IEEE Transactions on Engineering Management, Volume 71, 2024, pp. 10170-10184
DOI:10.1109/TEM.2023.3319736

Appraising the Transformation and Future of Digital Multisided Platforms- A bibliometric analysis and systematic literature review

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***Abstract*— This paper draws on the Digital Multi-Sided Platform (DMSP) literature from 1990-2022 to systematically review and synthesize its themes and contexts. We analyzed 344 articles from Web of Science and Scopus databases using a two-step approach: 1) bibliometric analysis to identify principal research themes in the DMSP literature. 2) content analysis to develop these themes further. This study contributes to highlighting the DMSP role in Industry 4.0 and Service 4.0, which is an exclusive finding that has not been discussed by any other SLR paper before, along with highlighting competition & collaborative innovation, antitrust, platform typologies, and data privacy as a future research direction, also, this paper analyzes the challenges and makes recommendations. In this way, the review advances the current understanding of the growing field of DMSP. Further, the study offers practical insights to guide policymakers, strategists, and managers about the prominent implications. The study does not only review the literature but offers a consolidated account of critical analysis, reviewing the evolution of DMSP. The bibliometric analysis depicts current research trends presenting us with four clusters i) Innovation and entrepreneurship, ii) Sharing economy, iii) Business model and iv) Network effects in DMSP literature. We have identified research gaps and presented future research questions for scholars to investigate along with managerial implications of DMSP owners and stakeholders.**

***Index Terms*— Digital Multisided Platform, bibliometric analysis, Strategic Management, Systematic Literature Review, Technology & Innovation.**

I. Introduction

Within the broader platforms literature [1], and originating in the notion of two-sided platforms, we trace the emergence, evolution, and development of the sub-stream focusing particularly on the concept of Digital Multi-Sided Platforms (DMSP) or digital ecosystems. Two-sided platforms can be differentiated from multi-sided platforms on the basis that the former connects two user groups while the latter connects multiple user groups (buyer, seller, mediator, developer) [2] and exemplified by eBay (buyer, seller) Apple iOS (buyer, mediator, developer), Facebook, Sony PlayStation, and others. Given their prevalence, it is important to understand the origins and nature of DMSPs. We do this through an examination of how the literature on DMSP has evolved over the years wherein DMSPs are defined as "the digital infrastructure that provides a common set of design and governance rules to facilitate interactions between multiple users. Digital platforms typically bring changes to the ways users access markets and consume products and services" [3, p. 110]

DMSPs can be conceptualized as aligning and coordinating key stakeholders or agents enabling i) innovation and competition while ii) creating value through economies of scope and iii) involving a technological architecture comprising of a periphery and a core [4]. The DMSP's purpose is not to fabricate or develop products and services but to link and coordinate different sides. For example, more than 80% of the activities carried out by Airbus, come through its suppliers but those suppliers do not interact with Airbus customers, Airbus is a product-centric company and operates a manufacturing platform, while in the case of DMSPs, they enable the interaction among different sides or users of the platform, this contrasting feature distinguishes DMSP with product platforms or linear businesses [5].

DMSPs are not unique to any single industry or sector, but have become a ubiquitous phenomenon embraced across sectors. DMSPs now pervade our daily lives: from ordering food

Manuscript received July 26, 2022; revised December 12, 2022, May 14, 2023, and June 21, 2016; accepted August 11, 2023. Date of publication ;

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through Uber Eats or Foodpanda to buying online gifts from Amazon or eBay and uploading a picture on Instagram or Facebook – much revolves around digital MSPs.

Further, their utility increases daily, from Android, iOS, Amazon, and Airbnb and extends, too, into industrial sectors, such as GE Predix an IoT industrial platform, Siemens Teamplay a digital healthcare platform and multi-sectoral platforms like Oracle, SAP. DMSPs have emerged as an important outlet for value creation and capture [6, 5, 7]. That is, DMSPs have become an important tool for organisations looking to establish competitive strategies. Digital multisided platforms can contribute some significant and meaningful insights into theory along with pertinent knowledge to researchers, managers, policymakers, and strategists [8].

Possibly as a result of the wide scholarly attention given to the topic of DMSPs in recent years, the literature appears to be fragmented, diverse and, at times, lacks connection and relatability. The distributed nature of the DMSP literature as well as the concept's conflation with industries, technologies, and markets, make it a challenging research phenomenon. Within this perspective, the literature on DMSP continues to grow with no clear boundaries or clusters of research. The purpose of the current article is, through a review of the literature, to advance conceptual clarity by tracing the evolutionary dynamics of DMSP and also to provide a future research agenda.

Two underlying questions drive this review, first how has the DMSP concept evolved, and what are the key current themes? And second, what are the future directions for DMSP? Our findings can act as a roadmap for future researchers and practitioners to understand the dynamics of the DMSP concept and current research gaps. The study aims to:

1) present a comprehensive literature review to aggregate and articulate different dimensions of DMSP, their semantics, and dynamics in the period of 1990 - 2022.
2) highlight challenges and reveal gaps leading to future research directions in DMSP.

To meet the objectives, we undertake a Systematic Literature Review (SLR), selected for its emphasis on being a robust and transparent scientific enquiry that aims to reduce researcher bias [125]. Further, the SLR approach is sufficiently versatile to accommodate a diversity of approaches to data synthesis depending on the nature of the primary studies included in the review and the review purpose [26].

To address the objectives outlined above, we adopt a multi-stage, multi-method approach to synthesis comprising of both bibliometric and content analysis. Our review is designed to build on and address limitations identified in previous reviews [9, 10, 11, 12, 13, 14]. First, we specifically focus on DMSPs and not on specialized themes within the broader literature, and, in doing so, this review provides a comprehensive perspective on the diverse research streams within the literature. Second, we update previous reviews which are partial and dated in their coverage: for example, we identify a further 166 papers published since the last review that covered the period up to 2020 [14]. Third, by adopting a comprehensive approach and undertaking a bibliometric analysis and content analysis, the current paper updates Facin et al.'s (2016) [9] landscape map to include aspects of entrepreneurship, the sharing economy, business models and network effects.

This article is structured into six sections. Following this introductory section, Section II reflects on previous reviews and analyzes the conceptual evolution of DMSP. Section III describes the methodological approach and the selection criteria for included papers. Section IV presents the results from the bibliometric and content analysis. Section V synthesizes discussion, future research agenda and policy and managerial implications. Section VI concludes the article.

II. Previous Literature Reviews on Platforms, and Digital Platforms

Reflecting the growth in the volume of literature relating to Platforms, six review articles have been published in recent years. These reviews have greatly enriched our understanding of certain thematic issues within literature and are summarized in Table I. These reviews are also evidence of the evolution of literature, from just platforms to multisided platforms and now to digital multisided platforms.

