Allocation), Latent Semantic Analysis (LSA), and Non-Negative Matrix Factorization (NNMF). All these approaches yield similar results, and the routine chosen depends on the researcher. LDA was chosen due to the vast number

of prior studies across various fields that have utilized this method and the resultant popularity (Chen & Zhao, 2015).

Text Pre-Processing

The 166 abstracts in this study form the text corpus for topic modeling. However, the text data needs to undergo some pre-processing steps to convert it to a format suitable for topic modeling.

One of the first steps in text pre-processing is to convert all text into lower letters, remove punctuation marks, remove digits, and strip whitespaces. Furthermore, words such as "the", "and", "or" which are commonly used words and do not add any value in generating distinct topics are removed from the text corpus. The next step is to stem or lemmatize the text corpus. Lemmatization was used in our paper so that related words such as "running", "run", and "ran" are reduced to the root word "run". All pre-processing steps were completed in the programming language R utilizing the package tm (Feinerer, 2023).

Number of Topics

Similar to data mining techniques such as K-means clustering, the number of topics has to be specified in topic modeling. Heuristic methods are available in topic modeling that can be applied to generate the number of topics. However, the method that works the best based on consultation with the authors and other topic modeling experts is to test different numbers of topics and the corresponding terms and conclude which number of topics works best for our text corpus. The number of topics was set to 8, 10, and 15. Based on the resultant topics obtained from experimenting with different topics, the number of topics deemed the best for this project was 8 topics along with the associated top 5 terms.

TABLE 4
TOPIC LABELS DECIPHERED FROM LDA-GENERATED TOPICS AND CORRESPONDING TERMS

Topic Label	Terms
Firm Innovation	firm innovation market model technology
Process Research	research use process management develop
Supply Chain Agility	supply chain study datum agility
Dynamic Capability	capability study finding dynamic relationship

Topic Label	Terms
Firm Performance	performance firm practice effect result
Manufacturing Strategy	manufacture strategy product competitive paper
Service Capability	capability service research different identify
Supplier Learning	supplier knowledge can learn improve

Table 4 showcases the 8 distinct research themes generated by topic modeling. We see very distinct research themes such as Manufacturing Strategy, Service Capability, Firm Innovation, and Supplier Learning.

The dataset was split into different time periods to showcase the utilization of DCV in OM and how it has grown over the past 23 years. As 23 years cannot be split into equal time periods, the years 2000-2019 were split into four 5-year periods and 2020-2022 was utilized as a 3-year time period. The time period of 2000-2004 yielded only 12 research articles while the last time period of only 3 years yielded 35 research articles. This showcases the growth of the use of DCV in Operations & Supply Chain Management.

To highlight how the DCV has evolved over the past 23 years, each time period split in the earlier step was further analyzed using topic modeling. 5 topics with the top 5 terms were generated for each time period to highlight the important topics for each time period. LDA was utilized and the same steps were used on the full-text data (pre-processing done on the entire text corpus earlier) to ensure consistency. The prominent topics and terms from the different time periods were then analyzed in detail.

On reviewing the topics generated by LDA from the first 5 years, i.e., 2000-2004, the prominent topics included Strategy Research (terms include “strategy”, “research”, “dynamic”), Resource Theory (terms include “competence”, “theory”, “resource”), Process Capability (terms include “capability”, “process”, “framework”), Market Experience (terms include “market”, “new”, “experience”).

Some of the research articles from 2000-2004 that encompass the prominent topics from the time period include the paper by Pandza et al (2003) that discusses the use of real options to manage capability development processes and a manufacturing operation case study, the paper by King & Tucci (2002) which examined technological markets specifically the disk drive industry, the relationship between prior market experience and the entry into a new technological market. The technological industry was chosen in this study due to the strong dynamic nature of this industry. The results indicated that experience in another market prior to market entry was a significant factor when entering a new market. Furthermore, the manufacturing sector was studied in papers such as the paper by Safizadeh et al (2000) which tested different theoretical paradigms in manufacturing strategy, and the paper by Narasimhan et al (2004) which studied the role of flexibility and execution competencies on performance. The results indicated that some firms were better at utilizing manufacturing flexibility, leading to better firm performance.

The prominent topics generated by LDA from the second 5-year period, i.e., 2005-2009 included Market Technology (terms include "firm", "market", "technology"), Team Capability (terms include "capability", "performance", "team"), Manufacturing Strategy (terms include "manufacture", "strategy", "operation"), Supply Chain Research (terms include "manufacture", "strategy", "operation"). As we move from the first 5-year period to the second 5-year period, we notice a shift towards more team-based capabilities, supply chain-based research, and the integration of manufacturing strategy.

