

## SYSTEMATIC LITERATURE REVIEW OF DECISION SUPPORT SYSTEM FOR SOCIAL MEDIA

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### ABSTRACT

Social media is a very active and fast-moving domain. It is not only a communication medium but also for information exchange. Based on all categories of sentiment interchanged in media, the central issue could be academically addressed and can be methodically converted to decision support. The study aimed to review the decision support system on social media, including structural issues and the data techniques to extract the estimated valuable information. This research used Google Scholar, IEEE, Elsevier, Research Gate, and Semantic Scholar online databases for articles published in English during the last nine years (between 2012 and 2021). We specifically searched for three keywords ("Social Media", "Decision Support" and "Decision Support of Social Media") to find the articles. In this literature, we presented a systematic review of the decision support system using three research questions. The final result is a continuity between a system of social media until being a system for decision support. So many fields support decisions based on social media facts and databases. The decision could support the decision unit for determining a big decision on their business or organization. Many scientific methods would make the decision, and varied methods and cases took the case selection. This research is expected to contribute to academic research on social media decision support.

**Keywords:** *Decision Support System, Literature Review, Social Media*

### 1. INTRODUCTION

Decision-making is a mechanism for making choices at each step of the problem-solving process [1]. A decision support system (DSS) is a computerized program that contains knowledge of a specific domain and analytical decision models to assist the decision-maker and is used to support determinations, judgment, and courses of action in an organization or a business [2]. Through DSS, it is possible to process large volumes of data using output models and outputs with interfaces that increasingly permeate the professions with a high level of knowledge [3]. Establishing a knowledge base on actions and outcomes could assist individuals in making decisions by illustrating potential outcomes given an action they intend to

perform [4]. A DSS sifts through and analyzes massive amounts of data and compiles comprehensive information that can be used to solve problems and in decision-making. The system supports the decision-maker in the decision-making (logic, rationale, verified, and structured), and the decision must be objective. The quality of a DSS is based on the appropriate frame, creative, meaningful, clear value, logically correct reasoning, and commitment to action [5]. Since social media networks (e.g., Facebook, Instagram, and Twitter) connect billions of social media internet users worldwide, organizations face a big database challenge of potentially important user-generated information, generating demand for advanced analytical strategies such as Social Media Data Analytics [6]. Social media is a very active and fast-

moving domain [7]. Social media also uses any kind of language. Language is the way of communication between people. Language helps us to understand the world around us. The languages that are spoken by people all around the world are known as natural languages [8]. Social media allows people from the whole area to share, from life choices to global issues, technology, and what is happening worldwide. Social media is also a useful tool used by multinational firms, medium-sized agencies, nonprofit organizations, and governments alike [9]. With data transmitted over such platforms, new means of understanding consumer perceptions have paved the way for businesses, and they strive to apply algorithms for analyzing opinions and sentiments of people [10]. This paper compared various methods of decision support in social media focused. Previous studies such as [11] and [12] still presented only what could be learned from research, such as the result and the method used. The difference of this study and the previous study are on the research question and the method using inclusion and exclusion rules.

This paper is organized into three key sections: first, the methodology used; second, a literature review, which presents theoretical support for the present research; third, the discussion of results and conclusions of this study. This paper is expected to contribute to the academic world concerning literature systems and decision support in social media.

## 2. METHOD

This research used a systematic literature review methodology based on multiple references from international publications. Reference searching involves two main parts: defining research questions and inclusion and exclusion rules. Research questions are used to determine the goals needed to be done in the research. To support those, inclusion and exclusion rules definition is done to filter past research for better output.

The study limitation of this research is by the inclusion and exclusion rules. This study has clear objectives, including publisher, year of publication, data-taking process, data source, case selection, and the improved method for the next research. This research was done by using 30 works of literature but only 14, which is the most compared literature.

The method used in this research uses keywords for the first filtering, the year of publication, and three research questions. The finding method use keyword as the first filtering. The keyword used is DSS, Social Media, and DSS in Social Media which is searched only in international journals and conferences. The second filtering is based on the publication year. First, the journal with many citations from all journal publication references will be joined, and the duplicate research, such as the same title, object, and duplicate content, will be removed. Final filtering is choosing the literature indexed by Scopus and then summarizing them by research question.