Facin et al. (2016) [9] adopt a hybrid methodology combining bibliometric and content analysis to thematically classify the literature and highlight emerging trends. From their cluster analysis, the authors identify three types of platforms: i) product (internal) platforms; ii) supply chain (external) platforms; iii) industry (external) platforms, with the weight of research focus being on the first of these. Regarding a future research agenda, Facin et al. (2016) [9] identify opportunities regarding both internal and external platforms and suggest an important role for dynamic capabilities theory combined with a platform evolutionary perspective to help explain how firms can achieve sustainable competitive advantage. Facin et al.'s (2016) [9] review covers the period 1993-2015 so it is time for another review to integrate the important research conducted in the intervening years. The literature review by Jia, Cusumano and Chen (2021) [10]is a bibliometric analysis of literature using the multi-sided platform as one of the keywords, which is slightly different from other reviews. Other reviews mostly included the "platform" keyword and the dimension of multi-sidedness was never included. This review identifies seven research streams within the multi-sided platform literature and has an analysis at three levels, namely - business, corporate and ecosystem. The paper concludes that platforms as a source of value creation, technological innovation and platforms as new business models shall remain topics of future research.

The identification of seven research streams has not been explained in Jia, Cusumano and Chen (2019) review, besides they have included data up to 2018.

After the publication of this review, a large amount of literature emerged, which needs to be analyzed, for example, “digital multisided platforms” (DMSP).

Rietveld & Schilling (2021) [11] review scholarship on “Platform Competition” between 1985-2019 and identify four themes: i) network externalities generate “winner takes all”, ii) corporate level strategy, iii) effects of heterogeneity, and iv) how platform governs value capture and creation.

Through an analysis of definitions and the defining characteristics of MSPs, Sanchez-Cartas & Leon (2021) [15] look to build some coherence from the conceptual diversity exhibited in the literature. Building on this, they were further able to elucidate pricing, coordination problems, and ownership structures of platforms. However, the review findings are somewhat limited by a lack of clarity about how the review was conducted, which papers were selected, and why. In particular, the review fails to present a convincing bibliometric analysis that adequately maps the landscape.

The bibliometric gap is addressed in Liu, Li & Wang’s (2021) [13] review. In addition to mapping the field in respect of influential scholars, journals, and institutions as well as seminal papers, their review notes a shift in platform research from ‘research object’ to ‘research context’ and the emergence of the “Sharing Economy” theme in recent years. This study is a “bibliometric analysis” with a search limited to the "Web of Science" database, without considering any other database for cross-checking. This paper also lacks conceptual clarity as terms for digital platforms are used interchangeably review. The paper does not detail the evolution of digital platforms, nor does it discuss the challenges. Shree et al. (2021) [14] review the factors influencing the adoption of digital platforms in B2B markets and, from an analysis of 37 papers published between 2011-2020, they identify important technological, organizational, and environmental context-based factors as well as factors leading to successful adoption. For example, they find that the overarching determinant of platform success is customer orientation and customer loyalty. This review, of limited scope, only considers a fraction of DMSP the literature.

Of the six review papers identified, Facin et al.’s (2016) [9] systematic review provides comparatively robust coverage of the literature. As discussed, previous reviews are limited by their selective focus in terms either of the topic or by failing adequately to provide a clear description of the literature selected to inform their review or of their analytic approach.

Our contribution in highlighting the DMSP role in Industry 4.0 and Service 4.0 is an exclusive finding that is not discussed by any other SLR paper before. Industry 4.0 is still a relatively new concept with regards to MSP, and Service 4.0 appears extinct in literature, the previous reviews have focused on themes important when those reviews were written, while now Industry 4.0 and Service 4.0 holds an integral connection with regards to DMSP and exposes a gap within the literature. The data privacy issue is a critical topic in DMSP literature but has not received due attention, this review also scrutinizes the discussion on various contributive and integral future research avenues.

TABLE I
COMPARISON OF CONTEMPORARY LITERATURE REVIEWS ON DIGITAL PLATFORMS

Review Paper	Focus area	Review Type	Data-base	Theme	Period
Facin et al. (2016) [9]	Platforms (All inclusive)	Bibliometric and content analysis	WoS	Gen*	1993-2015
Jia, Cusumano & Chen (2021) [10]	Multi-sided Platform	Bibliometric Analysis & Literature Review	WoS	Gen	1991-2018
Rietveld & Schilling (2021) [11]	Platform competition	Bibliometric Theme based analysis	WoS	Spe	1985-2019
Sanchez-Cartas & Leon (2021) [15]	Pricing, Network effects, Control	Survey	Not identified	Spec	Not mentioned
Liu, Li & Wang (2021) [13]	Platforms (All inclusive)	Bibliometric analysis	WoS	Gen	1990-2019
Shree et al. (2021) [14]	B2B platforms	Structured Theme based analysis	Scopus	Spec	2011-2020
This Review	DMSP (All inclusive)	Bibliometric Analysis and Systematic Review	WoS and Scopus	Gen	1990-2022

*Gen – stands for General; Spec – stands for Specific

A. *Conceptual evolution of Digital Multisided Platform*

As illustrated in Table II, the Platforms concept and definition has iterated and evolved over the years. To understand the evolution of DMSP it is necessary to track its origins in the Platforms literature. Prior to the early 2000s, the emphasis was on two-sided markets but, after this period, the terms "multi-sided platforms," "multi-sided markets", and "two-sided markets" interchangeably can be observed to emerge. The term ‘platforms’ has wider meanings in literature, but commonly, the mentioned terminologies fall under the umbrella of platforms [22]. However, it should be noted that there exist physical platforms and digital platforms, and it is necessary to comprehend the difference between them. Similarly, as the literature grew the distinctiveness of ‘two-sided’ and ‘multi-sided’ also emerged: the former is limited to only two groups across the platform, while the latter refers to two or more groups [21]. In this scenario, 'digital multisided platforms' or just 'digital platform' are more comprehensive terms that include two-sided and multi-sided platforms and delineate between digital and physical platforms. An early definition by Rochet & Tirole [16] highlights the presence of “network externalities” and the pricing structure used by market sides to carry out

interactions. The emphasis in this definition is on transaction cost and two-sidedness of the markets, themes discussed in the paper do exist, but the dynamics of the same themes have changed as of today in 2022 where many two-sided platforms have transformed into multi-sided platforms and the burden of pricing is sometimes not borne by either side. The idea of network externalities [23] comes into prominence while also discussing the element of price structure. The idea of two-sided platforms presented earlier [16] is further extended and exhibits four different types of two-sided platforms namely i) exchanges, ii) advertiser-supported media platforms, iii) transaction platforms, and iv) software platforms. Earlier definitions focused on network effects (NE), pricing, and appropriation. Further, the role of not only direct network effects but also indirect network effects is highlighted in the literature [17] discussing the cases of failed and successful platforms like Friendster, Sixdegrees.com, Facebook, and Myspace, The literature advances and presents the notion of "Platform envelopment" [1] along with the strong effects of the network, describing that a platform provider from one market can penetrate another market by compounding its functionality, leveraging upon its shared end-user relationships, and improving the market share. One of the highly cited works [21] talks about the economic trade-offs that either bring firms closer to the Multisided platform model or push them away from it toward a vertically integrated firm. Gawer & Cusumano [19] add the element of value creation along with network effects, while the literature here compares and contrasts the internal platforms (product or company specific) with the external platforms (Industrial) and their impact on innovation.

