

Mapping the Intellectual Structure of Service Innovation, 2003-2012

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Abstract—Service innovation plays an important role in shaping new markets and creating new business opportunities. To explore the intellectual structure of service innovation research in the last two four years, this study identified the most important publications and the most influential scholars as well as the correlations among these scholar's publications. In this study, bibliometric, social network and tag clouds analysis techniques are used to investigate the intellectual pillars of the service innovation literature. By analyzing 24,341 citations of 2,353 articles published in SSCI journal in service innovation area between 2003 and 2012, this study maps a knowledge network of service innovation studies. The results of the mapping can help identify the research direction of service innovation research and provide a valuable tool for researchers to access the literature in this area.

Index Terms—service innovation; literature review; social network analysis

I. INTRODUCTION

In an increasingly service-centered economy, service innovation is crucial to maintaining a firm's competitive advantage. While service innovation has attracted much attention and has resulted in the development of several service innovation typologies, these attempts remain rooted in the goods-versus-services perspective [1]. Service businesses do produce innovation originally, and do not depend only on industrial innovation [2]. Service supplier businesses pursue services innovation in order to retain or improve their competitive position in the market place. Services innovation refers to new or considerably changed service concepts or service delivery processes that deliver added value to the client by means of new or improved solutions to a problem [3].

Tether and Tajar [4] propose an innovation model using three dimensions: type of innovation (product or process), type of technology change (hard or social) and locus of innovation (internal or inter-organizational). A recent comprehensive review of the academic literature on product innovation also reveals little explicit coverage of research on service innovation [5]. The objective of this study is to provide service innovation researchers with a unique map to better understand Service innovation related publications and to provide a systematic and objective mapping of different themes and concepts in the

development of service innovation field. This study also attempts to help identify the linkage among different publications and confirm their status and positions in their contribution to the development of service innovation field. The principal methods used are citation and co-citation analysis, social network analysis, plus a factor analysis which is performed to identify the invisible network of knowledge generation underlying the service innovation literature.

II. STUDIES OF ACADEMIC LITERATURE

Hidalgo & D'Alvino [6] stated that innovation models have evolved in the past five decades. The first two generations represent innovation as linear, with a project orientation, on the basis of demand pull or technology push strategies. The third generation recognizes the value of interaction and feedback between different stages of the innovation process. Fourth generations of innovation models show how organizations connect upstream with key suppliers and downstream with customers that are keen to gain an understanding of how knowledge, ideas and teamwork transform into success. Fifth-generation innovation models comprise open-innovation models and the connect and develop model, which pays more attention to how the innovation process requires higher levels of integration and extensive networking to be more efficient.

Innovation has been studied in manufacturing industries, and it is on this basis that theories of innovation have been developed. There have appeared some literature review papers focusing on innovation. Garcia and Calantone [7] reviewed the literature on the marketing, engineering, and new product development disciplines attempts to put some clarity and continuity to the use of these terms. This review shows that it is important to consider both a marketing and technological perspective as well as a macrolevel and microlevel perspective when identifying innovations.

In addition, Innovation is often taken to be synonymous with new technology in the context of new product development and manufacturing processes [8]. Norton & Bass [9] pointed out that the two major categories of IT-related diffusion theory are Systemic Change Theories and Product Utilization Theories. They described two opposing philosophical views of technology: Determinism and Instrumentalism.

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On the other hand, service innovation is a wide concept. Service theory is evolving from good-dominant logic to service-dominant logic, where customers co-create value through service [10]. Greenhalgh, *et al.* [11] summarized the findings of systematic literature review of the diffusion of service innovations. They identified 13 research areas (Rural sociology, Medical sociology, Communication studies, Marketing, Development studies, Health promotion, Evidence-based medicine, Structural determinants of organizational “innovativeness, Studies of organizational process, context, and culture, Interorganizational studies networks and influence, Knowledge utilization, Narrative studies, Complexity studies) that had provided evidence relevant to the diffusion of innovations in health service organizations. Chae [12] also presented there are several streams of research and practice in service innovation from economics, operations, marketing, strategy, and organization science. Particularly, information systems (IS) literature discusses information technology (IT), along with services and service innovation, as a primary driver for economic growth and firms' competitive advantage. This study identifies the most important publications and the most influential scholars as well as the correlations among these scholar's publications.

This study aims at identifying the structure of the most important contributions to the field of service innovation. This structure shows the organization of the different research paradigms and whether or not these are linked together.

