

Servitization Trend in Big Data to Personal Styling Service

Jessica Won, Bo-Young Kim

Abstract: *Servitization is a customer service with integrated product-service offerings, called product-service systems. This study aims to analyze consumer awareness and user behavior of servitization and focus the personal styling service in fashion industry. We used the social network and text mining techniques to capture social network service communications, which is a great source of useful information close to customers. Frequency analysis, centrality analysis, clustering analysis, and network visualization were conducted to investigate consumer awareness and user behavior using big data in social media. “Shoes” and “clothes” were the most frequently apparent keywords with the notion of “servitization,” and the keywords “home” and “fashion” had the highest degree of centrality in the network. Four clusters were found on the notion of servitization: fundamentals, fashion, home, and job seeking. A significant transition toward servitization is ongoing in various industries, especially the fashion industry, according to the clustering analysis. To gain a better understanding of this transition, a commercially available personal styling service was investigated. Three major companies were selected by sales volume and reputation, and the names of these companies were used as search keywords to acquire related data on social media. The keywords “men’s fashion” and “subscription box” appeared frequently apart from common fashion-related hashtags. In betweenness centrality, “best quality” and “low price” were the most important keywords in the market. This study contributes to the investigation on the trend of servitization and provides insights to service providers on consumer awareness and user behavior toward this trend via social media.*

Keywords : Big data, digital service, network analysis, product service system, servitization.

I. INTRODUCTION

Emerging technologies offer new opportunities and challenges to firms to create new business models. Servitization is a business strategy that consists of offering customer-focused packages to add value to core corporate offerings [1]. The term “servitization” refers to the transformational process from product-centric to service-oriented business models [2]. Servitization accompanying digitalization is considered one of the most recent trends in transforming industrial companies and focuses on adding value to the customer by migrating from conventional product-centric approaches to digital-based service-oriented ones [3-5]. Servitization has become a pervasive business strategy that can lock out competitors by

making market entry more complex by leveraging data-driven and intuitive solutions [6]. Servitization also can be a solution by expanding their capabilities including innovation of the value chain and creation of sophisticated products and services [3]. Brax and Visintin (2017) developed an integrative meta-model of servitization and identified eight conceptually different constellations of servitization from products with limited support to total solutions [7]. The product-service system (PSS) refers to the output of this process [4]. Tukker (2004) established eight types of PSSs, from product oriented to functional result. Since servitization is a persistent process of adopting new ideas and technologies and transforming the business consistently, firms strongly need advanced studies to perform accurate steps [9]. Social media is the most popular means of information acquisition and facilitates the exploration of various topics and market trends [10]. The mining of social media has proven useful in multiple research fields as a tool for public opinion extraction and analysis. Therefore, this paper aims to describe the understanding of servitization in the current market by analyzing unstructured content on social media and investigate the perspectives of service users. The majority of studies on servitization focus on these processes from the viewpoints of service providers. However, this study aims to explore and analyze the perceptions of consumers on the outputs of servitization to provide insights to these service providers. The first part of this study explores the general notion of servitization and the integration of products and services to analyze consumer awareness on the concept and to understand user behavior of servitization. One of major markets goes through servitization is fashion industry. The fashion industry is a highly competitive industry because products have relatively short life cycles and are relatively easy to copy in the global market. Servitization is ongoing in the fashion industry to survive dynamic competition in the market [11, 12]. Thus, the second part is an in-depth case study of servitization in the fashion industry to identify specific practices. Servitization is called a “clothing as a service” system in the fashion industry and changes the product-centric business into a service-oriented business. This study focuses on online personal styling services, which outfits are selected by styling experts, data science, or both to personalize clothing items based on the client’s tastes, budget, and size, and the direct delivery of items to the client’s home. Estimates suggest that the United States will generate over \$121 billion by 2021 in apparel and accessories in retail ecommerce and that personal styling services are one feature of this move [13].