The literature on digital platforms in the last few years shows a shift and focus toward the topics of value creation & value capture and business models from the perspective of DMSP [7, 24, 6, 25, 26]. Literature talks about 'complementary assets' mentioning products, services, and technology as part of it, and for the first time, "Profiting from Innovation" is directly linked with digital platforms in the context of the value capture problem. As DMSPs are expanding and businesses are embracing them, the platform boundaries are also expanding, and this leads to the discussion on demarcating the platform boundaries and classifying the platforms accordingly so far, the literature has enlightened us about having i) Transaction Platforms (Amazon Marketplace, Alibaba) ii) Innovation platforms (MS Azure, Apple iOS, GE Predix) and iii) hybrid platforms (Apple, Google, Microsoft) [27]. This focuses the discussion on digital platform typologies as many of them seem to be falling on the boundaries of these three types or sometimes in none of them. Typologies could further be explored in the future through empirical research, as the boundaries identified appear to be blurred and overlapping, as in the case of the customer experience platform, which does not seem to be falling by the side of transaction platform nor innovative platforms and there are other cases based on which it is imperative to classify digital platforms.

TABLE II
CONCEPTUAL EVOLUTION OF DIGITAL MULTISIDED PLATFORMS

Author/s	**Definitions**	**Year**	**Outlet**	**Keywords**
Rochet & Tirole [16]	Markets in which single or various platforms enable transactions between end-users and try to get the two (or multiple) sides "on board" by appropriately charging each side.	2006	RAND Journal of Economics	Two-sided markets, membership and usage externalities, Coase Theorem
Evans & Schmalensee [17]	Businesses in which pricing and other strategies are strongly affected by the indirect network effects between the two sides of the platform.	2008	ABA Section of Antitrust laws	Multi-sided platforms, Two-sided platforms, Two-sided markets, market definition, antitrust
Baldwin & Woodard [18]	A platform is a set of stable components that supports variety and evolvability in a system by constraining the linkages among the other components.	2009	Platforms, Markets, and Innovation	(Book chapter)
Eisenmann, Parker, & Van Alstyne [1]	A business platform is a nexus of rules and infrastructure that facilitate interactions among network users.	2011	Strategic Management Journal	Entry, Platforms, network effects, bundling, two-sided markets
Gawer & Cusumano [19]	Multilateral platforms are defined as intermediaries between two or more groups of manufacturers and users associated with "network effects" to create value for each other.	2014	Journal of Product Innovation Management	Virtual issue, Disruptive innovation, Open Innovation
Cennamo & Santaló [20]	Multi-sided platform is a network that allows transactions between two or more independent users.	2015	MIT Sloan Management Review	Innovation, Strategy, Business models, Platforms & Ecosystems, Executing Strategy
Hagiu & Wright [21]	Multi-sided platforms have two key characteristics i) they allow "direct interactions" among distinct parties which could be two or more, ii) each side is associated with the platform.	2015	International Journal of Industrial Organization	Multi-Sided Platforms, Platforms, Two-Sided Markets, Reseller, Vertical Integration
Parker & Van Alstyne [8]	Platforms are open standards along with a default contract. The standard provides the technological real estate upon which developers build. The contract provides the mechanism that motivates and controls developer behaviour.	2017	Management Science	Open innovation, sequential innovation, Platforms, R & D spillovers, Intellectual property, Two-sided markets, two-sided networks
Teece [6]	A platform is a combination of software and hardware which administers interfaces, standards, and rules to grant	2018	Research Policy	Appropriability, Complementarity, General-Purpose Technology,

	providers of complements for adding value and to interact with each other / or users. Together the complementary and the platform innovator creates an ecosystem.			Licensing, Platforms, Standards, Technology Policy
Helfat & Raubitschek [7]	Digital Multi-sided platforms provide interfaces among economic actors on multiple sides of the platform, together with providers of complementary assets whereby complementary assets refer to the services, products and technologies complementary to the ones provided by the platform leader.	2018	Research Policy	Dynamic capabilities, Multi-sided platforms, Digital ecosystems, Business models, Value creation, Value capture, Integrative capabilities, Network effects
Pundziene et al. [3]	A Digital Multi-sided platform is a digital infrastructure that provides a common set of design and governance rules to facilitate interactions between multiple users. Digital platforms typically bring changes to the ways users access markets and consume products and services.	2022	California Management Review	Digital healthcare platforms, dynamic capabilities, incumbent MedTech companies, value impedance, incumbent upstream platform, digital transformation gaps

III. METHODS AND DATA

In this article we 1) review the literature to aggregate and articulate the range of conceptualizations of DMSP found in the literature to 2022 [28], their denotation, and dynamics, highlight challenges and discuss opportunities for future research.

To meet this aim and update the review studies detailed in Table I, we carried out a Systematic Literature Review (SLR). SLR is a "specific methodology that locates existing studies, selects and evaluates contributions, analyses and synthesizes data, and reports the evidence in such a way that allows reasonably clear conclusions to be reached about what is and is not known" [29, p. 671]. The SLR's distinct and exacting principles enable the bringing together of sometimes diverse bodies of literature in a transparent fashion, supported by a clear audit trail detailing decisions pertaining to study search, selection, and analysis. Transparency is provided through explicit descriptions of the steps taken (e.g., [30, 29, 31]). Having established our guiding research questions (How has the DMSP concept evolved? What are the current key themes in DMSP research? What are future research prospects in DMSP?), our SLR process proceeds with the identification, screening, and selection of primary studies for inclusion in the later analysis. We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology [32] to structure this process and provide transparency of decisions through to the final inclusion of studies (see Figure 1).

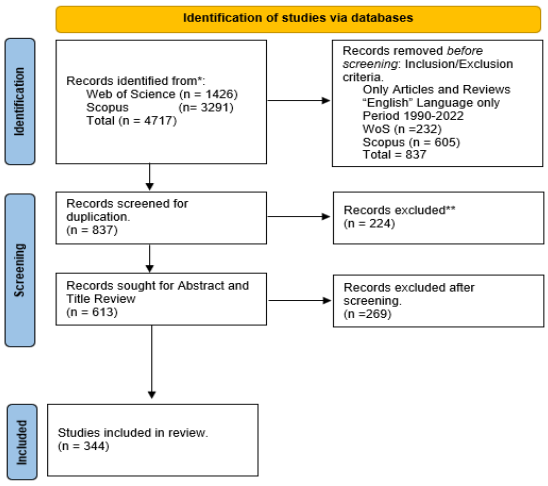

Fig I: PRISMA Flow diagram for article identification and selection.

For the analytic part, bibliometric analysis and content analysis were used to identify, map, elucidate, and illuminate key themes in the literature. Such an approach finds increasing support for its potential to generate insightful theoretical and conceptual contributions [33]. Bibliometric analysis is chosen for its capacity to handle large datasets to generate a presentational overview from keyword analysis and co-citation analysis of the evolution of the topic, allowing for new insights [34] [35] [36]. The latter, content analysis, allows for a finer-grained analysis and pattern identification through a disciplined examination of key themes within the selected studies [37].

Our review adds value to previous reviews in the following ways: 1) it provides a focus on DMSP where previous reviews have covered platforms more generally; 2) is more inclusive of DMSP literature through combining Web of Science and Scopus database searches, and 3) provides a contemporary updating to 2022 reflecting the recent dynamic growth in DMSP research activity.

