

Semantic Search Engine Optimisation (SSEO) for Dynamic Websites: A Review

Mohammed J. Sadeeq & Subhi R. M. Zeebaree

Abstract:

The billions of databases, worldwide, provide an increasing amount of information to the people. As a result, the researchers have to seek knowledge about the resources, which were generically known as the search engines. One such search technique that is popularly used is the semantic search technique which improves the search accuracy by determining the purpose of the search along with the contextual meaning of the terms which appeared in the data space or the web for generating accurate results. Many search engines exist today, which makes it difficult to collect useful data. In this paper, many types of research depended which prepared to describe the Semantic Search and Semantic Web techniques. Various types of semantic search engines are investigated and the differences between the Semantic Search and Semantic Search keywords are determined. Additionally, the benefits of using Semantic Search were highlighted. The literature review and the findings of the case study helped in understanding the new constructs. These researches also determined the relationship between the new and the previously existing constructs based on their perspective regarding the extension of Bedny's activity theory with regards to the SEO promotion techniques. They added the functional consequences of extending Bedny's activity theory faced by the promotion managers. The researchers have summarised the history of semantic search and its global position in search engine generation. The researchers also highlighted the role played by the search engines in the semantic search and smart web technologies.



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Literature Review

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1. Introduction

In the age of information technology, a majority of people seek all types of information on the internet. The internet is described as a vast society that includes millions of users who visit and explore this networking medium [Alzakholi et al., 2020; Zebari et al., 2020; Zebari et al., 2018; Zeebaree et al., 2020; Zeebaree et al., 2019]. The existing technology has allowed the internet to become a vast business network that allows people to conduct businesses and commerce trade across the globe. Digital users or the e-crowd uses internet technology for marketing and commercial purposes [Jader et al., 2019; Zeebaree et al., 2020; Zebari et al., 2019; Zeebaree et al., 2020; Zeebaree et al., 2020]. They commonly access the internet using the Search Engine Optimisation (SEO) technique, which is a unique web search approach that is used for improving the ranks of the websites and contributing to their web dominance [Amrahov, 2016; Haji et al., 2020; Shukur et al., 2020; Shukur et al., 2020]. SEO must consider the operational process used by the search algorithms, and determine the exact search query, and the user-centred interface knowledge and the meaning of the online data in addition to its cost-effectiveness [Amrahov, 2016; Ariza-Colpas et al., 2019; Dino et al., 2020; Haji et al., 21, May; Haji et al., 2020] described a novel method which was based on the operational principle. In an earlier study, the researchers [Arlitsch et al., 2013] observed that the internet searchers sought information using the search engines, wherein the intelligence data helped in addressing the prospective environment owing to their existing participation.

A search engine is seen to be a primary instrument that helps in browsing the internet. In the absence of a search engine, the information on the internet or forums is of no use. It becomes very difficult to search for information on numerous internet websites without a search engine. Semantics is described as the study of language (Abdullah et al., 2020; Dino et al., 2020; Zeebaree et al., 2020). It mainly focuses on the relationship between words, phrases, symbols, and signs. This term was first described by Tim Berners-Lee, who founded the World Wide Web. He described the internet as a web of data that could be directly or indirectly processed by machines [Mahmood et al., n.d.; Sharif et al., 2020; Squizzato et al., 2015]. A Semantic Search process is divided into 5 steps, described in Fig. 1. In Step 1, the user enters the search query in the search bar of a search engine. In Step 2, the search engine studies the search query, while the data is matched to the thesaurus in Step 3. In Step 4, the semantic search accesses the matched data, and in Step 5, the semantic search engine returns all related information.