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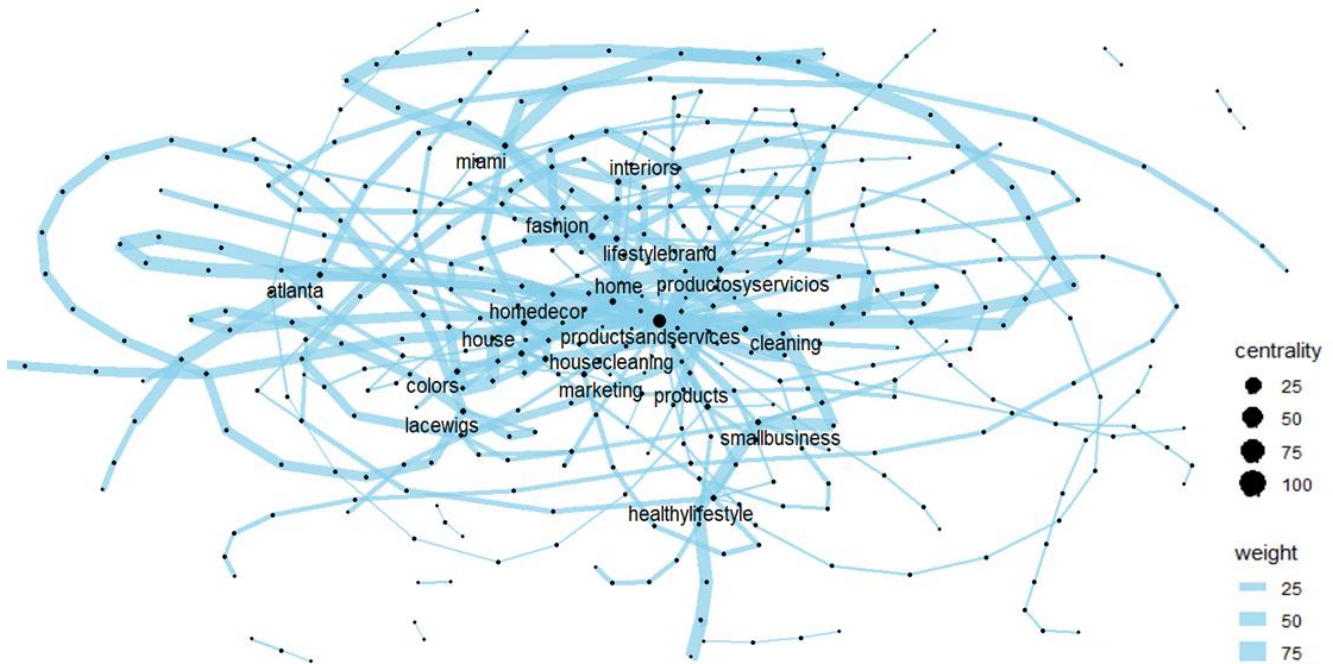


Fig. 1. Keyword co-occurrence network of servitization

packages, including tm, igraph, ggraph, and ape.

A previous research found that professionalism, flexibility, and convenience are some of the main motivators for customers to try out these services [14].

II. RESEARCH METHOD

The text mining and network analysis approach was adopted to understand the trend of servitization on social media. This study focuses on the analysis of Twitter and Instagram, wherein users express self-presentation by uploading content and using hashtags to categorize their posts into particular topics [15, 16]. The search keywords for the first part were “servitization” and “products and services.” Since the term “servitization” refers to the transformation of processes, it is frequently used by service providers as a new sales strategy. Thus, we adopted an additional keyword, “products and services,” to determine how consumers understand the outcomes of servitization. The search keywords in the second part were the names of three major service providers in personal styling services: “Stitch Fix,” “Trunk Club,” and “Frank and Oak.”