A. *Paper selection*

To meet the aims of the paper, and in contrast to other review papers listed in Table I, we sought to compose a more complete data set by cross-checking for relevant studies across two databases. WoS was our primary source and was complemented and supplemented by the Scopus database (only unique missing papers were added from Scopus). Our rationale for this approach is grounded in arguments for completeness in two respects. First, to identify DMSP papers not listed in WoS includes papers on topics like antitrust [38], DMSP design [39], platform innovation [40] which are critical topics for the future research directions and it was important to have an inclusive

dataset. Second, to ensure coverage of scope of themes for content analysis. Thus, there are advantages in bringing together primary studies from different databases. However, there are also risks attached to this approach. There is the risk of distortion due to the different citation-counting protocols adopted by the respective databases. To mitigate this risk, we have mainly relied on keyword co-occurrence analysis and not citation analysis to draw results. Also, we have removed duplicates through conditional formatting and then manually checked the titles of the papers to avoid any overlap that may cause misrepresentation in the results.

Our first step in composing a complete paper data set was to perform a brief scoping study to provide a sense of boundaries, and key literature and to develop and refine keywords and search strings to inform the subsequent database search [37]. From this, we identified “multi-sided platform*", "digital platform*", "multisided platform*", "two-sided platform*" and "2-sided platform*” as key search terms. As a further check on coverage, we ran a preliminary co-citation analysis to identify whether all principal scholars in the field had been identified through the keyword search. This process pointed us to works by scholars including Gawer, Cusumano, Teece and Jacobides. In both databases (WoS and Scopus) there is an option to include a search field, in WoS it is called "Add Row" we selected "Author" with the Boolean operator "OR". In Scopus database the same option is called "Add search field". Names of four authors identified through scoping were added at this stage before searching.

Our next step was to frame the key parameters of the study, set clear boundary conditions, draw up a definitive list of keywords and search strings, and transparently detail inclusion and exclusion criteria. Inclusion and exclusion criteria include the range of research types and data forms necessary to promote a full understanding of the phenomenon of interest [41]. *Inclusion/ exclusion criteria* were established as follows: Inclusion: 1) studies on DMSP, matching the scope of the study 2) English language; 3) peer-reviewed articles; 4) between 1990-2022. Exclusion criteria: Languages other than English; Grey literature (chapters, conference papers, reports); dates other than 1990-2022. The search operator was "Author Keywords" in WoS and "Keywords" in the Scopus database. Since the keywords act as an index of any research paper, and we wanted to include the most relevant studies that precisely are on the topics related to our selected key search term therefore only the 'keywords' field was selected. The wildcard operator "*" allows for a search for pluralization. The single keyword "Platform" was excluded from the search for its propensity to deliver large numbers of non-relevant articles. After getting a set of 1426 studies from Web of Science and 3291 studies from Scopus databases, this set of 4717 studies was further toned down. Selection on the database included "document type" as "Articles" and "Review articles," conference papers, and book chapters, which were all excluded from languages only "English" was selected on both databases. The next step of filtering was done by fine-tuning the "Web of Science Categories", four categories were selected namely i) Business ii) Management iii) Economics and iv) Operations Research and Management Science. Similarly, on Scopus, the same option is referred to as “Subject area” where i) "Business Management and Accounting" and ii) "Economics, Econometrics, and Finance" were selected. After this step, we received a set of 837 articles.

The next step was to screen returned articles by removing duplicates and review for relevance. Screening is the important step which rules out the studies that shall make to the review. Screening is done on the literature search-produced results. Then the screening of each database was done to remove duplicate records. Out of the 837 articles, 224 articles were found to be in duplication. After the removal of duplicates, the titles and abstracts of the remaining 613 articles were screened. Following the application of inclusion and exclusion criteria and removal of duplicates we were left with 613 articles. Two co-authors reviewed the titles and abstracts of each article, discarding those that failed to meet the relevance test, where a multi-sided platform or connected topic was not the major theme of the article. For example, some papers which were excluded from the full reading are on topics like "evolution of HTML", "3D printing platform", "Cultural heritage tourism in the digital era", "adaptive enterprise architecture", "supply chain" and similar topics which discuss digital innovation or digital platforms but altogether in a different context as not all digital innovation is related to DMSP, therefore after careful consideration papers off the topic were excluded. This process resulted in a further 269 articles being excluded, leaving a total of 344 for full-text review.

B. *Bibliometric Analysis*

We use the visualization of similarities (VOS) method using VOSviewer software, it provides bibliometric mapping with graphical representation [42]. The final dataset of 344 articles was run through VOSviewer, version 1.6.18, a software tool designed for constructing and visualizing bibliometric data based on co-citation, bibliographic coupling, or co-authorship relations, keywords analysis to create visualizations of themes in the included studies [43]. Results are presented in Fig. II.

As noted above, to ensure completeness of coverage, included studies were drawn from both Scopus and Web of Science (WoS) databases. Cross-checking between the databases revealed that, from a total of 232 articles found in WoS, 224 articles duplicated those in our Scopus list of 605 articles. After removing duplicate articles, we added 8 unique articles from WoS to the final selected dataset. In this way, searching both databases provided some assurance that our searches were thorough. We are, however, aware that different databases can have quite different citation reporting practices, and this is the case for WoS and Scopus. Scopus generally reports higher citation rates for articles than WoS and so there are clear implications for any bibliometric analysis focused on citation counts drawing articles from both these databases. Strategies, such as normalizing citation counts, exist to address this eventuality. However, in the current study keyword co-occurrence analysis, not citation counts were used to identify the important themes in the selected studies and address the overarching research question [44]. Bibliographic coupling (BC) occurs when two separate documents cite a common third document, it is a useful measure to understand the similarity of documents. But it is also contested in the literature as sometimes BC might not be a true indicator of the similarity of

the studies in the case of interdisciplinary topics [45, 46]. In this study we aim to identify the clusters to understand the themes within DMSP and keyword analysis is a sound measure to interpret the research streams within.

This study uses "Co-occurrence" as a type of analysis and "Author keywords" as a unit of analysis, the software offers a range of analyses that can be conducted including Citation, Co-citation, Bibliographic coupling, Co-authorship. VOSviewer allows bibliographic data mapping based only on a single file from either Web of Science, Scopus, Dimensions, or PubMed databases. To construct such a file, we incorporated the eight articles exclusively identified in the WoS alongside those from Scopus into a single, processable file type (.csv). Citation information, bibliographical information, author keywords, and abstracts were manually copied column-wise from the exported WoS Excel file and then pasted into the relevant columns of the Scopus file.

C. *Content Analysis*

Application of content analysis varies with some common characteristics of data collection, coding, analysis of content and interpretation of results. We examined DMSP themes using content analysis by applying a qualitative approach [47, 48]. A full reading of each of the included 344 papers was performed and data, drawn from the results, findings, discussion, future research directions and conclusion sections of the papers and relating to the key themes identified in the bibliometric analysis, were extracted for subsequent analysis [49]. These data and themes were analyzed and synthesized through an iterative process of looking for connections and contradictions, similarities and differences. Separately, we drew together prior recommendations relating to future research directions [29]. The results of this are presented below and summarized in Table III.

IV. RESULTS

A. Outcome of bibliometric analysis

The analysis revealed four clusters based on the combination of the co-occurrence of keywords, normalization of the data is based on the "association of strength" the higher the occurrence of a keyword the bigger the visualization bubble, and the clusters are formed based on the mutual co-occurrence, the higher it is the stronger is the connection [37] (See figure II). Clusterization is based on the keywords' mutual co-occurrence, indicating a probable similar research area, the spatial distance between keywords shows a related theoretical context [38].