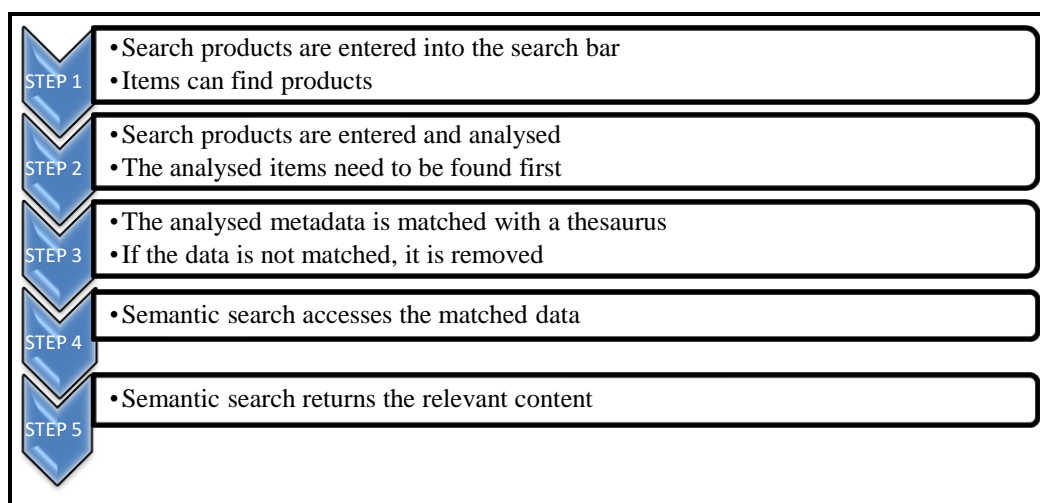


Fig. 1: Life cycle and the processes involved in semantic search optimization.

2. Background Theory

In this paper, we carried out a literature search and analysed the data using the available tools for fulfilling the objectives of this research. The researchers addressed the questions related to the origin of the literature survey and data analysis. The researchers aimed to search for the research papers, books, magazines, documents, conference proceedings, reviews, white business papers, and websites related to the research topic. For determining the relevant content, the researcher visited various websites like IEEE Xplore Digital Library, ACM Digital Library, BTH Library, and many other online websites and libraries, which offered information regarding the research topic (Salih et al., 2020; Shukur, Zeebaree, Ahmed, Zebari, et al., 2020; Umenhofer, 2019). Since search engines played a vital role in this study, the researchers would like to point out that they only used the official search engines provided by Bing, Yahoo, and Google for acquiring the most updated details for indexing the dynamic websites, using accessible SEO resources and various online articles provided on the official websites related to the research topic (HamaAli & Zeebaree, 2021; Hamad & Zeebaree, 2021; Khalid & Zebaree, 2021; Obaid et al., 2020; Qadir & Zebaree, 2021). In Step 2 of this literature survey, before using any sources listed in the literature report, we summarised and criticised the accessible and collected resources (Ibrahim et al., 2019). In the final step, all compared references were included in the literature review. Fig. 2 describes the various steps included in this literature survey.