### 2.1 Research Question

Certain criteria can be considered in identifying the research question (RQ). For example, there are three research criteria questions such as; the data-taking process (how was the data taken in the process of conducting the research?), case selection (what is the case selected for each research?), and future improvement for the method used (what is the future improvement proposed?).

### 2.2 Inclusion and Exclusion Rules

Certain rules regarding selecting references must be defined to produce better output in this research. In realization of that, inclusion and exclusion rules are made to select which papers are eligible to be referenced. Based on what this research discusses, these are inclusion and exclusion rules used as follows: Publication from international conferences and journals published in recent five years. In this case, the last reference should be from a paper published after 2011. The publication came from conferences and journals indexed internationally and was published in Google Scholar, IEEE, Elsevier, Research Gate, and Semantic Scholar. Literature selection and screening criteria were based on that published year, international indexed and also using keywords such decision support system and social media.

## 3. RESULTS AND DISCUSSION

The literature that is reviewed here consists of two conferences and thirteen journals. In addition, there are three related kinds of literature from Elsevier, four from Research Gate, five from Semantic Scholar, two from Springer, and one from IEEE. The distribution of the journal publisher is illustrated in Figure 1.

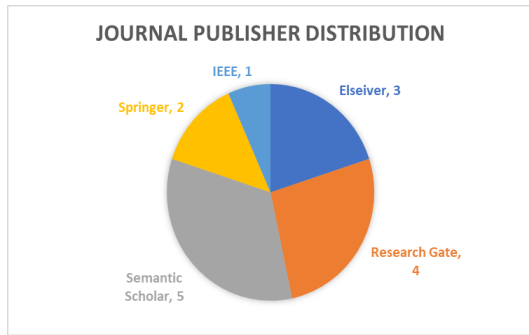


Figure 1: Journal Publisher Distribution Chart

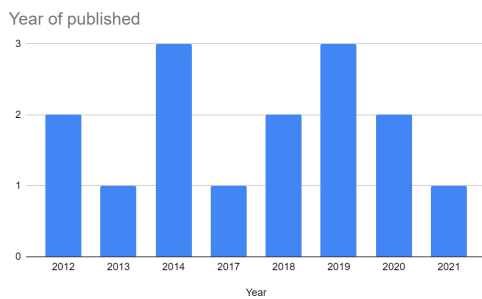


Figure 2: Year of Published Distribution

From Figure 2, two articles were published in 2012, one in 2013, three in 2014, one in 2017, two in 2018, three in 2019, two in 2020, and one in 2021. This distribution means that this paper reviewed and compared the research related to the research question that represents the last decade. How the data was taken in the process of conducting the research will be answered in Table 1.

Table 1: Data-taking Process

Title of the paper	The data-taking process
[13]	Initially trained using real data streams from different social media platforms specialized in a user review.
[14]	Data was collected from social media sites and blogs. Any followers, impressions, engagement, copy traffic, and brand mentions are key parameters to analyze during a social media audit. For example, great interest comes from user-produced data for companies and research institutions. These data contain useful knowledge, including customer perceptions, feedback, and suggestion.
[15]	This paper focused on data related to product reviews for product evaluation. It is restricted mainly to the data of vendors, manufacturers, entrepreneurs, and others of a similar domain. Messages can change from general opinions to individual ideas.

Title of the paper	The data-taking process
[16]	The issue of waste management is also a big concern discussed by Twitter users. More than 58600 mentions (22508 female and 20033 male)
[17]	Built a questionnaire with 26 questions about the connections among the seven concepts related to the considered variables, and we used a Likert scale to answer those questions.
[11]	The data was based on a literature review
[2]	A random sampling of 12371 validated reviews from 2005 to 2012 was extracted from the dataset Yelp Reviews. In order to begin structuring data, an exploratory analysis was performed on the sample.
[18]	Dataset of mental health posts (This dataset included 79,833 posts from 44,262 unique users that were shared between February 11 and November 11, 2014, on 14 mental health subreddits) from Reddit
[19]	Crawl from Twitter with FC, extraction of geolocation
[20]	Crawl from Twitter with FC, extraction of geolocation
[21]	Manual tagging, data extraction from discussion forums
[22]	Delphi method from Business Fundas
[23]	Crawling dataset from Tripadvisor.com (The data used were 980 social media users that provided an assessment of the tourist attractions visited.
[24]	Data was extracted from one social network "Instagram" using the "Octoparse" tool started from 2019