Figure II is derived from a VOSviewer analysis based on the co-occurrence of author keywords, we set this to a minimum of five occurrences [50] out of 1066 keywords 47 met this threshold. The highest occurrence was that of 'digital platforms' appearing 120 times but since this keyword was part of our original search string and original search strings were omitted from the keyword analysis as their presence would have skewed findings away from our phenomenon of interest, related research themes.

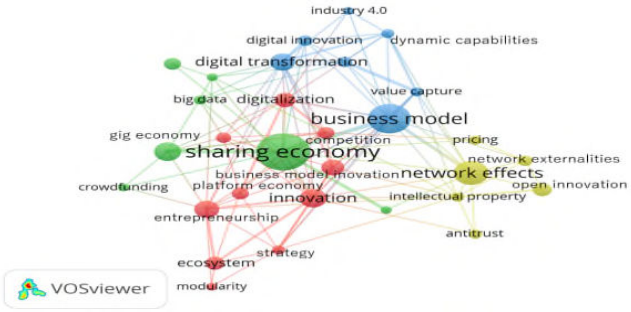

Fig II: Keywords analysis, clusters and connections

B. *Analysis of the contents of Identified Clusters*

Each of the themes identified in the bibliometric analysis is discussed in detail in the sections below. Following [27], we recognize that the results of the bibliometric analysis are merely based on quantitative properties mapping out the relations between variables. While this renders statistical relations more visible it has limits in providing qualitative insights into literature. To generate novel insights, we conducted a qualitative content analysis of the literature underpinning each cluster. Content analysis can be understood as "a research technique for making replicable and valid inferences from texts…to the contexts of their use" [49, p. 18] , often drawing on unstructured data.

Some of them are popular amongst the authors and repeated over the period, including i) network effects ii) business model iii) governance iv) technology & innovation v) value creation and value capture vi) and pricing. However, topics are intertwined at times as it is easy to trace various subtopics being discussed in one paper as they are overlapping in terms of the content. Keywords network identifies the associated concepts, themes, and research domains discussed in the literature over the period. On analyzing the articles published from 2018 to 2022, it is observed that many of them are concentrated on technology, innovation, and network effects [51].

Innovation and Entrepreneurship Cluster (Red)

The innovation and entrepreneurship cluster (red) contains the biggest block of keywords among all four clusters that refer to the role of Innovation and Technology and Platform ecosystem having Innovation, Business model innovation (BMI), competition, entrepreneurship, digitalization, platform economy, digital economy, ecosystem, strategy and modularity. Innovation, technology, and digitalization is the building block of digital multisided platforms, which extends to form a digital economy and ecosystem. Large-scale production, big budgets, and massive R&D can no longer guarantee success, but continuous business model innovation and transformation are mandatory to stay competitive and relevant for business firms in general and digital platforms in particular. Rival digital

platforms driven by technology and transformation put a burden on even established firms to amend their existing business models, two dominant features identified as prime movers of business models are i) transformative leadership and ii) technological adjustments in the extraneous environment [52].

The basic idea presented was about understanding why and how imitators overtake innovators. Together, complementor and platform innovators form an ecosystem whose activity depends on the continued development and maintenance of the platform by its proprietor and the harmony of competition and cooperation among complementors. Business model innovation (BMI) has received more attention than before in the last three years. Most digital platforms are shifting their focus to BMI. Digital platforms like Amazon, Google (Alphabet Inc.), Facebook Inc. (Meta Platforms), and Apple have continuously worked on the business model innovation and continuously transformed it, though these firms might not be the innovators among digital platforms many times, the imitators surpasses the innovator because of steady BMI efforts. Digital platforms are usually at the epicenter, and the firms, users, and complementors around them innovate productively either in their capacity or conjointly, taking advantage of the platform and creating a synergy effect ultimately profiting the platforms and making it more competitive. The literature identifies three strategies namely i) platform injection, ii) platform exploitation and iii) platform pacing, whereby the entrant platform takes advantage by utilizing the resources (exploitation) of the incumbent ecosystem matching or exceeding the pace of the evolution cycle (pacing) and the third strategy of injection refers to taking adequate advantage of the existing ecosystem and its resources and penetrating it, Amazon Fire in case of Google Play and Adobe flash in case of Apple iOS are the examples of platform injection [6, 53, 54]

Earlier literature mentions that a platform along with its complementors providing services and products creates an "ecosystem" of innovation [55]. It is important to understand the difference between a digital platform and a digital platform-based ecosystem. Literature also includes another definition as a "platform-based ecosystem" which is a network where a platform owner encourages complementors (third parties) to establish complementary innovations and the ensuing network of firms reveals compelling linkages [56]. Together the digital platforms and platform-based ecosystem give rise to the platform or digital economy.

DMSPs are becoming the linchpin of the digital entrepreneurial ecosystem while the digital economy is modifying the entrepreneurship landscape, lowering the barriers for potential entrepreneurs, the digital space provides a few opportunities from application development to game developers and idea generators. Literature on digital platforms and entrepreneurship presents a "digital entrepreneurial ecosystem" (DEE) which is a result of the integration of the digital ecosystem and entrepreneurial ecosystem [57]. Apple iOS Google's Android, Facebook, video game industry are just a few popular platforms where the rise of digital entrepreneurs has been recorded in the last decade. Most of the entrepreneurial ventures in the video game industry or app development are by former employees of companies like Electronic Arts, Microsoft, and IBM [58].

Sharing Economy Cluster (Green)

The keywords from sharing economy cluster (green) focus on a variety of topics ranging from sharing economy (SE), gig economy, crowdfunding, digitization, big data, platform governance, and trust. SE is the most frequently occurring keyword in the entire DMSP literature with a total count of 27. SE has become more of an umbrella term encompassing other related topics, including the gig economy and platform economy. It penetrates across B2B, B2C, and C2C platforms and is often synonymous with digital platforms. Most of the case studies in platform literature related to Airbnb or Uber also fall in the same category using the same keyword. But there exist several sharing economy platforms that are not as popular and as successful as Uber and Airbnb, which still need a thorough investigation and sharing economy does exist beyond ride-hailing and rental accommodation. The gig economy is interchangeably used for sharing economy in nascent literature and highlights the ethical concerns regarding data privacy, trust issues, and regulation concerns [59, 60, 61]. Design and platform governance strategies are furnished by platform firms to appropriate and create value alongside leveraging complementors' participation and performance. Platform design features are controlled by platform governance and act as a feedback mechanism where the results can help platform owners modify the governance choices. Governance mechanisms like conferring autonomy, access control, and information provision have a direct impact on design features like Application programming interface (API) Software development kit (SDK) for platforms, digital access or restrictions, and online reviews [62].

Crowdfunding digital platforms facilitate cooperation among the crowd and the fundraisers, it is a novel way of raising funds for projects, and ideas lead to social entrepreneurship and resource sharing by start-ups and individuals, like many other industries and business domains, crowdfunding has also penetrated the domain of digital platforms and is one reason why this keyword "entrepreneurship" and "crowdfunding" is found in DMSP literature in abundance. TaskRabbit, Kickstarter, and Fiverr are a few examples of such platforms where people can share their nonfinancial and financial resources, skills, and resource contributions, it is a great way of group thinking and improvising ideas [63, 64]. It is noticeable to see keywords from one cluster overlapping with keywords from other clusters as the topics are sometimes associated.