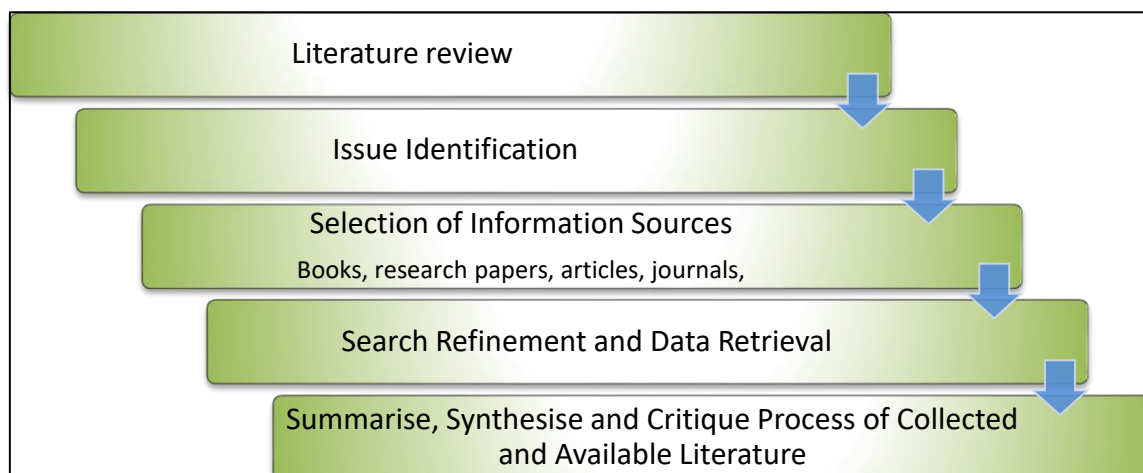


Fig. 2: Literature review Process

Retrieving information by searching for the information on the internet is an old concept, however, people can face many problems on the internet while retrieving information (Ahmed & Zeebaree, 2021; Husain & Zeebaree, 2021; Mohammed & Zebaree, 2021; Osanaiye et al., 2019; Razaq et al., 2019; Subhi R. Zeebaree et al., 2020). Different web search engines present different search results owing to their dissimilar search and indexing processes (Jacksi et al., 2016). The popular search engines like Google, Yahoo, and Bing answer the questions with the help of keyword processing. In addition to keyword processing used for retrieving information from the internet, many research groups have used a semantics-based search engine for obtaining information. However, these studies are in their nascent stage. Thus, it is difficult to obtain all the relevant information related to the search query unless the search engines complete the indexing of their web content on the internet. The promotion process, which formed the core of Bedny's approach for activity theory (i.e., methods, subject, aim, entity and results) was seen to be a recent and popular topic of research. Bedny's online promotion and operation theory focused on the structural and ontological approach (Jacksi et al., 2016), which has been used in this study. We stated that the critical-hermeneutic

approach can help in improving the investigation of ideas and the relationships between the factors used in the research (Jacksi et al., 2020). The search engines are seen to be a modern and dynamic internet marketing platform, as they act as a basic conduit for online users (Bello and Ootobo) (ADEL AL-ZEBARI, 2017). There is a lot of relevant knowledge-based literature which is available, like the activity theory (Spais, 2010) and other techniques related to the activity structure (Ariza-Colpas et al., 2019; Bennett, 2012; Jabaley et al., 2018; Krstić, 2019). However, the behavioral system structures like the 'subject', 'object', and the 'goal statement' have not been investigated thoroughly. The literature has highlighted the important role played by SEM and SEO in internet marketing processes. These techniques can be further enhanced for improving the website ranking, which could allow their web dominance (Wouter T. Kritzinger & Weideman, 2015; Wouter Thomas Kritzinger, 2017). The operational theory presented an important perspective on eMarketing literature (Wouter Thomas Kritzinger, 2017). The next section presents the literature review, which is divided into 3 stages.

3. Literature Review Process

In this paper, the literature review was carried out in 3 stages, as follows:

3.1. Set of bibliography and search strategy

In this strategy, the researchers used the "brief search" and "citation pearl-growing" search techniques. Strategy 1 helped them accumulate various research papers (very rapidly). For deriving additional benefits during the discovery process, the researchers introduced a second search process (AL-Zebari et al., 2019). This helped them to define the major research studies for incorporating the existing vocabulary and the definitions which helped in searching for other topics. Thus, they concluded that this was a very effective technique that could be used for investigating the research topic. After Stage 1, we proposed an extension of the literature review. Furthermore, they stated that an abstractive synopsis and homogenisation, depending on the keywords, could help them categorise the research study. They assumed that the G.I.S.T. process offered them a secure guide for recognising the large categories which emerged from the research topic.

3.2. Conceptual Framework

Based on the various research themes and Bedny's activity theory, we have proposed the following conceptual mapping (Fig. 3) which could help in our research: It could improve their understanding of the research topic, Help them identify important ideas, and Help them recognise and categorise the study practices within every SEO conceptual group as the creative online marketing process.

The conceptual mapping process was used based on the keywords necessary for fulfilling the previous research objectives, theoretical context, and results of Step 1 of the above-mentioned literature review process. Thereafter, the research papers were organised in the following manner: Based on the concepts, Depending on the research activity for every conceptual category, Classification of the empirical evidence in chronological order and Summarising the literature results.