The most relevant posts on Instagram were crawled via Python with the BeautifulSoup and Selenium modules in the fourth week of March 2020. The tweets on Twitter were crawled via R with the twitterR package in the first week of April 2020. Data preprocessing was conducted to exclude noisy data and filter all parsed terms into valuable terms. After data acquisition and preprocessing, frequency, centrality, and network analyses were conducted. To extract the frequency of terms, frequency analysis on hashtags was carried out via Python with the re module, and the results were visualized with the wordcloud module. The keyword lists were edited to remove common terms that did not assist in the identification of topics, such as “Instagram” and “SNS.” To extract the corpus of terms, bigram networks were identified via Python with the nltk module, which is the analysis of keyword co-occurrence. Further data cleaning, analysis, and visualization were carried out mainly via R with suitable

III. RESULTS

A. Analysis of servitization

The data set included a total of 220 results for “#servitization” and 3,723 results for “#products and services.” Frequency analysis found the most frequently hashtagged keywords in the entire data. The names of U.S. cities such as “Atlanta” and “Miami” appeared, which means the concept of servitization has spread widely and actively in the two cities. The result showed that “shoes” and “clothes” are important items for the integration of products and services. The frequent appearance of “business” and “small business” shows that many people are aware that the notion of servitization is a business item or strategy. The following majority of keywords were related to residence, such as “interior decor,” “living room,” “bedroom,” “bathroom,” and “Airbnb.” The results also showed that the notion is highly related to job seeking as keywords such as “coaching,” “interview skills,” and “personal branding” were extracted. The keyword “virtual” was also extracted, which implies that the integration of products and services accompanies digitalization and emerging technologies. Table I shows the top 30 frequent words.

Table- I: Frequency analysis of servitization

	Keyword	Frequency	Percentage (%)
1	Products and services	3430	9.01
2	Atlanta	1125	2.96
3	Shoes	1042	2.74
4	Clothes	1037	2.72
5	Miami	947	2.49
6	Business	746	1.96



7	Cleaning	674	1.77
8	Small business	592	1.56
9	Décor	528	1.39
10	Commercial	525	1.38
11	Interior decor	524	1.38
12	Colors	524	1.38
13	Residential	522	1.37
14	Elevating your environment	522	1.37
15	Organizing	522	1.37
16	Living room	521	1.37
17	Closet organization	519	1.36
18	Bedroom	518	1.36
19	Bathroom	518	1.36
20	Pantry organization	518	1.36
21	Airbnb	518	1.36

22	Kids room decor	514	1.35
23	Home	460	1.21
24	Coaching	455	1.20
25	Coach	454	1.19
26	Interview skills	451	1.18
27	Virtual	448	1.18
28	Personal branding	448	1.18
29	Powerful knowledge	447	1.17
30	Affordable services	447	1.17

The top 500 bigram networks were structured to identify keyword co-occurrence, and this process generated a network of 406 nodes. For these 406 words, centrality analysis was performed to identify the most prominent actors. Four