Big data is crucial for digital platforms, especially those platform firms which are either active in several markets or willing to expand, they collect different data and aggregate them to form a more comprehensive database, underlying algorithms help platforms understand consumer behaviour and pattern. These aggregated big data sets help digital platforms achieve economies of scope and better tailor their services and design strategies. Big data acquisition is also a motivation for platforms to acquire, merge or build partnerships within the same industry or cross-industry. Partnership agreement

between horizontal rivals Yahoo and Microsoft to share the search data is an example, AT&T's acquisition of Time Warner is an example of vertical integration between platforms [65] Facebook Inc (Meta Platforms) acquisition of WhatsApp and Instagram is also to acquire data and rule out the potential competition in future.

Business model Cluster (Blue)

This cluster mainly constitutes a variety of interrelated keywords including digital innovation and transformation, value creation and value capture, dynamic capabilities, industry 4.0, and digital transformation and innovations. Digital platforms have provided an opportunity to escalate digital innovations such as through Apple App. Store and Google's Playstore, where several developers join the platform to bring in technological innovation within their field of interest. Miric et al. [66] have analyzed the 'appropriability strategies' in-depth in the context of formal (patents, trademarks, copyrights) and informal strategies (versioning and lead time) and concluded that the majority of the small size firms protect their innovations through informal means while as the larger firms use a combination of formal and informal appropriability strategies to protect their digital technological assets. In the same study, another related but important revelation about the interdependence of innovators and users apprise that 46% of innovators benefit from the ideas of users in bringing about innovation.

The connection between complementary assets and business model is discussed [67] and designing a sound business model is termed an 'art' and an integral part of designing strategies for a firm where complementary assets are a key component of this whole process. Similarly, another study by Bonakdar et al. [68] resonates with one of our main hypotheses that the business model is one of the main components to capture the value and is also termed as under-theorized, although it is elemental to a firm's profitability, the study echoes the idea and importance of business model and its significance in value capture [69]. The literature however lacks a discussion on digital platforms in the context of industry 4.0 and service 4.0 is untraceable. As the domain of digital platforms is expanding therefore no industry is an exception and industrial digital platforms are also achieving recognition in business-to-business settings, altering the prevalent conventional business models [70, 71].

Network effects Cluster (Yellow)

The network effects (yellow) cluster follows the discussion on the topics like network effects, which is one of the most discussed themes within the extant literature and there are various offshoot topics like network externalities, antitrust and pricing. Earlier papers have different themes being discussed as evident from the article by Weyl (2010) which is also one of the most cited articles having 285 citations discusses the pricing issues in multi-sided platforms, similarly, Hagiu [72] [73] also discusses pricing issues in two-sided platforms. Evans & Schmalensee [74] and Boudreau [75] discuss the network effects in the context of digital platforms.

Our analysis shows that network effects are one important aspect for profiting from DMSPs and one of the major challenges as well for many platforms to create as this chicken and egg problem persists throughout. Network effects alone cannot guarantee profit maximization [76] as many of the failed platforms were able to garner a good number of suppliers and buyers creating strong network effects yet they failed so the next step is governance and that leads to safety and trust issues. Network externalities play an important role in adding value to product or service platforms, by bringing in more participants on either side of the platform but in this case, multihoming cannot be neglected since many users take advantage of multiple platforms offering the same services [77]. Some digital platforms have to create a balance of revenue from subscribers and advertisers therefore pricing strategy is of key importance, or in some cases, one side of the platform bears the prices while the other avail free services, so the revenue model is imbalanced. Digital platforms literature also shed light on pricing strategies in connection with privacy concerns, as network effects bring in a large number of users that attracts advertisers but it results in compromising the service standards and ultimately resulting in loss of customers, so an optimum balance is necessary for platforms to maintain [78]. Another important topic in this cluster is "antitrust" which is at times intertwined with "intellectual property rights". Antitrust (competition) laws for digital platforms are gaining more attention from the authors due to the rising concerns about unfair practices. Fair, Reasonable and Non-discriminatory (FRAND) terms are discussed in the literature to be implemented but the problem with intellectual property rights also exists as companies like Google will have to share their secret algorithms which are a result of intensive research & development in this connection US Competition laws and European framework exists but with continually changing dynamics the laws need to be revised and above all implemented for fair competition within the digital ecosystem [79].

A chronological view of the topicality in DMSP literature

The evolution of research streams during the last three years in different clusters is analyzed in the self-explanatory Figure III, the VOSviewer analysis of the overlay visualization of topics from 2019 to 2021 is colour coded according to the key in the figure and the bubble size shows the occurrence, the bigger the bubble size higher the occurrence. Although the keywords have already been analyzed in section 3 and then further summarized in Table III. But the above figure shall be discussed here to understand the evolution and pattern of different topics and research streams being discussed in extant literature.

The most used keyword "sharing economy" (SE) has been used the greatest number of times in 2020, similarly "innovation" and "business model" have also been averaged around the same period in 2020. To understand the pattern of the 'sharing economy' keyword, it has been analyzed that the keyword is still in use in 2022 but there are other keywords which are being used more in 2022 than Sharing economy, moreover, the context of some keywords has also transformed over the years. For example in 2020 and 2021 'Sharing Economy' is used mostly in the context of ridesharing (Uber), accommodation sharing (Airbnb) and expertise sharing (Upwork Inc) platforms [80, 61], but it is not only restricted to this context, as SE has also been discussed as a form of organizational and governance

aspect to co-create value having a dual nature of transactional platform and modular architecture [81].

'Innovation" is perhaps the only keyword which has been clubbed with most words and used in platform literature, for instance, it has been used as business model innovation, disruptive innovation, Innovation management, digital innovation, Innovation culture, Open innovation, and many other combinations. Discussing here the keyword 'innovation and digital innovation' they averaged most around 2020 in various contexts within the DMSP domain. An important topic of platform innovation regarding the mobile-payment platforms forecasts 33.4% annual growth of m-payments up to 2023 and is expected to achieve the $4.5 trillion mark. The role of smartphone manufacturers, financial firms, and mobile operators is crucial [82] this paper discusses an important aspect of cross-side network effects for the growth of this market, this 'chicken and egg' problem highlights a challenge for the platforms. Same-side and cross-side innovation has also been discussed in literature where the earlier mentions the Producer to Producer (P-P) or Consumer to Consumer (C-C) Innovation while the latter meant Producer to consumer (P-C) innovation that brings about the change in the core interaction between producer and consumer.

Research streams which are getting attention from scholars in 2021 and 2022 are the topics of 'Industry 4.0', 'trust' and 'platform governance'. The scope of Industry 4.0 in the context of DMSP is very wide and holds serious priority but this stream exposes a gap. However, a recent study highlights an important topic of industrial digital platforms' role in transforming business models in industry 4.0, study highlights the late implication of digital platforms in industry but its overpowering role, demanding more attention from industry practitioners and academicians in this regard.