III. METHODOLOGY

The principal methods used are citation and co-citation analysis, social network analysis, plus a factor analysis which is performed to identify the invisible network of knowledge generation underlying the service innovation literature [13]. The citation data used in this study included journal articles, authors, publication outlets, publication dates, and cited references. These techniques adopt author citations, co-citations, and systematic review [14] to examine the invisible knowledge network in the communication process by means of written and published works of a given field. These techniques are attractive because they are objective and unobtrusive [15].

The citation data used in this study included journal articles, authors, publication outlets, publication dates, and cited references. Based on the objective of this study, the authors explored the intellectual structure of service innovation between 2003 and 2012. This time period was chosen because contemporary service innovation studies of the last ten years represent the most update and probably also the most important research on service innovation. Citation and co-citation analysis is the main method for this study. First, the databases were identified as the sources of service innovation publications. Then data collection and analysis techniques were designed to collect information about topics, authors, and journals on service innovation research.

In this study, the Science Citation Index (SCI) and Social Sciences Citation Index (SSCI) were used for

analysis. The SCI and SSCI are widely used databases, which include citations published in over 8000 world's leading scholarly journals. While there are arguments that other online databases might also be used for such analysis, using SCI and SSCI provided the most comprehensive and the most accepted databases of service innovation publications.

The entire databases of SCI and SSCI from 2003 to 2012 served as the universe for analysis. In order to collect the data, we used “key word” method which utilizes the SCI and SSCI databases key word search in article's title and abstract. Using “service innovation and service innovation” as key word, this study collected 2,353 journal articles which further cited 24,341 publications as references. The cited references in these papers included both books and journal articles.

In the second stage, the collected data were analyzed and systematized by sorting, screening, summing, sub-totaling, and ranking. After a series of operations, key nodes in the invisible network of knowledge in service innovation were identified and the structures developed. In the final stage, the co-citation analysis was used and the knowledge network of service innovation was mapped to describe the knowledge distribution process in service innovation area. The co-citation correlation matrix was factor analyzed using varimax rotation, a commonly used procedure, which attempts to fit (or load) the maximum number of authors on the minimum number of factors [14]. Social network analysis techniques were used to graph the relationships in the co-citation matrix and identify the strongest links and the core areas of interest in digital divide [16].

IV. RESULTS

A. Citation Analysis

To identify the key publications and scholars that have laid down the ground work of service innovation research, citation data were tabulated for each of the 2,353 source documents and 24,341 references using the Excel package. The citation analysis produced interesting background statistics, as shown in the following tables. Table I lists the most cited journals in Service innovation area in the last five years, among which *Journal of Marketing*, *Strategic Management Journal*, and *Research Policy* are the top three most cited journals, followed by *Journal of Product Innovation Management and Academy of Management Review*.

Table II lists the most cited journals in Service innovation area in the second five years, among which *Journal of Marketing*, *Strategic Management Journal*, and *Research Policy* are the top three most cited journals, followed by *Journal of Product Innovation Management and Academy of Management Journal*. From Table I and Table II can be found in before the five journals are the same. Such a result indicates the majority of Service innovation research is still published in other, non-Service innovation specific journals and that there is still a long way before Service innovation develops into a fully-fledged field that can support its own knowledge generation and dissemination.

The most influential documents with the most citation and the most influential scholars were then identified by their total counts of citation within the selected journal articles. As shown in Table III, the most cited Service Innovation publication between 2003 and 2007 (the first five years) was *Rogers EM Diffusion Innovation*, followed by *Cohen and Levinthal's* paper *Learning and Innovation*, and *Nonaka Ikujiro's* book *Knowledge Creating Company* (see Table III). For the second five years (2008-2012), the first three most cited Service innovation publications were Barney J, 1991, Firm resources and sustained competitive advantage; Rogers EM, Diffusion Innovation and Pavitt's paper *Sectoral patterns of technical change* (See Table IV).