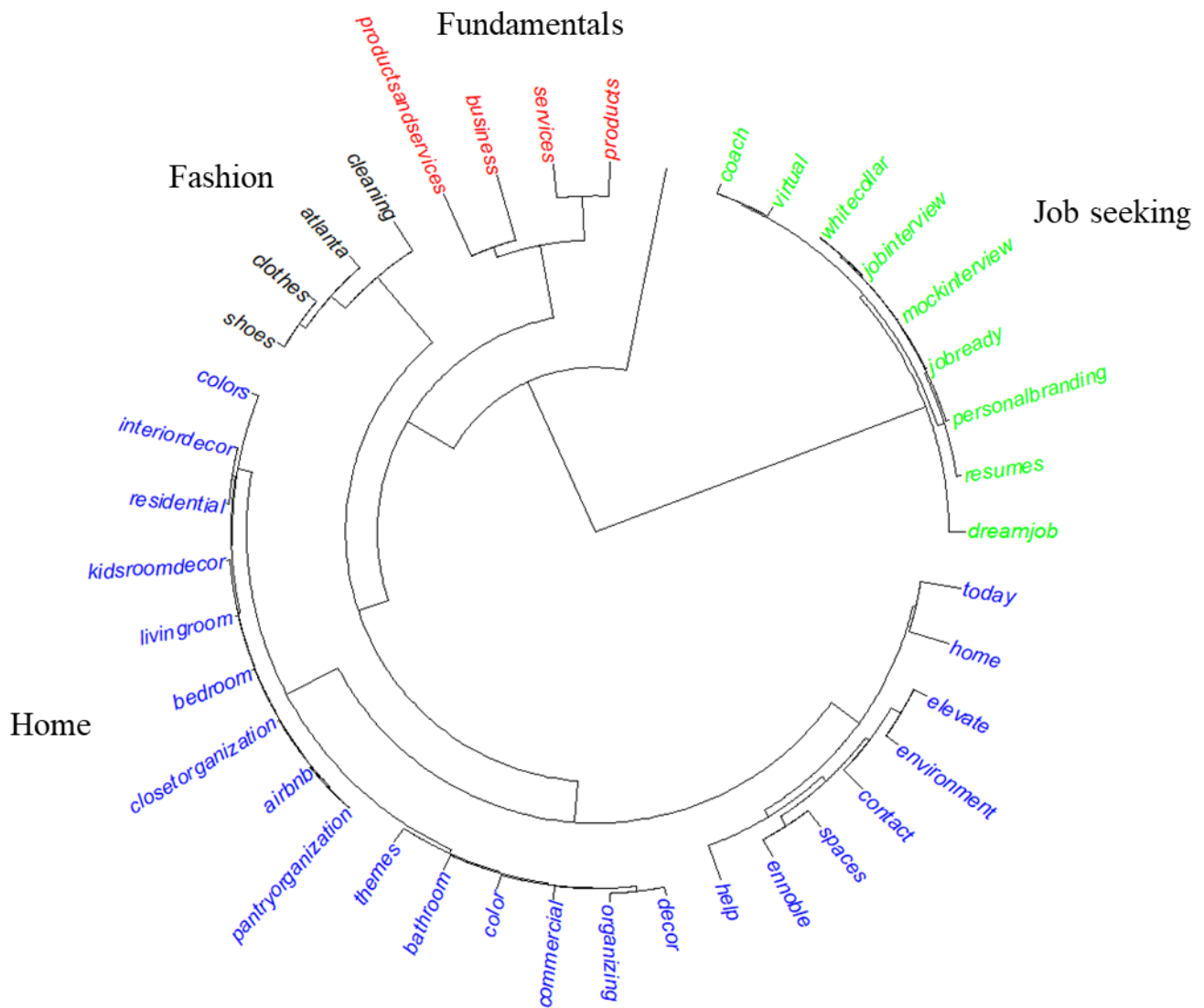


Fig. 2. Cluster analysis of servitization

different centrality scores were measured: degree centrality, closeness centrality, betweenness centrality, and eigenvector centrality. Degree centrality measures how many direct connections a node has to other nodes in a network, and closeness centrality focuses on the distance between an actor and all other nodes in the network [17]. While degree centrality captures the local importance of a node, closeness

centrality is a global measure [18]. Betweenness centrality emphasizes that for an actor to be central, it must reside on many geodesics of other nodes so that it can control the interactions between them [17]. Eigenvector centrality considers the importance of the neighbors of a node to compute its importance.

Thus, a node that is connected to many other important nodes gets high importance [18].