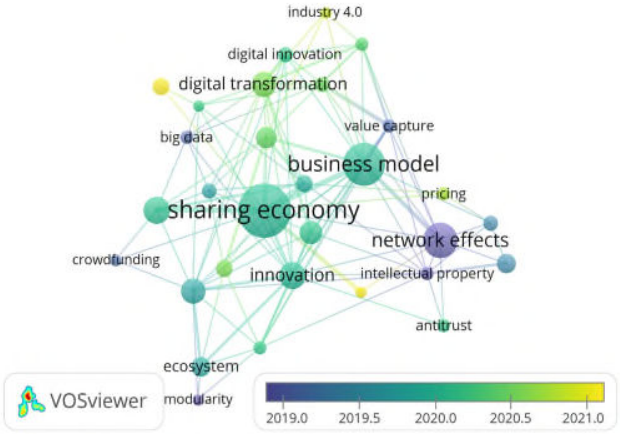

Figure III: An illustration of research streams evolution in DMSP Literature

Network effects are another popular topic like sharing economy and business model, it has been significant since the beginning of the extant literature. All platforms in one or another way try to create strong network effects. This keyword has been used in abundance in 2019, but it does not mean it holds no importance today, there has been a shift of focus, during all these years the literature has grown mature on NE. Network effects are under discussion in diverse contexts, and are now focused upon as playing an integral role in coordination and coopetition among platforms in creating and capturing value through these interdependent digital platforms [83, 84].

TABLE III
BIBLIOMETRIC ANALYSIS, SLR SUMMARY AND FUTURE RESEARCH QUESTIONS

Cluster	**Keyword**	**Occurrence**	**Illustrative References**	**Future Research Question**
Innovation and Entrepreneurship (Red)	Innovation	13	[85], [86], [87]	How DMSP can incentivize to innovate and regulate the complementors and stakeholders? How DMSP can enable servitization BM for industrial manufacturing companies?
	Business model Innovation	11	[88], [89] [24]	
	Competition	8	[90], [91]	
	Entrepreneurship	12	[58]	
	Digitalization	10	[92]	
	Platform economy	8	[93]	What platform typologies exist in the Platform ecosystem and on what grounds they should be classified? How to take insights about weaknesses and strengths from existing platforms, to understand the patterns and generate ideas & solutions for the future?
	Digital Economy	7	[87] [94]	
	Ecosystem	9	[95]	
	Strategy	6	[96]	
	Modularity	5	[97]	
Sharing Economy (Green)	Sharing Economy	27	[81], [61]	What lessons should be learned from the failed sharing economy platforms? How to counter unauthorized access to big data making it foolproof?
	Crowdfunding	5	[64]	
	Digitization	5	[66]	
	Gig economy	13	[98]	
	Platform Governance	8	[99]	
	Big data	6	[100]	
	Trust	5	[101]	
Business Model (Blue)	Business Model	21	[5]	How digital platforms can alter value proposition differentiating through business models?

	Digital Innovation	7	[102]	How can digital platforms influence business models in the industry4.0 context? How DMSP firms seeking to capture value can take advantage of dynamic integrative capabilities?
	Digital Transformation	12	[103]	
	Value capture	6	[104]	
	Value creation	7	[53]	
	Dynamic capabilities	6	[3]	
	Industry 4.0	5	[7]	
Network effects (Yellow)	Network Effects	17	[74] [12]	How can the coordinating mechanism between DMSP and network effects be regulated? How a unified digital market antitrust law (framework) effective globally can be devised and implemented?
	Intellectual property	6	[105]	
	Antitrust	6	[106]	
	Network externalities	7	[107]	
	Open Innovation	9	[108]	
	Pricing	6	[109]	

V. Discussion and Future research agenda

Table III summarizes and encapsulates the results listing the themes, clusters and their composition and the potential future research questions which may be investigated by academicians and practitioners. While Table IV lists the challenges and issues followed by the recommended proposals based on our comprehensive analysis of the literature. During the review of the literature, we have discussed the clusters and highlighted the different themes within and analyzed the transformation of the DMSP literature, as a result of the exhaustive review we find edges to work upon in the future, the following section feature research gaps, accentuate the future research agenda, present suggestions and recommendation.

Our review reveals that many topics within literature are intertwined and interconnected with each other. Network effects are discussed in literature by various authors and in different connections, this important topic leads to the governance of the platforms, and it further develops an idea of cyber security and trust issues.

A comprehensive analysis of the content reveals that sharing economy and network effects are the most argued topics in the literature, but the contexts of these topics are evolving and leading to other questions and offshoot topics, for example, sharing economy discusses the importance and necessity of creating an economic model where collaboration and sharing of resources can bring conducive results. Network effects lead to the topic of network externalities and governance issues within digital multisided platforms.

Results indicate that data privacy, regulation and trust issues related to DMSP are progressing, and pose a major concern to strategists and industrial organizational theorists. Technology and innovation have changed the dynamics of DMSP and it presents a lucrative business model for many organizations but at the same time, it points towards the challenges. The following discussion and identification of research gaps are based on the identified clusters and include an open discussion based on the in-depth literature analysis on DMSP.

A. Research Gaps

The research gap in DMSP literature regarding capturing value with the combination of data and technology utilizing and enhancing organizational capabilities is highlighted for future research. The literature presents a picture, highlighting the challenges being faced by platforms, which is the tip of the iceberg. In future research, it is pertinent to find the solution to the challenges and problems being faced by the platforms and to examine the run-down names of not-so-successful or vanished platforms like "MySpace, Blackberry OS, Sidecar, Orkut, and many other platforms that declined over time and need to be studied in detail to identify the problems which are being faced by DMSP.

Failed platforms are an important area to conduct research and an evident research gap is noticed concerning finding the reasons for failure and presenting results from empirical studies for the present and future digital platforms [110].

Platform firms need to mediate and moderate the parties associated with platforms for data, cyber security, and trust, with so much data being available and multiple data breaches in the recent past, it is of paramount importance to give due attention.

We also ascertain that technology and innovation have a key role to play in the sustainability and survival of any DMSP, need is for constant research and development and to upgrade the platform according to the existing needs and equip it with the future demands of the platform, with the ignorance of technology and innovation DMSP is at the risk of annihilation.

Our findings reveal that after technology and innovation, business model adaptability and alteration with requirement and time are critical for the survival of a digital platform firm, as highlighted in this study that not all innovators have succeeded, but in many cases, like that of Facebook, Amazon, Uber, Google the imitators have exceeded and maximized profits and grew in size than the innovators (Sidecar, Orkut) therefore a hybrid strategy focusing both innovation and imitation is vital. It is a good research direction for future researchers to explore further and conduct more empirical research to understand this phenomenon.

B. Future research directions (FRD)

The given future research directions are a result of a comprehensive analysis of the review of the literature based on thematic cluster analysis and the future research directions from each cluster are discussed independently.

Innovation and Entrepreneurship Cluster (Red) FRD: Competition & Collaborative Innovation

Competition and co-opetition go hand in hand, now different independent platforms create an ecosystem of interdependence, where platforms overlap and depend on each other concurrently. Google Meet, MS Teams, YouTube, Spotify,

Apple Music, Netflix, Google Play, and App Store all exist in an ecosystem where they compete yet depend on each other, for healthy competition, regulation is required to boost innovation. Strategists and policymakers have a role to play, and it provides good research insights to future researchers. The interplay between collaborative innovation and digital multi-sided platforms influences the operations management creating an allegiance where the platforms offer options to evolve and grow including the economic returns [111].