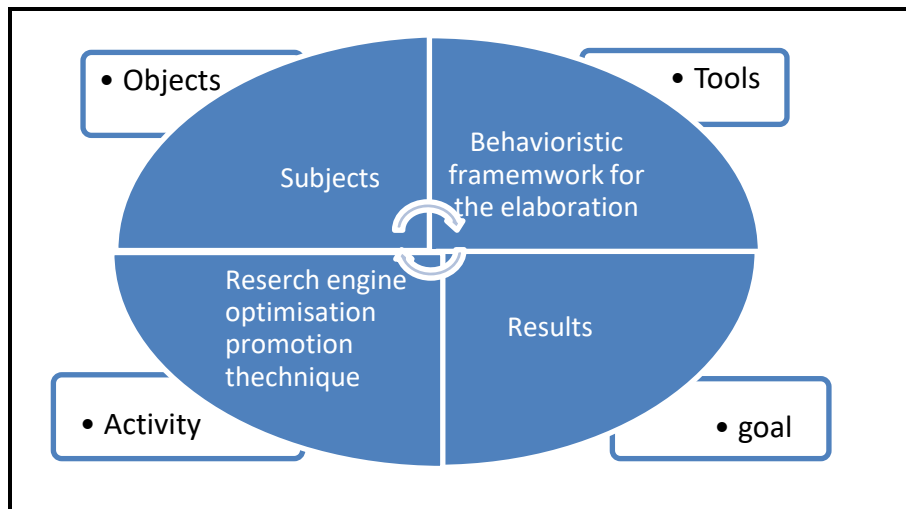


Fig. 3: Conceptual Framework

3.3. Overview of the 3 Main Search Engines and Their Indexing for Developing Dynamic Websites

Every person who is seeking information on the internet has to use a search engine. These search engines, like the crawler-based search engines, are seen to index all or any pages. The most popular search engines include Google, Yahoo, and Bing (Amrahov, 2016). They drive a lot of traffic and user volume to particular websites (Amrahov, 2016; Yu et al., 2012). Hence, the SEO activities are extended to the websites after considering these search engines. However, the above-mentioned search engines differ from one another based on their algorithm or rating parameters (Kapoor et al., 2018; Rinaritha et al., 2018; Sarlis et al., 2017; Sethuraman et al., 2018). Google is the most popular search engine as it presents better search results and can cover a large proportion of the market share (Ziakakis et al., 2019). A majority of users prefer using Google when seeking information on the Internet (Weissmann et al., 2017). It was noted that the different search engines yielded varying search results even when the users used the same search query (Yom-Tov & Fernandez-Luque, 2014). This indicated that these search engines used different algorithms for indexing and rating the websites. The bigger search engines are not only a search tool for finding information, but they also include additional features like mapping, news, and email. Furthermore, different applications are also offered by search engine providers. All additional features often encourage users to use and explore search engines.