Based on Table 1, data sources varied from multiple resources. However, we found that there are several common data sources used (more than one paper used the same dataset): 4 papers used Twitter, 2 papers used Facebook, 3 papers used Instagram, 2 papers used Yelp, 1 paper used Trip Advisor, 1 paper used Business Fundas, and 2 papers used discussion forums. Digital location-based services (LBS), such as Yelp, Google Maps, Foursquare, and Trip Advisor, are smartphone and web applications that aggregate and distribute data about real-world amenities, usually contributed by volunteers [25]. The data sources used are concluded in Figure 3.

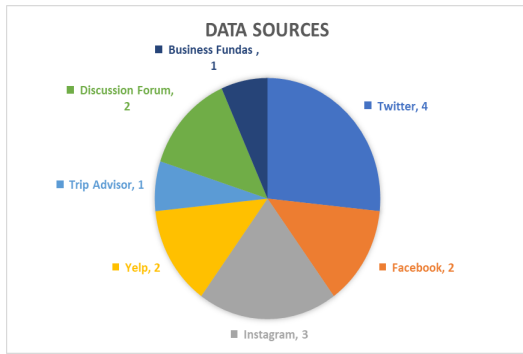


Figure 3: Data Sources Chart

The answer to the first RQ, "how was the data taken in the research process?" can be concluded that data sources varied from multiple resources based on the purpose. The purpose is varied; business, psychology, travel, and own purpose by the organization for finding the trend of people's habits on social media.

What is the case selected for each research will be answered in Table 2.

Table 2: Case Selection

Title of the paper	Case Selection
[13]	The case selection was based on <b>sentiment analysis</b> . The core of the proposed support system was expected to estimate the users' sentiment in terms of positive, negative, or neutral polarity expressed in a comment.
[14]	The case selection was based on <b>business decisions and clustering</b> . Focused on the problems and existing solutions to the commercial portfolio acquisition and research portfolio issues.
[15]	The case selection was based on <b>sentiment analysis, naïve Bayes, logistic regression, and a support vector machine</b> . It was restricted mainly to the data of vendors, manufacturers, entrepreneurs, and others of a similar domain. Messages could change from general opinions to unique ideas.
[16]	The case selection was based on <b>waste management and fuzzy logic</b> . The issue of waste management was a big concern discussed by Twitter users.
[17]	The case selection was based on <b>decision support and structural equation modelling</b> . The four main concepts in SEM exploratory were Technical infrastructure, online communities, network analysis, knowledge management, and online communities.

Title of the paper	Case Selection
[11]	The case selection was based on <b>decision support comparison</b> . A social network for decision and reconstruction support needs to ensure an automatic tagging feature to emphasize the issues of temporal information (time stamp) and those relating to the authorship of the content, even if it results from the contribution of multiple users
[2]	The case selection was based on a <b>business decision and sentiment analysis</b> . This paper used a text mining and sentimental analysis technique to structure inline reviews and presented them on a decision support system with two different dashboards to assist in decision-making. Companies that wish to develop such systems may need to reinforce their marketing teams with new business intelligence skill
[18]	The case selection was based on <b>social support decisions</b> . The main issue of this paper started from human assessments on the presence of suicidal ideation risk markers in posts. However, the findings of the paper also not all individuals posting in the Reddit mental health communities are equally likely to be influenced by the support received through comments.
[19]	The case selection was based on <b>natural disaster information and information extraction</b> . Natural disaster information used Twitter messages
[20]	The case selection was based on <b>natural disaster information and information extraction</b> . Information extraction for twitter data, extracting information and geolocation for user
[21]	The case selection was based on <b>vehicle safety decisions</b> . Vehicle safety and performance related to automotive manufacturers
[23]	The case selection was based on <b>decision support criteria</b> . Started from prioritizing facilities that are the trend of tourism
[24]	The case selection was based on <b>business decisions</b> . Business challenges turned into the business decision to win the competition of business