Innovation and Entrepreneurship Cluster (Red) FRD: Platform ecosystem typologies

One of the major challenges and gaps that exist in "Platform literature" is to classify and identify typologies of platforms in a simple way that may bring them in some order or class and solve all the complexity of various platforms in different industries and sectors including payment platforms, social media, crowdfunding, gaming platforms, marketplaces, entertainment, industry-specific platforms and many more categories and classes that exist need to be brought under simplified categorization also called as "Platformization" by Gawer [22]. To summarize, the entire discussion to discern the diverse contexts in which DMSP is analyzed in the literature, we see a compelling need to expand research on digital platforms, especially regarding categorization so that strategies and policies can be formulated and develop a better understanding of various types of platforms evolving every day including innovation platforms, payment platforms, and hybrid platforms. A concise classification of platforms needs to be done in the future to identify the right categories that exist [112].

Sharing Economy Cluster (Green) FRD: Data privacy

Data privacy issues are another flagrant aspect that is worth discussing in future by considering it as a competitive parameter. It is one important area which is scarcely researched and is a growing concern for platform users and owners. Recent data breaches of Microsoft and Facebook and the subsequent outcry and lawsuits are a reality and a matter of concern about personal data and information. This critical issue is not only restricted to social media platforms but all other digital platforms in this ecosystem including payment platforms, e-commerce websites, industrial platform users, and participants are equally concerned about data privacy. Concerns regarding data privacy have been raised [113] but this issue needs detailed investigation due to the changing dynamics of the platforms and the amount of data each platform holds. Data privacy would act as a metric to gauge the performance of future digital platforms. Privacy campaigners have been raising their concerns, but it needs to be explored by technologists and researchers [114]

Business Model Cluster (Blue) FRD: Digital platforms and Industry 4.0

Digital multi-sided platforms are driving the fourth industrial revolution (Industry 4.0) through innovation and technology, transforming business models, and bringing considerable alterations to value offering, value capture and value creation, no sector or industry is an exception, [70] but there is an undeniable gap in the literature on DMSP from the lens of Industry 4.0 and an even wider gap related to Service 4.0 that provides a potential agenda for future research.

Network Effects Cluster (Yellow) FRD: Antitrust

Theoretical evidence indicates that 'antitrust' is a growing field and requires future researchers to investigate this scarcely explored theme in more detail and with a multisided approach. Though cases are being discussed in the literature on antitrust [106, 115] the problem persists regarding rules, regulations and operating laws whether multisided markets can be treated with existing laws for single-sided markets, or a new set of procedures and laws need to be devised. The purpose of antitrust laws should be to maintain a level playing field for all players in the market and create a free and fair competition but the non-price-based competition and acquisitions by big players is a growing concern, which could lead to monopolistic practices within the ecosystem boundaries. Meta Platforms Inc. is an example which is also being alleged by competitors to have monopolistic instincts and along with Google (Alphabet Inc) both tech giants have expanded either by acquiring copying or killing the competition raising the issue of antitrust laws to be not only formulated but implemented [12]

C. Issues, Challenges and Proposals

Following our review, Table IV details the emergent issues, challenges and recommendations identified.

Table IV
ISSUES, CHALLENGES AND RECOMMENDATIONS

Issue	**Challenge**	**Recommendation**
Importance of Innovation and Technology	Lack of understanding among strategists and practitioners about how innovation and imitation can help/affect platforms	Make innovation and technology an elemental part of DMSP supported by imitation and constant R&D to have a pro-active approach (E.g. BlackBerry, Symbian)
Business model adaptation	Difficult to adapt but imperative for survival	Business model adaptability is pertinent for survival, and it even requires horizontal and vertical integration at times. (E.g., Google, Facebook, Amazon)
Ecosystem and DMSP have long-term prospects	Cross-sectional and Snapshot studies do not contribute to recognizing the cause-and-effect behaviors	Carrying out longitudinal and marathon research on the dynamics of digital platforms

Understanding Network effects	Network effects (NE) differ for different platforms for some international NE and for some network effects at local needs to be realized	Fixation according to the dynamics of the platform. The tailored solution required for different platforms (E.g. UBER, Bolt require local NE, Oracle, Airbnb require international NE)
Profit maximization, Governance, and Data privacy issues	Network effects alone cannot guarantee profit maximization. Governance of platforms, Cyber security of data are big challenges.	DMSPs need to step into the role of a moderator rather than just a facilitator and take responsibility and control of the data and resolve trust issues between stakeholders.
Understanding the failures	Research is required to understand the underlying problems of failed platforms (Sidecar, Orkut, RIM Blackberry etc.)	Case studies to explore debacles and learn by examples to strategize in the future. Policymakers, researchers, and academicians need to collaborate

D. Policy and Managerial Implications

The key takeaways from this review can be classified as dealing with i) *network effects* for DMSP, which works like a deal maker or deal-breaker. It is imperative to create a large network of participants on either side of the platform and then it works like a synergy effect. Successful platforms like Google, Amazon, and Facebook are examples for policymakers and managers to follow. ii) *technology and innovation* management throughout the life of a digital platform is crucial for its survival, attending to the platforms' failures can teach a better lesson to strategists, policymakers, and managers [116]. Innovation management and unceasing endeavour to evolve digital platforms is critical for sustainability. iii) *Business model innovation* and utilizing digitalization to achieve objectives and create a digital ecosystem that complements the 'platform economy'. iv) bridging the second and third takeaway constitute the *value capture* mechanism in DMSP which is largely neglected in the literature. To appropriate the returns from innovation, it is vital to have science, engineering, and business competencies to create technological prowess [117]. This study attempts to touch on the untouched themes and dynamics of DMSP that can serve policymakers, strategists, researchers, and academicians.

VI. Conclusion

This study presents a bibliometric analysis and content analysis of literature on Digital Multisided Platforms (DMSP) reviewing the concept's evolution from its origins to date. Earlier studies cover various aspects from the definition, characteristics, and related themes of "platform", but still there was a need to accomplish scholarly facets including new emerging features, technological adoption, and incessant evolution of the field. Through this review, we have tried to advance knowledge and establish an understanding of the literature for the practitioners and researchers, since the next-generation operating models will be based on digital platforms. Value capture challenges being faced by DMSP need to be addressed and designing of policies for the adoption of technology, resulting in the creation and above all capturing the value. The descriptive analysis in this study incorporates authors, keywords, and country of origin of authors to evaluate the regions and associated themes discussed in the extant literature, the country analysis shows the dominance of the USA, England, and Italy having roughly half of the studies originating from these three countries. Results indicate that while the platform is an important topic worldwide yet it is not getting due attention from all parts of the world.

In the platform ecosystem, capturing value for the present and future generations of platforms is exceedingly more complex than network effects [118]. For policy and planning, researchers need to focus on the associated themes in connection with multi-sided platforms and also build networks among academia and industry to overcome the gap and identify the challenges.

This study contributes to the strategic management literature and the policy and management specialists dealing with digital multi-sided platforms across the globe. The process of conducting a systematic literature review has proved to be useful as it enabled us to present a holistic view of digital multi-sided platforms.

This study sought to present a quantitative analysis of the previous studies on the topic of the platform along with a qualitative content analysis of emerging and existing themes. Platforms have swept away the conventional linear business models and have forced firms of all sizes to embrace digital platforms

ACKNOWLEDGMENT

The authors would like to thank the editor-in-chief, department editor and three anonymous reviewers for their valuable comments and suggestions that improved the quality of this work.

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