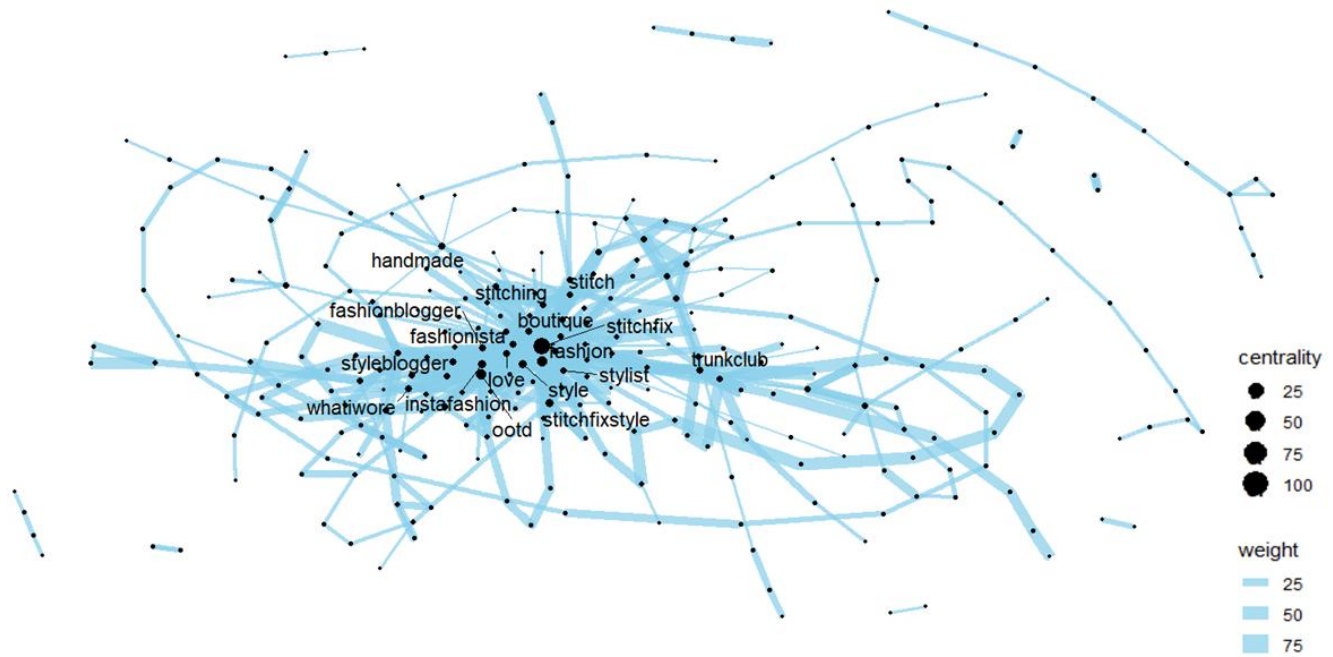


Fig. 3. Keyword co-occurrence network of personal styling services

Except for “products and services,” which was one of our search keywords, “home” and “fashion” had the highest degree centrality (0.0241). This means that the two nodes reached most of the other nodes directly in the network. This result implies that the topics of the posts are mainly about “home” and “fashion.” In closeness centrality, “creativity,” “fashion,” and “organization” were the top three nodes (0.0211). This means that these three topics can diffuse information quickly in the network. The measures of betweenness centrality were similar to those of degree centrality. In eigenvector centrality, “fashion” was the most prominent actor in the network (0.2802). “Marketing” and “branding” followed important nodes (0.2540 and 0.2349, respectively). Table 2 shows the top twenty centrality analysis results of servitization in descending order of degree centrality. The keyword co-occurrence network is visualized in Figure 1. The label highlights the keywords with a degree centrality greater than 0.0120. Node attributes are the frequency with which a keyword has been used, while edge weight denotes the frequency with which two keywords have been used in combination.

Cluster analysis was carried out for the entire data set to classify similar terms into groups. A text-parsing process was applied to identify unique terms and phrases and create a term-by-document matrix, where each entry represents the number of times a term appears in a document. Sparse terms with sparsity lower than 0.92 were removed. As a result, four keyword clusters are identified: “fundamentals,” “fashion,” “home,” and “job seeking,” as presented in Figure 2.