Based on Table 2, the case selection was taken by varied methods and cases. This research found that 4 papers used sentiment analysis; 3 papers used business decision, 1 paper used clustering, one

paper used naïve Bayes, logistic regression, and support vector machine, 1 paper used waste management, 3 papers used decision support, 1 paper used structural equation model, 2 papers used natural disaster information and information extraction, 1 paper used vehicle safety decision and 1 paper used fuzzy criteria on tourism trend. However, many papers used more than 1 case selection. The data selection used in the paper was distributed in Figure 4.

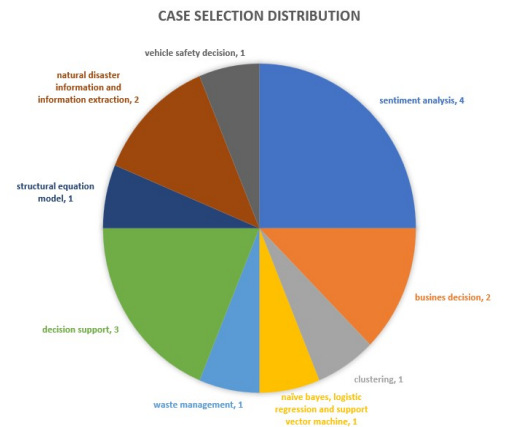


Figure 4: Case Selection Distribution Chart

The answer to the second RQ, "what is the case selected for each research?" is still related to the answer to the first RQ. The case came from the field that wants to be traced and based on the available data. For example, the most selected case is Sentiment Analysis, and the most used data is text. This is the effect of growth from social media platforms. With the increase of social media data networks and platforms over the previous years, the world has significantly transformed. As a result, we can access much data from various social media platforms such as Twitter, Instagram, and many others. This opens the opportunity to analyze this open access data for various purposes, such as customer behavior analysis, electability analysis based on public opinion, business decisions and many more. Sentiment analysis is the best tool to determine whether the opinion is positive or negative [12] and can be used for further planning. That is also a reason why based on figure 4, sentiment analysis is the most used for case selection.

Research by [13] aims to develop businesses using social media data analytics to present a decision support system for supporting companies and enterprises in managing promotional and marketing campaigns on multiple social media channels. This paper presents a DSS for a

Sentiment Analysis Engine, which can estimate the users' sentiment in terms of positive, negative, or neutral polarity expressed in a comment. The case selection in this paper is a practical application of sentiment classification algorithms that are presented based on machine learning models in digital marketing and social media communication. In particular, the design and the development of a DSS for Social Media Listening are carried out expressly conceived for companies wanting to exploit the valuable knowledge spread across social media to build effective, long-term strategies for their business. The developed method for every case is text representation (tokenization, stop word filtering, stemming, stem filtering, feature representation), text classification sentiment analysis, and support vector machines (SVM) classification models.

A support vector machine or SVM is a machine learning technique based on the supervised machine learning model. An SVM is based on statistical learning theory and classifies data by determining a set of support vectors and members of the labelled training data samples. The main objective of an SVM is to find an optimal hyperplane for the classification of new data points [26]. Based on [14], this paper thinks that Business intelligence is a significant field that uses data analysis to produce key information as part of business decision-making. The data-taking process was from social media network (SMN) data. Case selection focus on BDMS (Business decision-making system) based on social media data analytics.