TABLE I. THE MOST FREQUENTLY CITED JOURNALS: 2003-2007

Journals	Total Citations
Journal of Marketing	400
Strategic Management Journal	374
Research Policy	365
Journal of Product Innovation Management	341
Academy of Management Review	315
Academy of Management Journal	311
Administrative Science Quarterly	307
Management Science	303
Organization Science	257
Harvard Business Review	241

TABLE II. THE MOST FREQUENTLY CITED JOURNALS: 2008-2012

Journals	Total Citations
Journal of Marketing	1,663
Strategic Management Journal	1,433
Research Policy	1,347
Journal of Product Innovation Management	1,078
Academy of Management Journal	1,026
Management Science	902
Academy of Management Review	881
Harvard Business Review	845
Journal of Marketing Research	718
Service Industries Journal	708

Journal articles and books combined, the top five most cited scholar between 2003 and 2007 (the first five years) were Rogers, Cooper, Nonaka, Eisenhardt, and Damanpour (See Table V). For the second five years, the status of the most important scholars changed. The top five most cited scholars were Damanpour, Rogers, Von Hippel, Vargo, and Eisenhardt (See Table VI). These scholars have the most influence in the development of

Service innovation area and thus collectively define this field. Their contributions represent the focus of the main research in the field and thus give us an indication of the popularity of certain Service innovation topics as well as their historical values.

TABLE III. HIGHLY CITED DOCUMENTS: 2003-2007

Total Citations	Full Citation Index For Document
45	Rogers EM, 1995, Diffusion Innovation
35	Cohen Wm, 1990, Admin Sci Quart, V35, P128
35	Nonaka Ikujiro, 1995, Knowledge Creating C
29	Eisenhardt KM, 1989, Acad Manage Rev, V14, P532
29	Nelson R, 1982, Evolutionary Theory
26	Damanpour F, 1991, Acad Manage J, V34, P555
22	Gallouj F, 1997, Res Policy, V26, P537
20	Barney J, 1991, J Manage, V17, P99
18	Johne A., 1998, Eur J Marketing, V32, P184
18	Yin R.K, 1994, Case Study Res Desig

TABLE IV. HIGHLY CITED DOCUMENTS: 2008-2012

Total Citations	Full Citation Index For Document
100	Barney J, 1991, J Manage, V17, P99
100	Rogers EM, 2003, Diffusion Innovation
84	Pavitt K, 1984, Res Policy, V13, P343
83	Drejer I, 2004, Res Policy, V33, P551
78	Chesbrough H. W., 2003, Open Innovation New
78	Nunnally J., 1978, Psychometric Theory
71	Eisenhardt Km, 1989, Acad Manage Rev, V14, P532
65	Anderson Jc, 1988, Psychol Bull, V103, P411
63	Menor Lj, 2002, J Oper Manag, V20, P135
60	Vargo Sl, 2004, J Marketing, V68, P1

TABLE V. HIGHLY CITED AUTHORS: 2003-2007

Author	Frequency	Author	Frequency
Rogers EM	72	Cohen WM	45
Cooper Rg	71	Teece DJ	42
Nonaka I	65	Debrentani U	38
Eisenhardt KM	57	Von Hippel E	32
Damanpour F	49	Gallouj F	30

Although the citation analysis does not eliminate the bias against younger scholars, a paper-based ranking (as in Table III & IV) places more emphasis on the quality (as opposed to the quantity) of the documents produced by a given scholar than a ranking of authors based on the

frequencies with which a particular author has been cited (as in Table V & VI). In addition, Table III and IV represent the key research themes in a field and give us an indication of the popularity of certain Service innovation topics. The readers can find high citations are associated to what can be termed field-defining titles and they lay down the ground work for the understanding of service innovation as a distinct phenomenon. A comparison between Table III and IV reveals some interesting patterns from the first five years (2003-2007) to the second five years (2008-2012). First, only Roger's publication (1995) in the last five years remain in top most cited five document, indicating the most influential papers in the first five years and the second five years change much. Second, among the top five most cited authors, three of them were the same, even though the rankings were slightly different. This indicates the development in service innovation is fast and a few classical works and influential authors still dominate the service innovation research. More efforts and theoretical breakthrough are thus needed in order to further advance the development of service innovation research.

TABLE VI. HIGHLY CITED AUTHORS: 2008-2012

Author	Frequency	Author	Frequency
Damanpour F	183	Teece Dj	153
Rogers EM	177	Cohen WM	143
Von Hippel E	172	Gallouj F	114
Vargo SL	159	Podsakoff PM	112
Eisenhardt KM	157	Miles I	106

B. Co-Citation Analysis

In this stage, data mapping was conducted and an intellectual structure of current Service innovation studies was revealed. Co-citation analysis is a bibliometric technique that information scientists use to map the intellectual structure of an academic field. It involves counting documents from a chosen field - paired or co-cited documents. Co-citation analysis compiles co-citation counts in matrix form and statistically scales them to capture a snapshot at a distinct point in time of what is actually a changing and evolving structure of knowledge [17].