Table- II: Centrality analysis of servitization

	Word	Degree centrality	Closeness centrality	Between-ness centrality	Eigen vector centrality
1	Products and	0.1446	0.0214	0.3662	1.0000

	services				
2	Home	0.0241	0.0208	0.0414	0.0329
3	Fashion	0.0241	0.0211	0.0454	0.2802
4	Miami	0.0169	0.0207	0.0305	0.0170
5	Small business	0.0169	0.0210	0.0372	0.1269
6	Lifestyle brand	0.0169	0.0207	0.0132	0.0433
7	Products	0.0169	0.0211	0.0580	0.2667
8	Marketing	0.0169	0.0210	0.0239	0.2540
9	Atlanta	0.0145	0.0207	0.0242	0.0168
10	House cleaning	0.0145	0.0201	0.0074	0.0022
11	Home decor	0.0145	0.0205	0.0045	0.0058
12	Healthy lifestyle	0.0145	0.0204	0.0273	0.0046
13	Productos y servicios	0.0145	0.0210	0.0391	0.2592
14	Cleaning	0.0120	0.0204	0.0058	0.0063
15	Colors	0.0120	0.0201	0.0058	0.0013
16	House	0.0120	0.0205	0.0075	0.0051
17	Lace wigs	0.0120	0.0206	0.0106	0.0149
18	Interiors	0.0120	0.0204	0.0083	0.0047
19	Business	0.0096	0.0210	0.0100	0.1210
20	New job	0.0096	0.0206	0.0082	0.0162

B. Analysis of servitization in the personal styling service sector

A case study is conducted to investigate the trend of servitization in a specific field: personal styling services. Frequency, centrality, and cluster analyses in the previous section demonstrated that “fashion” is one of the most prominent sectors related to servitization to consumers. In the group of fashion-related services, personal styling services are selected as a state-of-the-art case of digital servitization in the fashion sector. This service selects outfits via styling experts, data science, or both based on a client’s tastes and sends the outfits directly to the client’s home. “Stitch Fix,” “Trunk Club,” and “Frank and Oak” were the most searched keywords to collect data in practice.



As customers expect companies to be represented on social media platforms, many companies promote customers to share their experiences and sponsor influencers to post their products and services [19]. As a result, the data set included a total of 124,325 results for “#stitchfix,” 16,402 results for “#trunkclub,” and 11,074 results for “#frankandoak.”

With the proliferation of smartphones, users capture and share the details of their daily lives on social networking services such as Daily Fashion. Frequency analysis found that the most frequently hashtagged keywords were “ootd” (outfit of the day), “fashion,” and “style,” which are popular hashtags to share fashion-related items. As popular hashtags can increase the level of interaction with others, both individuals and companies tend to add popular and trending hashtags to their posts. In the same vein, “instafashion,” “fashion blogger,” and “fashionista” had the highest frequency. The results included terms for luxurious details and features of fashion items, such as “embroidery” and “handmade.” “Men’s fashion” appeared frequently, which shows that these styling services target and emphasize on the men’s fashion market. “Subscription box” also appeared frequently, which shows that these services laid the foundation for the subscription business model or the so-called Netflix model.

Table- III: Frequency analysis of personal styling services

	Keyword	Frequency	Percentage (%)
1	Stitch fix	88493	27.85
2	Ootd	16903	5.32
3	Fashion	15663	4.93
4	Trunk club	12330	3.88
5	Style	8515	2.68
6	Frank and oak	6807	2.14
7	Stitch fix style	5556	1.75
8	Stitch	5188	1.63
9	Embroidery	4769	1.50
10	Love	4355	1.37
11	Insta fashion	4030	1.27
12	Fashion blogger	3938	1.24
13	Stitch fix Friday	3539	1.11
14	Fashionista	3445	1.08
15	Handmade	3129	0.98
16	Stitching	3026	0.95
17	Outfit of the day	3014	0.95
18	What I wore	2963	0.93
19	Stylist	2958	0.93
20	Style blogger	2905	0.91
21	Embroidery art	2825	0.89
22	Stitchers of Instagram	2685	0.85
23	Stitches	2648	0.83
24	Clothes	2575	0.81
25	Wiw	2544	0.80
26	Men’s fashion	2448	0.77
27	Insta style	2325	0.73
28	Subscription box	2312	0.73
29	Insta good	2303	0.72
30	Nordstrom	2234	0.70