Research by [2] provides important contributions to the literature by presenting an ETL (extract transform load) procedure that may be replicated to structure text using transparent and readily available algorithms and a new dimensional model that may accommodate data from multiple sources. The study uses sentiment analysis, text mining techniques to extract unstructured information, accurate topic-modeling algorithms based on Bayesian models to group terms into latent topics and a dimensional model approach to set the bases for a DSS in hospitality and tourism analysis. This paper is organized into three key sections: first, a literature review, which presents theoretical support for the present research; second, the methodology used; third, the discussion of the results and conclusions of this study. Two-dimensional models were created to develop a DSS that could help decision-makers identify factors that positively or negatively influence customer satisfaction. Results were obtained using R for cleaning, transforming,

structuring data, and carrying out descriptive statistics. Sentiment analysis was performed using Semantria to classify the polarity and sentiment score of each comment, term, and latent topic. Two-dimensional models were developed to allow managers to explore sentiment markers using multiple perspectives such as date, region, or type of business reviewed. The current DSS helps managers align their offers and set strategies about which business to invest in for each city's future and how to manage their online reputation better. R is often described as a programming language [27].

Based on [15], a labeled dataset publicly available on Kaggle is used, and a comprehensive arrangement of pre-processing steps that make the tweets increasingly manageable to regular language handling strategies is structured. The main intention is to break down sentiments all the more adequately. In twitter sentiment analysis, tweets are classified into positive and negative sentiments. This can be done using machine learning classifiers. Such classifiers will support businesses, political parties, analysts, etc., and so evaluate sentiments about them. By using training, data machine learning techniques correctly classify the tweets. So, this method does not require a database of words, and in this manner, machine learning strategies are better and faster in performing sentiment analysis. The method started with Data cleaning (use various data tools that can help in cleaning the dataset; use several artificial intelligence (AI) tools that help identify duplicates in large corpora of data and eliminate them; for correcting the corrupted data, the source of error be tracked and monitored; validate). Then continued by data pre-processing (assessing data quality, identifying inconsistent values, and aggregating the features).

[16] consist of five parts; literature studying (systematical review), hot issue finding (social media quantitative analysis), parameters defined, model construction (fuzzy logic, mathematical model), and model testing. Fuzzy logic, mathematical model, and quantitative analysis. The public's participation has functioned via survey conduction to measure the current condition. Fuzzy logic is used to eliminate the biased value of parameters. The mathematical concept functioned to describe the interconnection among parameters and define the decision clearly.

[17] The above bibliographic resources present the most relevant concepts of the analyzed online social networking and decision-support systems research literature based on manual and

automatic text extraction procedures. As the interconnections of online social networking and the decision support system concept, the researcher in this paper resorts to network text analysis theory, as it assumes that language and knowledge can be modelled as networks of words. After getting the cluster concept, this paper wants to find interconnection and impact on DSS. The exploratory study uses structural equation modeling (SEM). SEM is essentially a path analysis bearing a structural model.

A paper by [11] is a literature review with 65 references using the social network for decision and reconstruction support, combining ostensive and performative approaches to social network decision-making must explicit decision-making trust.

Based on [10], This paper applied a stratified propensity score matching the content of comments shared on mental health communities on Reddit to identify subpopulations of individuals more likely to be affected by the comment. Based on [19], the system exploits the messages shared in real-time on Twitter and analyzes the message to get seismic events and information via Twitter messages and e-mail. [20] focused crawling (FC), trustworthiness analysis (TA), multilingual tweet classification (MTC) for handling multilingual tweets, and geo-parsing (GEO).

[21] using Text mining and the ANOVA (Analysis of Variance) method to mine alternative vehicle defect data sources: Vehicle Defect Discovery System (VDDS). A one-way ANOVA or an F test is a statistical procedure to determine if a difference exists among three or more variables [28]. Based on [22], the application of a group decision support system has been presented for integrating a web portal with social media channels using fuzzy set theory and analytic hierarchy process as the method of this research.

Nowadays, the way tourist information is accessed and used has changed dramatically, primarily due to the influence of social media [29]. Based on [23], multi-criteria decision-making (MCDM) using Fuzzy-Hierarchical Analytical Process (F-AHP) methods of tourism were used. This research also combined Fuzzy and AHP methods for getting a normalized decision matrix for getting the priority ranking based on reviews of ten destinations in ten categories in East Asia. AHP could demonstrate a preference that reflected the importance scores of each decision-maker group [30]. Related research has also been studied by [31]

for making trust in consumer decision journeys. With the appearance of social media, the travel decision-making process has rapidly changed.