Some of the research articles from 2005-2009 include the paper by Franco et al (2009) that investigated the technological capabilities of a firm as a potential moderator on the relationship between new market entry and firm survival in high technological industries. The results indicated that early entry into new markets mainly benefits only those technologically sound firms. Witcher et al (2008) utilized a case study of the Japanese car manufacturer Nissan to differentiate between higher-order dynamic capabilities and other core strategic resources. The paper by Karim (2009) utilized a longitudinal dataset of 250 medical-industry-based firms over 20 years to investigate the relationship between business unit reorganization and innovation in new product markets. The results indicated that reorganization exhibited a U-shaped relationship with innovation. This paper drew upon the theories of dynamic capabilities and organizational learning.

On reviewing the topics generated by LDA from the third 5-year period, i.e., 2010-2014, the prominent topics included Managerial Performance (terms include "performance", "use", "managerial"), Service Industry (terms include "firm", "service", "industry"), Operational Capability (terms include "capability", "model", "operational"), New Product Innovation (terms include "new", "product", "innovation"). As we move from the second 5-year period to the third 5-year period, we notice that there is a shift towards more managerial performance, an increase in the use of DCV in the service industry, and new product innovation.

In the time period 2010-2014, the paper by Vanpoucke et al (2014) introduced the concept of supplier integrative capability. Furthermore, the paper utilized a global industrial sample to showcase that three complementary capabilities need to exist simultaneously for supplier integrative capability to be effective. Chiang et al (2012) utilized the competence-capability framework and the DCV on a sample of 144 manufacturing firms. The results showed strong support for the relationship between strategic sourcing and the firm's supply chain agility, and partial support for the mediation effect of the firm's strategic flexibility on the relationship between strategic sourcing and the firm's supply chain agility. The integration of complementary technologies for startups (both for products and services) was explored by Anderson & Parker (2013).

The prominent topics generated by LDA from the fourth 5-year period, i.e., 2015-2019 included Management Process (terms include "management", "process", "practice"), Dynamic Service Capability (terms include "capability", "service", "dynamic"), Supply Chain Performance (terms include "supply", "chain", "performance"), Knowledge Research (terms include "research", "knowledge", "relationship"). As we move from the third 5-year period to the third 5-year period, we notice that some for the trends from the 3rd 5-year period continue into 2015-2019. There is a greater emphasis on the Management Process and overall supply chain performance. Some of the articles from this time period include the paper by Brandon-Jones & Knoppen (2018) which examined the role of two dimensions of strategic purchasing on dynamic capabilities development. In this paper, a sample of 309 firms (both manufacturing and service) was utilized to test the hypotheses. The results indicated a positive relationship between purchasing recognition, purchasing involvement, and dynamic capability. Mitchell et al (2015) utilized a theoretical approach to study the relationship between free entry, competition, and the dynamic capabilities of existing firms. Lam et al (2019) empirically tested the implementation of 3D printing on stock returns. Utilizing a sample of 232 event studies of 3D printing announcements from publicly listed companies during the time period 2010-2017, the study showed that firms that implemented 3D printing exhibited higher stock returns for over 2 years after the implementation as opposed to firms that did not implement 3D printing. The relationship between front-office and back-office service capabilities and firm performance of SME's (small and medium-sized enterprises) was studied by Valtakoski & Witell (2018) wherein the authors found support for the positive relationship between front-office service capability and firm performance and negative relationship between back-office service capability and firm performance for SME's that were

relatively young. Stevenson & Busby (2015) explored the strategies employed by counterfeiters and recommended strategies to improve the resilience of supply chains to the threat of counterfeited products.

On reviewing the topics generated by LDA from the last 3-year period, i.e., 2020-2022, the prominent topics included Team Project (terms include "project", "analysis", "team"), Lean Performance (terms include "lean", "performance", "relationship"), Supply Chain Resilience (terms include "supply", "chain", "resilience"), Capability Study (terms include "capability", "study", "finding"). As we move from the fourth 5-year period to the final 3-year period, we notice a shift towards more team projects, lean performance studies, and an emphasis on supply chain resilience.