To facilitate analyses and improve the probability of its success, it was made sure that all authors in the final set had at least 30 citations in the first four years and 30 in the second four years. Based on the total number of citations in the selected journals, the top scholars were identified, and then a co-citation matrix was built before a pictorial map was drawn to describe the correlations among different scholars. In doing so, we were following the procedures recommended by White and Griffith [17].

Social network analysis techniques were used to graph the relationships in the co-citation matrix and identify the strongest links and the core areas of interest in service innovation [16]. Fig. 1 and Fig. 2 show the core research themes in service innovation studies, based on sampled articles with links of greater than or equal to ten co-

citations shown in the network. This is produced using UCINET software [19] and shows graphically the core areas of interest. Different shapes of the nodes result from performing a faction study of these authors. This method seeks to group elements in a network based on the sharing of common links to each other. The few scholars (Eisenhardt KM ; Damanpour F ; Schumpeter J; Von Hippel E ; Daft RL ; Nunnally J; Cooper RG; Tether BS; Bitner MJ) in Fig. 1 and Fig. 2 are the most links (co-citation) scholars in service innovation research. Their heavy citations and intensive interlinks with each other undoubtedly indicate their prestigious status in service innovation research and their publications and research work collectively define the future research directions of service innovation studies.

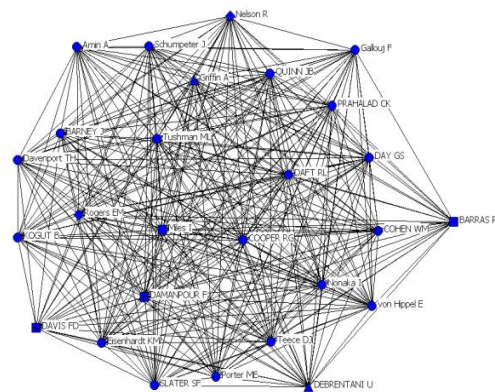


Figure 1. Key research themes in service innovation (2003-2007)

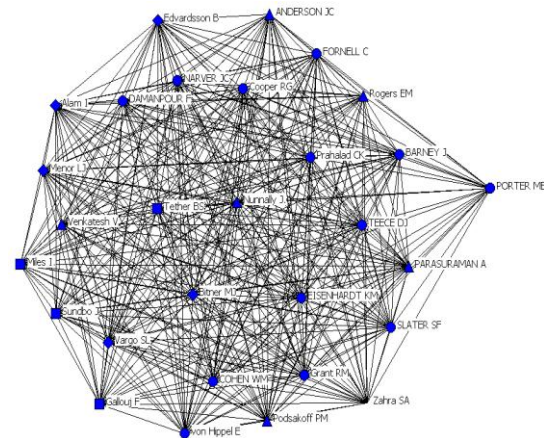


Figure 2. Key research themes in service innovation (2008-2012)

While the diagrams in Fig. 1 and Fig. 2 provide a clear picture, their foci are only on the very core areas and only a limited amount of information is revealed. By taking the co-citation matrix and grouping the authors using factor analysis of the correlations between the entries, we can determine which authors are grouped together and therefore share a common element. According to this, the closeness of author points on such maps is algorithmically related to their similarity as perceived by citers. We use r-Pearson as a measure of similarity between author pairs, because it registers the likeness in shape of their co-citation count profiles over all other authors in the set [20].

Five factors were extracted from the data in the first five years (2003-2007) and together they explained over 72.80% of the variance in the correlation matrix. Table VII lists the five most important factors along with the authors that had a factor loading of at least 0.5. As is usual in this type of analysis, authors with less than a 0.5 loading or with cross-loadings were dropped from the final results [21]. We tentatively assigned names to the factors on the basis of our own interpretation of the authors with high loadings. Our interpretation of the analysis results is that service innovation research in this period is composed of at least five different sub-fields: Innovation management, Successful Factors, Service innovation theory, Diffusion Innovation and User acceptance (Please see Fig. 1). We made no attempts to interpret the remaining factors due to their small eigenvalues. They have also been excluded from Table VII.