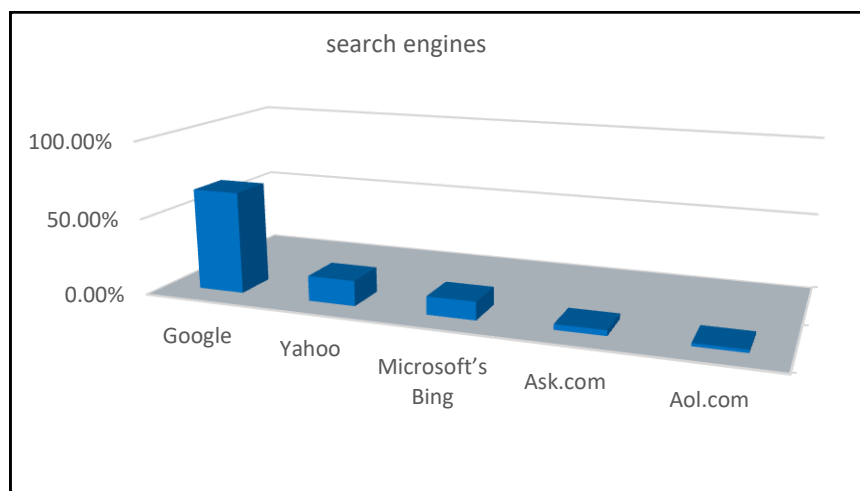


Fig. 4: Explicit search share of all main search engines

A market research study conducted in Nov. 2010 by comScore, Inc. showed that Google held the maximum share (66.2%) in the core search market, followed by Yahoo! (16.4 %) and Microsoft's Bing (11.8%) (Fig. 4). On the other hand, Ask.com (3.6%) and Aol.com (2.0%) were the other less popular search engines (A.-Z. S. R. Zeebaree et al., n.d.).

As shown in the above figure, Google, Yahoo, and Bing accounted for almost 94% of the search market. In this paper, the researchers have explored the various SEO techniques which were used on these search engines. Thus, they classified 94% of the users who can be affected by the complicated website indexing issues.

3.4. Some Common Issues

In this paper, the previous researchers surveyed the existed situation and dynamic situation existing in the area of intelligent semantic search methodologies and engines. Though this was not a very thorough survey, the researchers were able to identify some common problems which affected the semantic search methods and engines, which have been described below:

1. A lower precision and higher recall: Some intelligent Semantic Search Engines cannot improve the precision of their search results or reduce the recall. In the case of Ding's semantic flash search engine, it was noted that the search engine resource was based on Top-50 search results derived from Google. Thus, it was a semantic search engine that showed a lower precision value but a higher recall (Arlitsch et al., 2013; Enge et al., 2016).
2. Furthermore, the identity and user authentication played a vital role in the working of an intelligent semantic search engine. For instance, in the case of Wilson, Lazer used a framework for interpreting all request terms for suiting the user functions, in such a manner that the offered service was more relevant to the users (Brickley et al., 2019; Robertson et al., 2019).

Some particular user habits could be extrapolated to global users.

The early search engines showed some uncertainty regarding the search words. When the user typed a vague search word (e.g., Java), the search engine presented many alternative results for the same (such as programming language, coffee, island in the South Seas).

3.5. Unprecise questions:

Generally, the user has primary domain expertise, but they do not know probable synonyms or word combinations while wording their query (Jacksi et al., 2018). As a result, they are not able to frame a precise and accurate search query, which can yield unhelpful results.

4. Comparison of Some Similar Studies

Table 1 presents an overview of the earlier similar studies which used or developed an SEO promotion technique.

Table 1: A comparison of the earlier related studies.

Authors and Year	Research Title	Description
(Gandour & Regolini, 2011)	Web site SEO: A case study of Fragfor.net	Here, the researchers developed an idea related to the search engine marketing procedure, which could be used for non-profit organisations for improving the organic search results. They noted that this technique could allow the organisation to fine-tune its online presence based on its principles. They could increase their business by using phrases and keywords which could be helpful for future voters. This proposed technique was a response to the literature demand for a fine-grained approach towards segmentation, precise targeting, and a better value distinction
(Dong et al., 2014)	Progress and development of information and communication technologies in hospitality	In this study, the researchers determined the efficiency of the search engine marketing technique for making it accessible and easy for the existing and prospective clients so that they could search for small or medium-sized hotels. The researchers presented 8 case studies where they carried out in-depth and semi-structured interviews. The results indicated that poor SEM usage was due to a weak campaign strategy and lack of control of the owners on their websites since they outsourced their web creation and website optimisation activities. The researchers highlighted the important issues and encouraged the smaller operators to implement active SEMs and make complete use of their websites as a strategic and tactical marketing platform.
(Ziakos et al., 2019)	Important Factors for Improving Google Search Rank	In this study, the researchers determined the efficiency of the search engine marketing for making it accessible and easy for the existing and prospective clients to search for small or medium-sized hotels. The researchers presented 8 case studies where they carried out in-depth and semi-structured interviews. The results indicated that the SEM abuse was due to a lack of influence and poor campaign planning since the owners had outsourced their web creation and website optimisation activities. The researchers highlighted the important issues and encouraged the smaller operators to implement active SEMs and make complete use of their websites as a strategic and tactical marketing platform.
(Bhandari & Bansal, 2018)	Impact of Search Engine Optimisation as a Marketing Tool	Here, the researchers presented some strategies for determining target keywords in any type of market along with general errors which were made by the Search Engine Marketing (SEM) firms. The researchers stated that running paid search campaigns could be considered as the first move during any SEO campaign. Results of this paid marketing strategy offered vital evidence for the long-term, rigorous SEO strategy.
Zhang & Cabage (2017).	Search Engine Optimisation: Comparison of Link Building and Social Sharing	The researchers discussed the ability of innovative approaches to extend the link-building strategy, which presented an optimal result in the study. The results indicated that the users who collect inbound connections from similar websites for improving the rating of the search engines, thereby allowing them to access their products or blogs, were using a time-consuming process.
Xiang & Gretzel (2010)	Role of social media in online travel information search	In this dissertation, the researchers determined the correlation between online publishing and information retrieval techniques. The authors stated that the different aspects of the internet showed varying consequences for browsing and indexing the pages using 3 main web search platforms (directories and search engines) which could be merged for establishing a one-stop search site. This led to a web business model called portals.