One method using the K-means clustering algorithm was researched by [24]. The main objective of this article is to develop a decision support system tool based on K-means clustering to find the optimal place to open a new store based on the location of social network events. The contribution of the decision support system tool is to provide an opportunity to get the most popular places for the specific region according to social network activity and put much emphasis on the visual representation of received results.

After knowing the data-taking process, the case selection, and the methods used, the next step is understanding the research gap in the DSS research field. This will be answered in Table 3.

Table 3: Future Improvement Method

Title of the paper	Future Improvement Method
[13]	This paper didn't mention future improvement method
[14]	This paper didn't mention future improvement method
[15]	This paper didn't mention future improvement method
[16]	Defining the decision alternatives in each parameter
[17]	This paper didn't mention future improvement method
[11]	A social network for decision and reconstruction support should transparently embed these techniques into Tools, making them available to non-Semantic-Savvy users.
[2]	This paper allows for other sources to be included in the dimensional model; future research might show how other online platforms, such as TripAdvisor or Zomato, may be treated so that they may adhere to the standard model presented
[18]	This paper didn't mention future improvement method
[19]	This paper didn't mention future improvement method
[20]	This paper didn't mention future improvement method
[21]	This paper didn't mention future improvement method
[22]	Replicate with a different set of data
[23]	This paper didn't mention future improvement method
[24]	Implement the classification of results based on different types of business criteria to choose the store location, also adopting

	detailed user interface development to maximize the benefits of DSS in the business sector.
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To answer the third RQ's conclusion, not every article provides suggestions for the next researcher to improve their research. There is a similarity between articles related to improvement methods. It is the data used in the previous research. As an example from [21] and [14], they need improvement on the parameter and the data. Reconstruction, transparency, and classification also need to develop based on the case of [16] and [23]. Further development is also needed in collecting data from social media platforms [2], as technology has rapidly changed, which means that social media will be very developed to get a better model presented.

Nevertheless, the method proposed by each researcher for further development will contribute to the scientific and academic suggestions for deciding a solution in the future case of the new era with new social media usage. But this systematic literature review will be better if covers the last 5 years of international published literature.

#### 4. CONCLUSION

This literature review concludes based on the systematic literature review related to decision support systems and social media. Many scientific methods could make the decision, and varied methods and cases took the case selection. This research focused on articles from Google Scholar, IEEE, Elsevier, Research Gate, and Semantic Scholar online databases for articles published in the English language during the last nine years with three keywords ("Social Media," "Decision Support," and "Decision Support of Social Media"). From the first RQ, it can be concluded that data sources varied from multiple resources based on the purpose. The purpose is varied; business, psychology, travel, and own purpose by the organization for finding the trend of people's habits on social media. The second RQ answered the case selection distribution related to the previous RQ's answer. The case came from the field that wants to be traced and based on the available data. For example, the most selected case is Sentiment Analysis, and the most used data is text. This is the effect of growth from social media platforms. With the increase of social media data networks and platforms over the previous years, the world has significantly transformed. As a result, we can access much data from various social media platforms such as Twitter, Instagram, and many

others. This opens the opportunity to analyze this open access data for various purposes, such as customer behaviour analysis, electability analysis based on public opinion, business decisions and many more. To answer the third RQ's conclusion, there is a similarity between articles related to improvement methods. It is the data used in the previous research. Some articles need improvement on the parameter and the data. Reconstruction, transparency, and classification also need to develop based on the case.

Further development is also needed in collecting data from social media platforms, as technology has rapidly changed, which means that social media will be very developed in the future to get a better model presented. Nevertheless, the method proposed by each researcher for further development will contribute to the scientific and academic suggestions for deciding a solution in the future case of the new era with new social media usage. The decision could support the decision unit in determining a scientific solution for their business or organization.

For future works, a systematic literature review like this is still needed to simplify a whole of study for becoming a piece of simple information for academic research. Focusing the literature into the supervised and unsupervised method of decision support in social media would be a good idea for the renewable study.

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