TABLE VII. AUTHOR FACTOR LOADINGS: 2003-2007

Factor 1: Innovation Management	variance	Factor 2: Successful Factors	variance
Quinn JB	0.896	Debrentani U	0.929
Schumpeter J	0.861	Griffin A	0.890
Prahalad CK	0.861		
Cohen WM	0.847	Factor 3: Service Innovation theory	variance
Kogut B	0.847	Miles I	0.856
Porter ME	0.842	Barras R	0.832
Barney J	0.816		
Eisenhardt KM	0.811		
Nonaka I	0.806	Factor4: Diffusion Innovation	variance
Von Hippel E	0.794	Nelson R	0.914
Teece DJ	0.793	Rogers EM	0.754
Daft RL	0.790		
Davenport TH	0.759		
Tushman ML	0.695	Factor5: User acceptance	variance
Day GS	0.673	Davis FD	0.951
Slater SF	0.587	Damanpour F	0.551

Similarly, studies on Service innovation also clustered on different research themes between 2008 and 2012 and together they explained over 69.30% of the variance in the correlation matrix of the second five years, as pictured in Table VIII lists the four most important factors along with the authors that had a factor loading of at least 0.5. We also tentatively assigned names to the factors on the basis of our own interpretation of the authors with high associated loadings. Our interpretation of the analysis results is that Service innovation research at this stage is also composed of at least four key sub-

fields: performance, user acceptance, service-dominant (S-D) logic and service Innovation pattern.

Table VII clearly indicated that the most influential authors in Service innovation studies between 2003 and 2007 clustered together. The main research focused on managing Innovation. They attempted to determine factors crucial to successful firm innovation. Dynamic capability, absorptive capacity, sustainability, innovation strategy were discussed. Miles's data [22] indicated that some service organizations behave very much like high-technology manufacturing. This is especially true of technology-based, knowledge-intensive business services.

TABLE VIII. AUTHOR FACTOR LOADINGS: 2008-2012

Factor 1: Performance	variance	Factor 2: User acceptance	variance
Zahra SA	0.955	Venkatesh V	0.874
Porter ME	0.940	Parasuraman A	0.809
Prahalad CK	0.905	Anderson JC	0.793
Grant RM	0.901	Nunnally J	0.789
Cohen WM	0.853	Podsakoff PM	0.780
Von Hippel E	0.849	Rogers EM	0.606
Eisenhardt KM	0.807		
Teece DJ	0.802		
Damanpour F	0.781		
Barney J	0.770		
Cooper RG	0.730		
Factor 3: service-dominant (S-D) logic	variance	Factor4: innovation patterns in services	variance
Vargo SL	0.888	Gallouj F	0.808
Edvardsson B	0.827	Sundbo J	0.772
Menor LJ	0.767	Miles I	0.650
Alam I	0.752	Tether BS	0.588
Bitner MJ	0.615		

For the second five years, Table VIII clearly indicated the most influential authors in service innovation studies between 2008 and 2012 also clustered together. The main research focused on service innovation performance. The firm's potential and realized capacities can differentially influence the creation and sustenance of its competitive advantage [23]. Service is the process of using one's competencies for the benefit of another party. The customer is always a co-creator of value. It is also found that service theory as a discipline is evolving from good-dominant logic to service-dominant logic, where customers co-create value through service [24].

Acceptance is more concerned in this period. TAM is a useful model. It examines the mediating role of perceived ease of use and perceived usefulness in their relation between systems characteristics (external variables) and the probability of system use (an indicator of system success) [25].

V. CONCLUSION

The main emphasis of innovation research is on new products and production processes, especially in manufacturing [26] [27] [28]. However, services tend to innovate differently from manufacturers, or at least that innovation in services brings to the fore “softer” aspects of innovation based in skills and inter - organisational cooperation practices [29]. Business services are an extremely important component of the service economy [30]. Academic researchers are shifting their focus from products to services as the next hot area. With more scholars and more resources contributing to the service innovation area, a better academic environment conducive for service innovation research ideas and will gain more momentum for further development.

The mapping of the intellectual structure of Service innovation studies indicates that service innovation has somehow created its own literature and that it has gained the reputation as a legitimate academic field. Our analysis has shown that it has an evolving structure, it is believed that service innovation publication outlets will gain more popularity and prestige that is required to become a more prominent academic field when we learn more about current paradigms and the key research themes in Service innovation studies, how they relate, and what they stand for.

The contribution of this paper is multi-faceted. First, there is recognition that complexity theory can be useful for service science. This research offers complexity theory as the basis for explaining service innovation. Second, this study identifies the most important publications and the most influential scholars as well as the correlations among these scholar's publications. However, there are some dangers in using citations to make inferences also. We typically are basing our inferences on the first author, rather than all authors, and hence may miss important contributions and collateral citations by secondary and later authors. It's a potential weakness of this research.

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