5. Conclusion

SEO is an important tool that increases the popularity of the websites in the search engines, the on-page, and off-page SEO tools are used in the web-page SEO processes. Out of these, the on-page SEO strategies improve the content presented on the websites by increasing their accessibility/understandability by the search engines as the search engines interpret only those website content formats. On the other hand, the off-page SEO is not related to the

website content however it allows the websites to improve their ranking and increase the number of visitors visiting the websites. The webmasters can use many helpful and accessible SEO resources like those provided by Google (Google Analytics, Google Webmaster Tools, and Google AdWords, i.e., paid advertisement); Yahoo (Yahoo Site Explorer); and Bing (Bing Webmaster Tool). Out of all these applications, Google Analytics and the Bing Webmaster tools are very powerful SEO resources. Amongst the browser extensions (add-ons), YSlow was seen to be a useful tool that offered a simulated environment for viewing the page changes in addition to the page content information. As different search engines utilize various other hierarchical web index algorithms, the search results offered by the search engines can differ.

The larger search engines (Google, Yahoo and Bing) state that they do not index/rank the static websites (if optimised); however, some conflicting figures were noted with regards to the indexing of dynamic websites. The search engines (particularly Google) do index the dynamic URLs. Thus, the experimental testing of the degree to which the search engines index the websites have been investigated. In this paper, we have reviewed the indexing process of the different search engines like Google, Bing, Yahoo, AOL, Ask, and Yes. The results indicated that none of these search engines could completely index all the complicated websites. The researchers used different SEO strategies for supporting the indexing of the dynamic webpage(s) and determine the extent to which the dynamic websites could be streamlined. They stated that an URL rewriting technique could allow the complex websites to maintain their URL consistency so that altering the product code or position did not affect the URLs. As the dynamic URLs contain the commonality and category code; when the product was transferred to a table format, the URL changes. Furthermore, the dynamic webpage(s) with good URLs can be indexed into the search engines. Based on all experiments in the study, we concluded that the SEO techniques were vital for indexing the dynamic websites. As properly-indexed websites help in their ranking, it allows the websites to become more prominent in the search engines. Hence, it is important to optimise the websites for improving their reputation. The dynamic webpage(s) are indexed in all the search engines with the help of desirable SEO processes. No single strategy can be applied for all the search engines; hence all the search engines have to be considered separately.

6. Limitations

In this paper, we have presented some quantitative tools for fulfilling all objectives. Many variables affect the rating of a website. All variables are hidden by the different search engines for stabilising their ranking algorithms. Many SEO methods were used for the experiments; however, no general inference could be derived from the results acquired owing to the limitation of the user queries and individual participation.

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