The top 500 bigram networks were structured to identify keyword co-occurrence, and this process generated a network of 331 nodes. For these 331 words, centrality analysis was performed to identify the most prominent actors: degree centrality, closeness centrality, betweenness centrality, and eigenvector centrality. Except for our search keywords, “ootd” and “fashion” had the highest centrality in all four centrality scores. The rank of centrality scores was quite similar, while betweenness centrality revealed terms directly

related to sales, such as “best quality” and “low price” (0.0353 and 0.0332, respectively). Table 4 shows the top twenty centrality analysis results of personal styling services in descending order of degree centrality. The keyword co-occurrence network is visualized in Figure 3. The label highlights the keywords with a degree centrality greater than 0.0242. Edge weight denotes the frequency with which two keywords have been used in combination.

Table- IV: Centrality analysis of personal styling services

	Word	Degree centrality	Closeness centrality	Betweenness centrality	Eigen vector centrality
1	Stitch fix	0.3233	0.0132	0.2443	1.0000
2	Ootd	0.0876	0.0132	0.0401	0.4182
3	Fashion	0.0785	0.0132	0.0398	0.4315
4	Insta fashion	0.0483	0.0132	0.0202	0.3077
5	Style	0.0453	0.0131	0.0055	0.3165
6	Stitch fix style	0.0423	0.0131	0.0096	0.2354
7	Love	0.0363	0.0131	0.0142	0.2245
8	Fashionista	0.0363	0.0131	0.0137	0.3086
9	What I wore	0.0363	0.0131	0.0176	0.0993
10	Trunk club	0.0332	0.0131	0.0171	0.1309
11	Style blogger	0.0332	0.0131	0.0070	0.1657
12	Fashion blogger	0.0302	0.0131	0.0109	0.1461
13	Handmade	0.0302	0.0131	0.0167	0.0925
14	Boutique	0.0272	0.0131	0.0009	0.2068
15	Stitch	0.0242	0.0131	0.0175	0.1697
16	Stitching	0.0242	0.0131	0.0024	0.1724
17	Stylist	0.0242	0.0131	0.0010	0.2337
18	Embroidery	0.0211	0.0131	0.0029	0.1429
19	Cross stitch	0.0211	0.0131	0.0119	0.0713
20	Men’s wear	0.0211	0.0129	0.0187	0.0052

IV. CONCLUSION

This study provides important implications for practitioners so they can better understand how consumers relate to servitization keywords. Firms can create new opportunities in the growing markets through networks of keywords on social media. In general, our analysis offers four key findings:

- 1) Fashion and home businesses need to develop advanced product service systems to meet consumer expectations. The notion of servitization is the most strongly associated with “fashion” and “home” on social media big data. From the perspective of the consumers, the integration of products and services most frequently occurs in these two domains, which are closely related to our daily lives.
- 2) Companies adopting the servitization strategy can emphasize on the future-oriented side of the concept to their consumers. Consumers link the servitization concept to forward- and positive-thinking ideas, such as “creativity,” “dream job” and “personal branding” on social media.

- 3) SNS promotion was a significant factor for the companies operating personal styling services. A vast number of posts about personal styling services are created every day. Major fashion keywords such as “ootd” and “instafashion” appeared frequently with the search keywords, which can expose their products and services to the public in an effective way. Companies should actively utilize SNS marketing using customers and influencers.
- 4) The big data is a growing technology which maintains all kind of data’s in the real world and the big data related tools and technologies have improved enormously [20]. Our empirical contributions include an investigation into how big data can be used to explore consumer awareness on emerging concepts such as servitization.

Several limitations exist in this study which point out directions for future research. First, the dataset size of the keyword “servitization” was small. We introduced additional keyword “products and services” to acquire higher number of data from consumer perspective, but irrelevant data may have been included which differs from the notion of servitization. Second, as the personal styling service is in the emerging stage, the data was concentrated on a specific leading company which means the results may contain the uniqueness of the specific company. Finally, an examination of other forms of servitization in other industries would be valuable since servitization has become a pervasive business strategy in various fields.

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