Some of the papers from this period include the paper by Sousa-Zomer et al. (2020) that investigates the micro-foundations that lead to digital transforming capability, which is a dynamic capability for digital transformation. The dataset comprised of large US-based firms and the results showed 3 micro-foundations, i.e. digital-savvy skills, digital intensity, and context for action and interaction that lead to digital transforming capability. Furthermore, the results supported the authors' hypothesis of a positive effect of digital transforming capability on firm performance. Roh et al (2022) investigated the effect of the manager's ability to design and implement organizational change initiatives on the supply chain's responsiveness. Utilizing survey data gathered from 199 experts in the field of supply chain, the results indicated that capabilities in organizational design coupled with functional leader negotiations and workforce communications lead to better supply chain responsiveness utilizing increased structural adaptability. Munir et al (2022) described the capabilities needed to face unforeseen disruptions such as the COVID-19 pandemic. Utilizing survey data collected from 206 manufacturing companies in a developing country that was functional during the Covid pandemic, the results suggested that anticipation and improvisation, led to better supply chain responsiveness and resilience.

Furthermore, the results supported the positive relationship between data analytics capabilities on anticipation and improvisation. Gutierrez et al. (2022) investigated the effect of lean practices and cultures in developing dynamic capabilities. Utilizing a mix of primary survey data collected from 153 manufacturing firms located around the world and secondary archival data, the results provided evidence for the positive impact of lean operations and lean supply chain practices towards the development of dynamic capability micro-foundations, which in turn lead to improved process innovation. Cadden et al. (2022) studied the effect of competitive pressures and environmental dynamism in a supply chain analytical setting. The results provided evidence for the moderation effect of intangible supply chain capabilities on the relationship between big data characteristics and supply chain agility. Akter et al. (2021) studied the ability of analytics capability to help resolve emergencies. The authors utilized a sample of 245 service systems managers based in Australia and the results indicated that the development and sustainment of analytics empowerment capability can be beneficial in combating emergencies such as those arising from supply chain disruptions. Nikookar & Yanadori (2022) studied the managerial antecedents of supply chain resilience utilizing survey data of 598 manufacturing firms based in Australia. The results indicated that human capital, social capital, and cognition positively affect supply chain resilience. Furthermore, the authors also discussed mediators for the relationship between dynamic managerial capabilities and supply chain resilience.

FUTURE DIRECTIONS

The results of this study provide an avenue for future research. For example, the results of this study indicate a lack of research in the service area. Future studies should include the role of DCV in the service industry. Moreover, future studies should investigate similarities/ dissimilarities between dynamic service capability and manufacturing capability. Due to the increase in service-based firms and projectized organizations such as technological firms, future studies can focus on project-based organizations and the role of dynamic capabilities as a potential mediator/moderator. For example, the role of dynamic capability as a potential mediator between project complexity and firm performance can be explored and investigated in an agile setting. For such studies, a mix of survey data along with secondary data can be used.

Given the rise of AI (Artificial Intelligence) and corresponding AI tools such as ChatGPT, future research can focus on AI-based dynamic capabilities and how these capabilities can provide a competitive edge to firms, especially those working in dynamic technological industries.

CONCLUSION

This study explored the intellectual structure of DCV in the operations and supply chain management discipline. Our paper highlights the influential authors deciphered from the papers utilizing DCV in operations management and the inter-relationships among them. Furthermore, the ACA clusters depict a wide array of research topics such as strategic management, operations & and technology, Operations & and economics.

Analyzing the topics from the different periods within the 23 years, we notice the evolution of topics from basic topics such as resource theory, process capability, etc. to the latest advanced topics. Moving further down through the years, a marked development of nuanced ideas is evident with the emergence of newer topics such as new product innovation, operational capability, etc. The period of the last 8 years, i.e., 2015-2022 saw the rise in service industry-related research, which is evident with newer topics such as dynamic service capability generated from the LDA. Towards the latter part of 2015-2022, team projects, lean performance, and supply chain resilience gained prominence. Specifically, newer topics such as digital transforming capability and data analytics capabilities were developed to address the new world of big data, IoT (Internet of Things), & and analytics.

Our study has found that DCV is still a relevant theoretical base within operations and supply chain discipline. Furthermore, the DCV theory has evolved away from its initial narrow topic of strategic management towards more broad topics such as IoT and data analytics.

All empirical studies suffer from some limitations, and ours is no exception. The first limitation is that this study chose only four journals for analysis. While articles from these journals can represent the most relevant articles on DCV, they may not fully capture the DCV area. The second limitation is that most of the articles identified in this study are from manufacturing industries rather than the service industry. Consequently, this study could not capture the evolution of DCV from the service industry perspective. Finally, this study uses only the first authors of the article for ACA.

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